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Escala S, E and T Series Reference Guide

This document is composed of 1 Section

Section 1: System Hardware

Escala S, E and T Series
Reference Guide - Revision 4

This edition of the Escala Reference Guide describes the Escala S, E and T Series offer with:

- **March 99 Announcement Set**

The Escala S, E and T Series Reference Guide covers:

- **System Hardware:** Family Overview, Models Descriptions, Cabinets Subsystems, Serial Storage Architecture Subsystems, Graphics Subsystems, Disks and Media, Memory Expansion Cards, Communications Controllers, Reference Information, Conformance to Standards.

The Escala S, E and T Series Reference Guide is available in CEDOC under Reference:
86 A1 84 HX 04

Other volumes are also available in CEDOC :

• DPX/20 Monoprocessor Series Reference Guide	**86 A7 28WG**
• Escala M, D and R Series Reference Guide	**86 A7 70AJ**
• Estrella Series Reference Guide	**86 A7 72AJ**
• Bull Open Systems Software Reference Guide	**86 A7 74AJ**
• Escala EPC Series Reference Guide	**86 A1 99JX**

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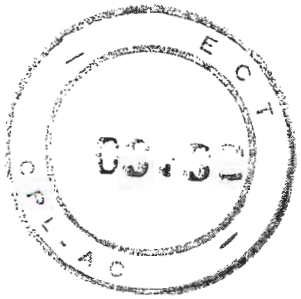


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Chapter 1: Family Overview

This Chapter gives an overall view of the Escala S, E and T Series, describing its main general features and presenting the models by means of comparison charts.

1. ESCALA S, E and T Series - General Features

The ESCALA S, E and T system units are a family of UNIX-based computers using the PowerPC RISC architecture within a symmetric multiprocessing architecture for Escala E & T. They offer a full range of multi-user, multitasking, open-architecture servers. The ESCALA system units are designed to be used in a wide variety of environments as Distributed Data Server, and target input/output-intensive commercial applications, databases, and communication servers.

The ESCALA E and T system units are designed to provide Reliability, Availability and Serviceability solutions through suited technologies as SMP architecture, PCI bus, Ultra-SCSI disk interface, Raid option and Hot-Swappability technology.

1.1. PowerPC Architecture

The PowerPC architecture is a derivative of the multichip POWER architecture that has been developed specifically for single-chip processor designs. The changes incorporated into the PowerPC architecture from the POWER architecture are:

- Simplified Instruction Set
- Single precision floating point
- Modified storage model
- Multi-processor support
- Simplified I/O architecture

The PowerPC architecture is binary compatible with applications written for POWER architecture. Any unimplemented, infrequently used POWER instructions are trapped and emulated.

1.2. PowerPC 604e Processors

The PowerPC 604e is a superscalar processor capable of issuing four instructions simultaneously. As many as seven instructions can finish execution in parallel. The PowerPC 604e has six execution units that can operate in parallel:

- Floating-point unit (FPU)
- Branch processing unit (BPU)
- Load/store unit (LSU)
- Three integer units (IUs):
  - Two single-cycle integer units (SCIUs)
  - One multiple-cycle integer unit (MCIU).

This parallel design, combined with the PowerPC architecture's specification of uniform instructions that allows for rapid execution times, yields high efficiency and throughput. The PowerPC 604e rename buffers, reservation stations, dynamic branch prediction, and completion unit increase instruction throughput, guarantee in-order completion, and ensure a precise exception model. (Note that the PowerPC architecture specification refers to all exceptions as interrupts.)

The PowerPC 604e has separate memory management units (MMUs) and separate 32-Kbyte on-chip caches for instructions and data. The PowerPC 604e implements two 128-entry, two-way set (64-entry per set) associative translation lookaside buffers (TLBs), one for instructions and one for data, and provides support for demand-pages virtual memory address translation and variable-sized block translation. The TLBs and the cache use least-recently-used (LRU) replacement algorithms.

The PowerPC 604e has a 64-bit external data bus and a 32-bit address bus. The PowerPC 604e interface protocol allows multiple masters to compete for system resources through a central external arbiter. Additionally, on-chip snooping logic maintains data cache coherency for multiprocessor application. The PowerPC 604e supports single-beat and burst data transfers for memory accesses and memory-mapped I/O accesses.

The PowerPC 604e uses an advanced, 3.3-V CMOS process technology and is fully compatible with TTL devices.

1.3. PowerPC 620 Processors

The PowerPC 620 microprocessor is a 64-bit implementation of the PowerPC(TM) Reduced Instruction Set Computer (RISC) architecture. The PowerPC 620 microprocessor provides high levels of performance for technical and scientific work-stations, application and LAN servers and symmetric multiprocessing computer systems and is software compatible with the PowerPC 601(TM), PowerPC 603(TM), and PowerPC 604(TM) microprocessors.
It features a high bandwidth memory subsystem ideal for symmetric multiprocessing, transaction processing and numerically intensive computing.
It is the 64-bit implementation of the PowerPC Architecture supporting both 32/64-bit applications.

1.3.1. 64-bit advanced Superscalar Microprocessor

The PowerPC 620 microprocessor is a superscalar design capable of issuing four instructions per clock cycle to six independent execution units, including:

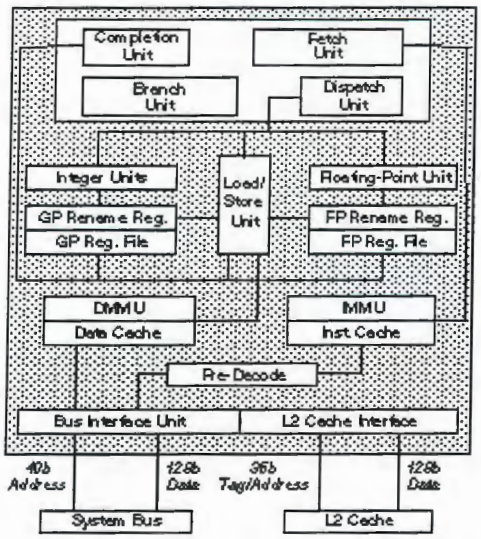
- two single-cycle integer units
- multicycle integer unit
- branch processing unit
- load/store unit
- floating-point unit

The PowerPC 620 microprocessor uses dynamic branch prediction to improve the accuracy of instruction prefetching. Dynamic branch prediction, combined with the ability to speculatively execute through four unresolved branches, minimizes pipeline stalls and allows the multiple execution units to provide a high level of efficiency and throughput. The PowerPC 620 microprocessor supports out-of-order execution with in-order instruction completion assuring precise exceptions.

1.3.2. Cache and MMU Support

The PowerPC 620 microprocessor has separate 32-Kbyte, physically addressed instruction and data caches. Both caches are 8-way set-associative. An on-chip 128-bit Level 2 cache interface provides support for Level 2 caches of 1 Mbyte to 128 Mbytes in size, and is ECC protected.

The PowerPC 620 microprocessor also contains separate memory management units (MMUs) for instructions and data. The MMUs support one Heptabyte (280) of virtual memory and one Terabyte (240) of physical memory. Access privileges and memory protection are controlled on block or page granularities. Address translation for recently accessed memory locations is provided by independent 64-entry, fully-associative, effective-to-real address translation caches. A large, 128-entry translation lookaside buffer (TLB) provides efficient physical address translation and support for demand-paged virtual memory management for both page- and variable-sized blocks.



1.3.3. Flexible Bus Support

The PowerPC 620 microprocessor has a high performance 128-bit data bus and a separate 40-bit address bus. The interface protocol allows multiple masters to access system resources through a central arbiter. Additionally, on-chip snooping logic maintains cache coherency in multiprocessor applications.

1.3.4. PowerPC 620 Microprocessor Major Features

Technology

- 0.35-micron static CMOS technology
- 311 mm2
- 7.0 million transistors

Specifications

- Center frequency of 180MHz
- 32K instruction and 32K data caches
- Superscalar--up to 4 instructions per clock
- Dynamic branch prediction
- Multiple integer units
- 128-bit data bus
- Separate L2 cache interface
- 128-bit L2 data bus
- Fully JTAG compatible

Packaging

- 625 BGA

1.4. PowerPC RS64-II Processors

The PowerPC RS64-II is a 4 way, superscalar microprocessor implementing the 64-bit PowerPC architecture. The internal structure of the processor is optimized for commercial transactions.

- Full 64-bit implementation of PowerPC architecture
- Architectural extensions for 32-bit OS migration support
- PowerPC Common Hardware Reference Platform (CHRP) compliant
- 4-way superscalar
- On chip 64KB L1 Instruction cache and 64KB Data cache,128-byte line size
- On chip L2 cache controller:
  - Up to 8 MB 4 way set associative L2 cache using 4 Mbit SRAM chips
  - Up to 32 MB 4 way set associative L2 cache using 16 Mbit SRAM chips
  - 32 Byte Data Buses
- PowerPC 6XX Bus Architecture:
  - 16 Byte data bus (2:1, 3:1 or 4:1)
- Full multiprocessor support
- Technology:
  - CMOS 6S2
  - Standard Cell Library
- Data Integrity:
  - L1 Data cache = ECC
  - L1 Instruction cache = Parity and Retry
  - L2 cache = ECC
  - Main Storage = ECC
  - I/O and Bus = Parity

1.5. PowerPC RS64-III Processors

The RS64 III superscalar processors have been well optimized for commercial workloads. Target environments are characterized by heavy demands on system memory, both in the form of very large working sets and latency-sensitive serial dependencies. As a result, the design of the RS64-III processors has focused on large cache sizes and data paths having high bandwidth and low latency.

The RS64 III processor has separate internal 128 KB L1 caches for instructions and data. Both L1 caches have doubled in size over the RS64-II. It contains an L2 cache controller and a dedicated 32-byte interface to a private 4-way set associative L2 cache. The L2 cache controller supports up to 8 MB L2 cache. The L2 interface runs at half processor speed, but transfers data twice per cycle to provide 14.4 GB/s of bandwidth. RS64 III internal data paths are 32 bytes wide. The RS64 III processor also has a separate 16-byte system bus interface.

The RS64-III has a total of five pipeline execution units. There is a Branch Unit, a Load/Store Unit, a Fixed-point Unit, a Complex Fixed-point Unit and a Floating-point Unit. The processor has a 32-byte interface to the dispatch logic. There is a current instruction stream dispatch buffer that is 16 instructions deep. The RS64-III has an eight deep branch buffer. The RS64-III can sustain a decode and execution rate of up to 4 instructions per cycle.

All of the arrays in the RS64-III have either redundancy and ECC or parity and retry to support the high requirements desired for customer reliability, availability and integrity. This enables full fault detection and correction coverage.

1.6. Escala E & T PowerPC System Structure

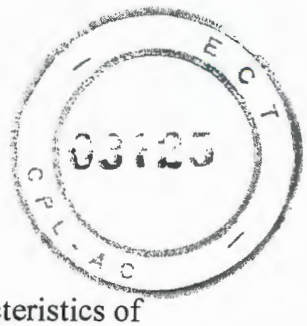
Many different system designs are available with the PowerPC processor.
The ESCALA E & T Family is designed to achieve performance scalability and high availability from the PowerPC processor chip.
One of the major features of the ESCALA design is the symmetric multiprocessor architecture that allows to progressively upgrade the system by adding processors. The processors coordinate and share access to the various system resources (memory, I/O, ...).

1.7. PowerScale Architecture - PowerPC SMP Design

The ESCALA symmetric multiprocessor (SMP) design incorporates multiple processors sharing a single, common memory and a single copy of the AIX® Version 4 for Servers operating system. Jobs are scheduled across the processors, allowing separate processes to be run simultaneously. Data and instructions are accessed from the shared memory through a high-speed cache to the processors. This simple design with a coherent memory allows programs to exploit the parallelism provided by the multiple processors.

There are several requirements that the design of a multiprocessor system must satisfy when compared to a uniprocessor system:

- Provide for scheduling of separate jobs across the various processors.
- Provide for synchronization of those separate jobs.
- Provide efficient paths between each processor and the memory subsystem.
- Manage the processor caches to maintain cache coherency (consistency).
- Provide an input/output interface to the memory subsystem.



There are several additional requirements placed on the design by the unique characteristics of commercial applications. The key to delivering good commercial performance is not a factor solely of the processor, but rather of the memory hierarchy and the ability to do rapid cache-to-cache transfers. Typically, commercial applications exhibit data access patterns with a large "footprint". This is different from scientific or technical work. Commercial workloads are characterized by high L1/L2 cache miss rates, heavy memory traffic, and high cache migration rates. As data traffic increases due to the large footprint of commercial workloads, it is evident that the memory bus is potentially a bottleneck. It is, therefore, critical to performance that the SMP system be designed to handle these applications.

In a traditional SMP architecture the interconnection between CPU caches and global memory is met by means of a common memory bus shared amongst the various resources. This is typically the weak point of the system design and will tend to become saturated as the number of processors installed is increased. This is because the data traffic between caches and memory increases as well as the cache to cache transfers and they all compete for bandwidth on the memory bus.

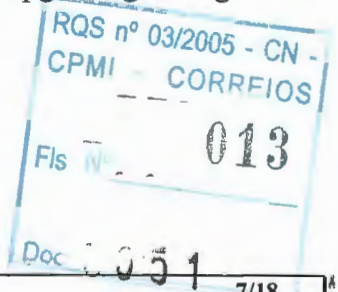
Bull's PowerScale™ architecture implements the memory interface in a manner designed to anticipate the above application profile and to exploit the forthcoming generations of even higher performance microprocessors.

The approach adopted utilizes a memory bus to carry only simple address tags and to use a non-blocking crossbar switch for data traffic. This crossbar switch is used to interconnect up to 4 dual-CPU ports, an I/O port and the memory sub-system.

Following the setup phase of a transaction, e.g. posting an address on the address bus, the data can then be transferred at full clock speed through the switch. This is possible through a private point to point link created for each separate transaction. Therefore there is no further contention. It is also possible to perform several operations in parallel, such as multiple accesses to memory or cache to cache transfers.

The fact that PowerScale™ addresses both high speed memory interfacing and cache to cache transfers makes it suitable for managing faster processors and larger caches in the future.

This has enabled Bull to build a range of systems around a single architecture, with the in-built flexibility to upgrade both horizontally, by adding processors, or vertically, by upgrading through the generations of PowerPC.



The ESCALA models have the following major attributes:

- The operating system can schedule and synchronize work across the available processors.
- A high-bandwidth bus is provided for access between cache and memory.
- Cache and memory are efficiently managed to provide cache consistency.

An example of how the design of the ESCALA servers can maximize performance follows:

- The most recently used or projected to use program elements are kept in L1 cache (fastest access).
- Programs and control objects are kept in L2 cache (next fastest).
- Directories to databases are kept in memory (next fastest to L2 cache).
- Actual databases are stored on disk drives.

Reliability and availability are key concerns for any commercial system. In a widely distributed environment, this becomes more critical. To address this, the Bull design provides remote as well as local control.

The ESCALA servers include features, such as embedded support processors, that enable remote operation of the system; remote power-on and power-off; running of diagnostics, service, repair and console support, and processor reconfiguration in case of errors. The support processor is continuously powered even when system power is off.

The mirrored console support means that remote service actions are visible and controlled by the customer. This includes control over whether the system can be restarted or not.

An additional feature is that the system can be set to dial a remote service or support point should the system fail, and a surveillance function allows the system to detect "hang" conditions in the system and if necessary invoke a rapid restart.

In addition to the support processor, the error checking and correction circuitry protecting memory is able to detect and correct all single-bit failures. Double-bit errors are also detected and auto-restart invoked.

Scalability is also a key design consideration. The ESCALA servers can be easily upgraded. The packaging permits convenient replacement or upgrading of processor, memory, or I/O adapters. For example, the processors are contained on processor cards that plug into slots on the system board. A processor card contains two processors, and upgrading from a two-way system is a matter of plugging in an additional processor card.

AIX® Version 4 for Servers operating system provides reliability and serviceability with such features as the Logical Volume Manager, Journalized File System and dynamic kernel all contributing to a reliable and robust operating system implementation.

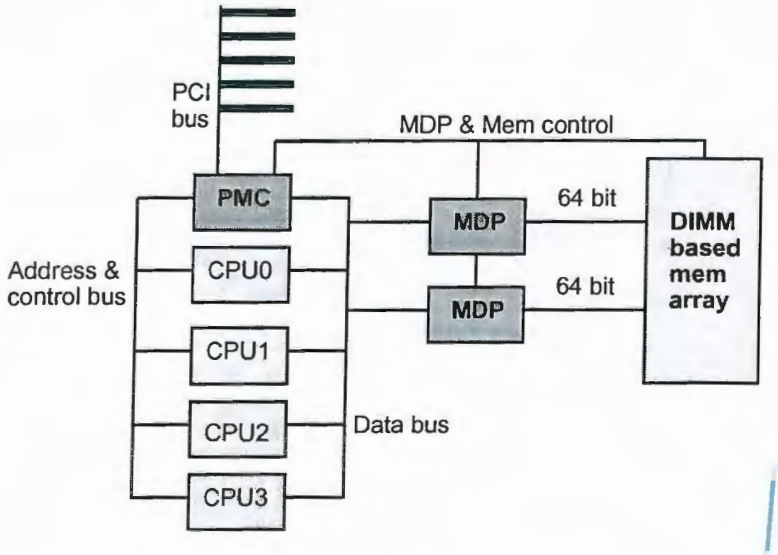
1.7.1. PowerScale/2 Architecture

The PowerScale/2 Architecture, designed by Bull, is an entry high performance 1-2 way symmetric processing architecture designed for the PowerPC 604e and PowerPC 620 microprocessors.

PowerScale/2 is a traditional SMP design with a split transaction approach to the bus architecture. The "intelligence" center of the architecture is the PMC (PCI & Memory Controller) which integrates the coherency engine of the SMP design and manages all of the system busses (address & control, memory data path & control, system data bus and the PCI bus).

The MDP (Memory Data Path) ASICs are used to switch the data to/from the memory array. They also contain buffering logic and are responsible for the ECC handling on the memory DIMMs.

Illustrated below is the basic bus structure supported by the PowerScale/2 chipset.

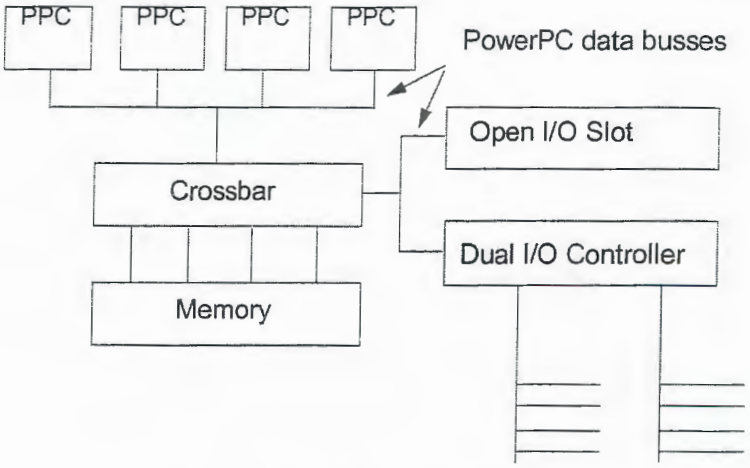


PowerScale/2 Logical Bus Architecture

1.7.2. PowerScale/4 Architecture

The PowerScale/4 Architecture, designed by Bull, is a high performance 1-4 way symmetric processing architecture designed for the PowerPC 604e and PowerPC 620 microprocessors.

PowerScale/4 is a traditional SMP design with a split transaction approach to the bus architecture.

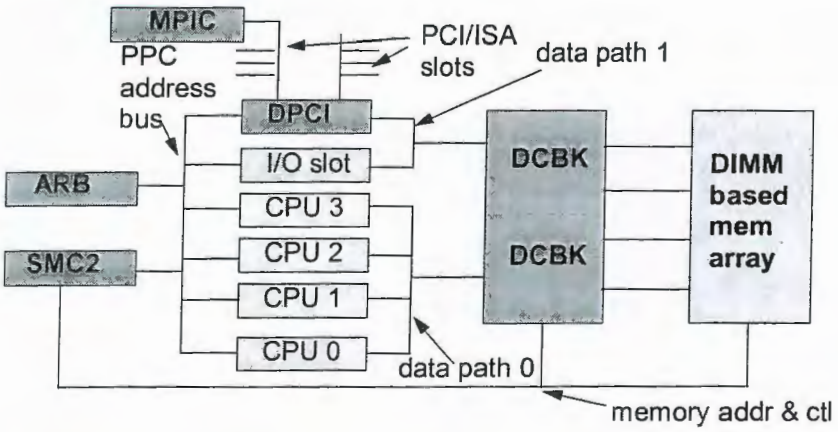


PowerScale/4 Architecture

The architecture distinguishes itself in that the system data bus has been divided into 2 separate paths with one being used exclusively by the CPUs and the other being reserved for the system I/O.

- The CPU data path can support up to 4 agents (CPUs).
- The I/O data path has been implemented on the reference platform motherboard to support 2 agents, although the chipset also supports up to 4 I/O agents.

This unique feature permits a high degree of hardware parallelism to occur during system I/O operations and means that the architecture is ideally suited for applications demanding high I/O traffic.



PowerScale/4 Reference Implementation Bus Architecture

The above diagram illustrates the motherboard PowerScale/4 ASIC set.

DCBK	Data Cross Bar for Escala T Series (2 ASICs required)
SMC2	System Memory Controller
ARB	System Arbiter
DPCI	Dual Peripheral Component Interconnect
MPIC	Multi PCI Interrupt Controller

There are two additional ASICs that are required per CPU card in the case of a PowerPC 604e based system. These are:

CCA2	Cache Controller Address
CCDK	Cache Controller Data for Escala T Series

In the case of a PowerPC 620 based system these additional ASICs are not required since the 620 processors will interface directly with the PowerPC 6XX bus implemented inside Escala T Series.

The system data bus has been divided into 2 separate paths with one being used exclusively by the CPUs and the other being reserved for the system I/O.

The CPU data path can support up to 4 agents (CPUs).
The I/O data path has been implemented on the T604e/T620 motherboard to support up to 2 agents.

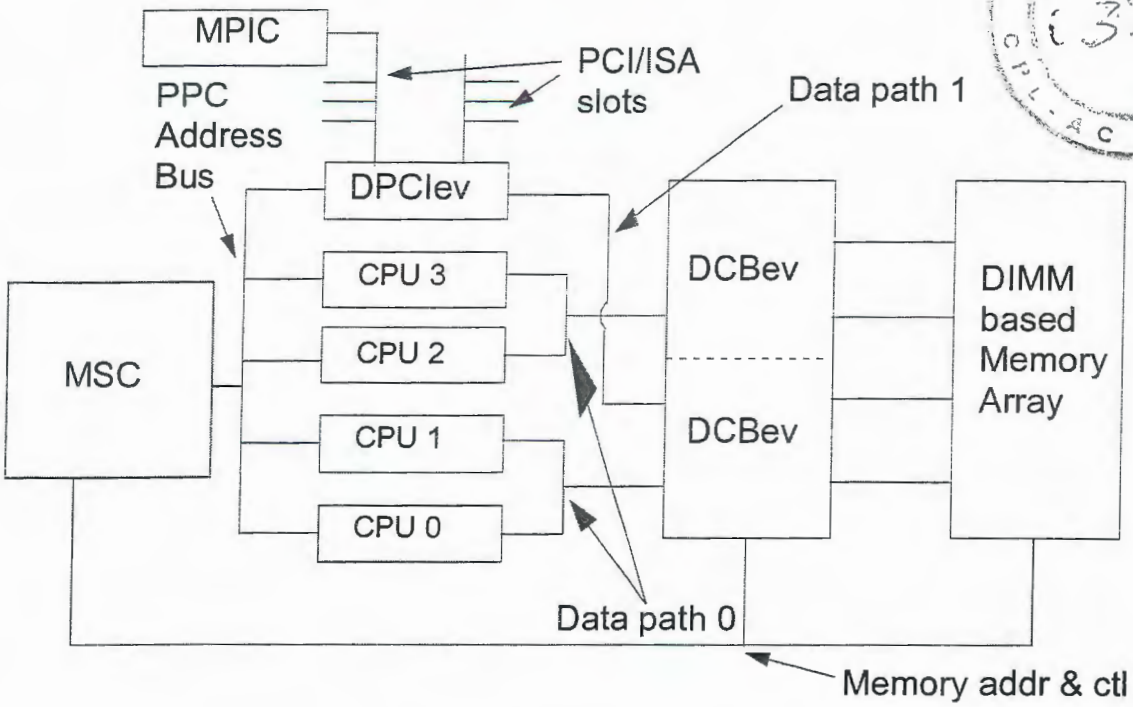
The first agent is the DPCI and the second agent has been left as an open I/O slot on the board. Bull will create various add-in card options to plug into this slot such as: an additional DPCI option; a high speed inter-system link controller for clustering and there will be other options created in the future. This slot is also open for Bull partners to develop options for, remember that it is an opening directly on the PowerPC 6XX bus and is therefore a very high speed point of entry into the architecture.

1.7.3. PowerScale/Flex Architecture

The PowerScale/Flex chipset is an evolution of the PowerScale/4 and PowerScale/2 chipset to provide support for PowerPC RS64 processors. This design has been implemented to meet schedule and price/performance objectives.

The evolution towards PowerPC RS64 processors does not require a new cabinet design, as far as available power requirements, power dissipation and ventilation is concerned. Therefore the Escala T604e/T620 cabinet can be used to enclose the new 4-processor board with integrated I/O.

ASICs pin number will be kept within today Max available solutions (750 pins); consequently the I/O data channel of the chipset implementation will be kept at 64 bits (DPCIev). The technology used for ASIC integration is the LSI Logic G10 for the first run and will be replaced by the LSI Logic G11 for the second run.



PowerScale/Flex Reference Implementation Bus Architecture

The above diagram illustrates the motherboard PowerScale/Flex ASIC set.

DCBev	Data Cross Bar for Escala T Series (2 ASICs required)
MSC	Memory System Controller
DPCIev	Dual Peripheral Component Interconnect
MPIC	Multi PCI Interrupt Controller

The system data bus has been divided into 2 separate paths with one being used exclusively by the CPUs and the other being reserved for the system I/O.

The CPU data path can support up to 4 agents (CPUs).

2. ESCALA S, E and T Systems

The ESCALA E and T Series, the world's first PowerPC-based symmetric multiprocessing (SMP) systems, are designed with industry leading price/performance and evolution capabilities.
The ESCALA S, E and T systems run AIX, the most scalable and robust Unix operating system for commercial environments. In addition, these systems come with several standard I/O interfaces plus expansion slots for memory and I/O adapters. A wide variety of optional features, including communications, graphics, and storage products are available to provide highly configurable, robust systems.
The PowerScale architecture, inside the ESCALA E and T systems, extends system life and enhances performance and efficiency. These new, expandable servers are easy to configure and satisfy users' unique computing requirements.
All ESCALA systems are built for tomorrow - ready to evolve with future generations of the PowerPC technology. With investment protection through easy, in-field upgrades: either replace existing processors with more powerful processors, or simply increase the number of processors in the system.
The flexibility, power and configurability, inherent to ESCALA, give users a variety of application servers to choose from. These are designed with Bull's Distributed Computing Model and other middleware solutions.

2.1. Servers Series

ESCALA S Series Servers

Escala S is an entry-level UNIX system delivering exceptional power for its class, offering outstanding performance and reliability. Its rugged, compact design and the robustness of its AIX® operating system ensure trouble-free operation. Simple to install, simple to use and simple to monitor thanks to the integrated WatchWare management tool, the new Escala S Series makes life easy for the user.

Escala S target applications:

- Small workgroup applications for:
  - Database
  - File & print services
  - Communication (workgroup to host / workgroup to workgroup)
  - Groupware
- Internet/ Intranet as:
  - Web Server
  - Intranet Groupware
  - Internet Access Server (Firewall)
- Escala S can also be used as:
  - A system Management Server (OpenMaster)
  - A GCOS front-end Communications Manager (part of Bull's Mainway offer)
  - A workstation with High-Capacity Graphics

Escala S offers exceptional software reliability:

The robustness of the AIX® operating system helps make the Escala S a robust and reliable server. Compliant with major industry standards, AIX® is the world's leading commercial UNIX system with a vast portfolio of applications (over 14,000) able to run on Escala S series systems. The latest version of AIX® (version 4.3) provides 32/64-bit environments and offers advanced Internet services and Java support, B1 security option and enhanced Reliability, Availability and Serviceability features.

Outstanding versatility and expandability:

Configurable as either desktop or minitower and with a wide range of options available (choice of processor speed, memory and internal disks expansion capacities, communication features, storage devices), Escala S responds to a wide variety of needs. Upgrading from the 200/233 MHz microprocessor to the 332 MHz option is accomplished by removing the existing processor and plugging the new one. Through adding to or adapting the system, investment costs can be minimized.

Simple-to-use secure system

The pre-installed systems monitoring tool, WatchWare, gives complete details about the system and the network status through a Web interface. For even more security, a modem available on the system ensures reboot capability and allows Bull to check and perform maintenance operations on the system without on-site intervention.

ESCALA E Series Servers

The ESCALA E Series Servers provide scalable solutions based on SMP architecture using PCI and ISA busses. The ESCALA E Series are designed with the PowerScale/2 and PowerScale/Flex architecture to increase access to distributed data, to improve productivity, to integrate large PC workgroups in a multi-vendor environment and to consolidate increasing quantities of business-critical data without compromising existing investments. The ESCALA E Series provides Power scalability through 1 to 2 CPU boards, Disk capacity and performance through Ultra SCSI interfaces, Disk Array Subsystems (SCSI or Fibre Channel connection), availability through the robust Operating System AIX® and HA technology, Communicability through LAN/WAN and Internet offering. The ESCALA E Series Servers offer a very suited platform to plug end-user solutions or to build appropriate Customer solutions.
The ESCALA E Series Servers are designed to house the PowerPC 620, PowerPC RS64-II and the PowerPC RS64-III processors, and to offer full 64-bit capability.

ESCALA T Series - Tower Servers

The ESCALA T Series Servers provide scalable solutions based on SMP architecture using PCI and ISA busses. The ESCALA T Series are designed with the PowerScale/4 and PowerScale /Flex Architecture to increase access to distributed data, to improve productivity, to integrate large PC workgroups in a multi-vendor environment and to consolidate increasing quantities of business-critical data without compromising existing investments. The ESCALA T Series provides Power scalability through 1 to 4 CPU boards, Disk capacity and performance through SCSI Fast Wide and Ultra SCSI interfaces, Disk Array Subsystems (SCSI or Fibre Channel connections), availability through the robust Operating System AIX® and HA technology, Communicability through LAN/WAN and Internet offering. The ESCALA T Series offers a very suited platform to plug end-user solutions or to build appropriate Customer solutions. The ESCALA T Series Servers are designed to house the PowerPC RS64-II and the PowerPC RS64-III processors, and to offer full 64-bit capability.

3. ESCALA S, E and T Series Features Summary

The following elements and options are featured on the ESCALA S, E and T Series systems:

Processors

The ESCALA E and T Series are built on a symmetric multiprocessing architecture (1-2 ways for the E Series, and 1-4 ways for the T Series) based on the PowerPC RISC chip and the PowerScale architecture.
The ESCALA S Series is based on a single PowerPC RISC chip.
The PowerPC 604e processors at 233MHz, 332MHz and at 375MHz are used in the ESCALA S Series.
The PowerPC 604e (225MHz and 360MHz) and the PowerPC 620 at 180MHz are used in the ESCALA E and T Series.
The PowerPC RS64-II at 262MHz is used in the ESCALA E and T Series.
The PowerPC RS64-III at 400MHz is used in the ESCALA E (with 2 MB L2 cache) and T (with 4 MB L2 cache) Series.
The ESCALA S100 models can be upgraded by replacing the PowerPC 604e processor.
All ESCALA E and T Series models can be upgraded by adding additional processors, or by changing the processor type. All processors in a system must be of the same type.

System memory

On ESCALA E and T Series, symmetrical multiprocessing based systems, the memory and the memory bus are shared by the processors. The various processors coordinate and share for access to the various system resources. All resources outside the processor are shared.
The minimum memory configuration is 64MB/128MB. The maximum configurqtion is 768MB/1GB for the S100/S120 models respectively.
For the T Series, the minimum memory configuration is 128MB. The maximum configuration is 8 GB, depending on the model.
For the E Series, the minimum memory configuration is 64MB. The maximum configuration is 4GB, depending on the model..

Internal disk drive storage

For the Escala S Series, the maximum internal disk capacity is 45.5GB in the basic cabinet and the Expansion Disks Cabinet provides up to 63.7GB disk capacity. Up to two Expansion Disks Cabinets are available.
The maximum internal disk capacity with two Expansion Disks Cabinets is 172.9GB.
The Escala E and T Series provide 5 area for Disk and Media. Each area can house 2 or 3 disks depending on the form factor (1"6 and 1") by using a specific cage.
The maximum internal disk capacity is 218.4GB in the Basic Cabinet.
The Expansion Disks Cabinet provides up to 218.4GB disk capacity. Up to two Expansion Disks Cabinets are available.
The maximum internal disk capacity with two Expansion Disks Cabinets is 655.2GB.

Diskette storage

A 1.44MB 3.5-inch internal diskette drive is standard on all system units.

External disk drive storage

On Escala E and T, several disk storage solutions are available using DAS Disk Array Subsystem (SCSI or Fibre Channel connection) or based on Serial Storage Architecture (SSA), or Symmetrix EMC disks cabinets

Magnetic Media

Storage devices such as 4mm DAT and 8 mm VDAT, 1/4-inch streamer cartridge, DLT4000/DLT7000 cartridge or 1/2-inch 9-track tape drives allow loading (Escala E and T only), backing up, restoring, and archiving of programs and data.
Storage media Solutions are available using 8mm Cartridge Tape Library and DLT4000/DLT7000 Cartridge Tape Library.

CD-ROM drive

A read-only, high-speed, compact disc drive is standard on each model. It is used notably for software distribution.

Terminals and printers

Bull Questar 306, 310 and 310C video display terminals are available with the ESCALA E and T Series, which emulate the VT320 industry standard. For graphical user interfaces, graphic terminals are also available from Bull. For hardcopy output, Bull provides a family of serial dot matrix, high-quality non-impact, and high speed band printers.

Communications

Hardware and software options are available to support connectivity such as Asynchronous communications, Ethernet, Token-Ring, and Fiber Distributed Data Interface (FDDI) Local Area Networks, Wide Area Networks (WAN), ATM networks and Internetworking support such as TCP/IP, OSI, SNA and 3278/79 emulation (Escala E and T only).

Other System Features

Note: A console is not standard on any system unit; however, console capability is required for diagnostics and configuration tasks. A supported ASCII terminal can provide console capability.

Chapter 2: Models Description

This Chapter describes the Escala S, E and T Series models.

1. ESCALA S, E and T Servers Table

ESCALA S, E and T Models	S100	S120	E604e/E620	E230/E250	T604e/T620 (1)	T430/T450
PowerScale Architecture	-	-	Yes	Yes	Yes	Yes
PowerPC Processor	604e	604e	604e / 620	RS64-II / RS64-III	604e / 620	RS64-II / RS64-III
Processor Speed (MHz)	233 or 332	375	225 or 360 (604e) 180 (620)	262 (RS64-II) 400 (RS64-III)	225 or 360 (604e) 180 (620)	262 (RS64-II) 400 (RS64-III)
Processor Number (min/max)	1/1	1/1	1/2	1/2	1/4 (604e) or 1/2 (620)	1/4
L2 cache per CPU	1 MB	1 MB	1 or 4 MB	4 MB (RS64-II) 2 MB (RS64-III)	1 or 4 MB	4 MB
Max Internal memory	768 MB	1 GB	2 GB	4 GB	3 GB	8 GB
PCI Bus	132 MB/s	132 MB/s	133 MB/s	2x264 MB/s	2x133 MB/s	2x264 MB/s
Expandability						
PCI Slots 64 bit	-	-	2 (Opt1)	4	5	4
PCI Slots 32 bit	3	5	7 (Opt2)	4	1	4
PCI/ISA Slots shared	2	-	2 (Opt2)	1	2	1
ISA Slots	-	-	2 (Opt1)	-	1	-
Disks/Media Areas in the base	-	-	5	5	5	5
Disk devices in the base	3	3	8/12 (2)	8/12 (2)	8/12 (2)	8/12 (2)
Media devices in the base	2	2	4 (3)	4 (3)	4 (3)	4 (3)
PCI/disk expansion cabinet	opt.	opt.	opt.	opt.	opt.	opt.
Storage and connectivity						
SCSI Ultra 2 80 MB/s	-	-	-	Std.	-	Std.
Ultra SCSI Wide 40 MB/s	-	Std.	Std.	Std.	Std.	Std.
SCSI Fast/Wide 20 MB/s	Std.	-	-	-	Std.	-
SVGA graphic adapter	Opt.	Opt.	Std.	Std.	Std.	Std.
Disks & Media						
Max Internal disk capacity	168.3 GB	168.3 GB	655.2 GB	655.2 GB	655.2 GB	655.2 GB
Internal 3"1/2 Diskette	Std.	Std.	Std.	Std.	Std.	Std.
Internal CD-ROM	Std.	Std.	Std.	Std.	Std.	Std.
Internal VDAT (7/14GB)	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
Internal DAT (4/16GB)	Opt.	Opt.	-	-	-	-
Internal DAT (12/24GB)	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
Internal QIC (2.5/5GB)	Opt.	Opt.	-	-	-	-
Internal QIC MLR1 (16/32GB)	Opt.	Opt.	Opt.	Recon (4)	Opt.	Recon (4)
Internal QIC MLR3 (25/50GB)	-	Opt.	Opt.	Opt.	Opt.	Opt.
External VDAT (20/40GB)	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
External DLT4000 (20/40GB)	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
External DLT7000 (35/70GB)	-	-	Opt.	Opt.	Opt.	Opt.
Robustness features						
Redundant Power supply	-	-	Opt.	Opt.	Opt.	Std.
Hot pluggable disks	-	-	Std.	Std.	Std.	Std.
Independant service processor	-	-	Std.	Std.	Std.	Std.
Internal Ultra SCSI RAID adapter	-	-	Opt.	Opt.	Opt.	Opt.
Internal SSA RAID adapter	-	-	EOC	EOC (4)	EOC	EOC (4)
DAS RAID	-	-	Opt.	Opt.	Opt.	Opt.
Communications Connectivity						
Ethernet Adapter (10/100 Mbps)	Std. (5)	Std.	Std. (5)	Std.	Std.	Std.
Token-Ring, FDDI, ATM, Ethernet 1GB Adapters	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
Asynchronous ports number & 1 Centronics port	2	2	3	3	3	3
8-, 64-, 128- port Serial Adapters	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
1 & 4- port multiprotocol Synchronous Adapters	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
Performances						
Estimated Transaction per minute (1-2-4 CPU)						
604e@225MHz - 1MB L2 cache (Sybase)	-	-	2400-4200	-	2400-4200-6400	-
604e@332MHz - 1MB L2 cache (Sybase)	2100	-	-	-	-	-
604e@375MHz - 1MB L2 cache (Sybase)		2400	-	-	-	-
604e@360MHz - 4MB L2 cache (Sybase)	-	-	3325-5625	-	3325-5625-8117	-
620@180MHz - 4MB L2 cache (Sybase)	-	-	3400-5800	-	3400-5800-9001	-
RS64-II@262MHz - 4MB L2 cache (Oracle)	-	-	-	4600-7800	-	4600-7800-11000-13700
RS64-III@400MHz (1-2-3-4 CPUs, Oracle)	-	-	-	5200-10000	-	5800-11000-15600-19000
SPECint95 -SPECfp95 with 604e @225MHz -1MB	-	-	9.27-6.02	-	9.27-6.02	
SPECint95 -SPECfp95 with 604e @233MHz -1MB	8.6-5.6	-	-	-	-	-
SPECint95 -SPECfp95 with 604e @332MHz -1MB	12.9-6.2	-	-	-	-	-
SPECint95 -SPECfp95 with 604e @375MHz -1MB	-	15.1-10.1	-	-	-	-
SPECint95 -SPECfp95 with 604e @360MHz -4MB	-	-	14.2-8.2	-	14.2-8.2	-
SPEC int_rate'95 (2-4 CPU) with 604e@360Mhz -4MB	-	-	249	-	249-480	-
SPEC int_rate'95 (1-2-3-4 CPU) with RS64-II@262MHz -4MB	-	-	-	105-210	-	105-210-315-419
SPEC int_rate'95 (1-2-3-4 CPU) with RS64-III@400MHz -4MB	-	-	-	165-329	-	165-329-493-655
SPECint95 -SPECfp95 with RS64-II@262MHz -4MB (est.)	-	-	-	15-12	-	15-12
SPECint95 -SPECfp95 with RS64-III@400MHz -4MB (est.)	-	-	-	18.34-xx	-	18.34-xx
SPECweb96 with RS64-III@400MHz -4MB (est.)	-	-	-	-	-	4700 / 8600 / 12000 / 14600

Notes

(1) T620: discontinued.
(2) 8 Disks (1.6" high) or 12 Disks (1" high) on Area 4 (12x9.1 GB).
(3) 5 areas are available in the Base.
Area N°1 is reserved for Media (two media by area).
Area N°2 can be configured either for Media or for Disks (three 1" high disks or two 1.6" high disks maximum by area).
The other Areas are reserved for Disks.
(4) Recon: feature available if reconnection is required when upgrading from the T604e/T620 to the T430/T450 or when upgrading from the E604e/E620 to the E230/E250.
(5) Standard: 10 Mbps for S100 and E Series and 10/100 Mbps for S120 and T Series. Optional 10/100 Mbps adapter for each Series.
(Opt1) With the PCI Entry Extender Card.
(Opt2) With the PCI Extender Card (the 7 PCI slots 32 but include the 2 PCI/ISA slots shared).

2. ESCALA S100 / S120 Servers

2.1. Technical Features

The ESCALA S100 model features a single PowerPC 604e RISC processor at 233MHz or at 332 MHz and the S120 features a single PowerPC 604e RISC processor at 375MHz (maximum one CPU board) The PowerPC processor 604e @233 or 332MHz has 32KB of instruction and data cache plus an additional 1MB of L2 cache for fast data transfer between the processor and memory for balanced system performance.
The S100 includes a Fast Wide SCSI bus for Disks, 6 memory slots, 5 I/O slots are available (5 PCI 32 bit slots, 2 shared PCI/ISA slots) and Up to 2 Media (including the CD-ROM), up to 3 disks (including the system base disk) can be configured.
The S120 includes an Ultra Wide SCSI bus for Disks, 4 memory slots, 5 I/O slots are available (5 PCI 32 bit slots) and Up to 2 Media (including the CD-ROM), up to 3 disks (including the system base disk) can be configured.
For the S100, the maximum memory configurable is 768 MB (with a swap of the 64 MB base memory, otherwise 704 MB).
For the S120, the maximum memory configurable is 1 GB (with a swap of the 128 MB base memory, otherwise 896 MB).

The maximum internal disks capacity is 45.5 GB (9.1 + 2x18.2GB) using 3 bays in the base cabinet. This maximum internal disks capacity is 172.9 GB (45.5 + 2x(7x9.1) GB) using 2 expansion disks Cabinets.

Standard Features

- S100: 1 single CPU module PowerPC 604e @233MHz - 1MB L2 cache
  or 1 single CPU module PowerPC 604e @332MHz - 1MB L2 cache
  S120: 1 single CPU module PowerPC 604e @375MHz - 1MB L2 cache
- S100: 1 Fast Wide SCSI bus for Disks & Media
  S120: 1 Ultra Wide SCSI bus for Disks & Media
- S100: 64MB memory (up to 768 MB)
  S120: 128MB memory (up to 1 GB)
- 9.1GB Disk minimum (up to 45.5GB)
- S100: 1 Ethernet Port (10 Mb/s)
- S120: 1 Ethernet Port (10/100 Mb/s)
- 1 CD-ROM disk Drive
- Keyboard and Mouse ports
- 2 Asynchronous ports + 1 Centronics port

Options

Optional features include:

- System Memory expansion up to 768MB for S100, 1GB for S120
- Internal disk expansion up to 45.5GB
- Expansion Disks/Media Cabinet (63.7GB disk capacity)
- Internal media device (DAT, VDAT, QIC)

- LAN, WAN, and asynchronous communications adapters
- Graphics adapter, graphics display, keyboard and mouse

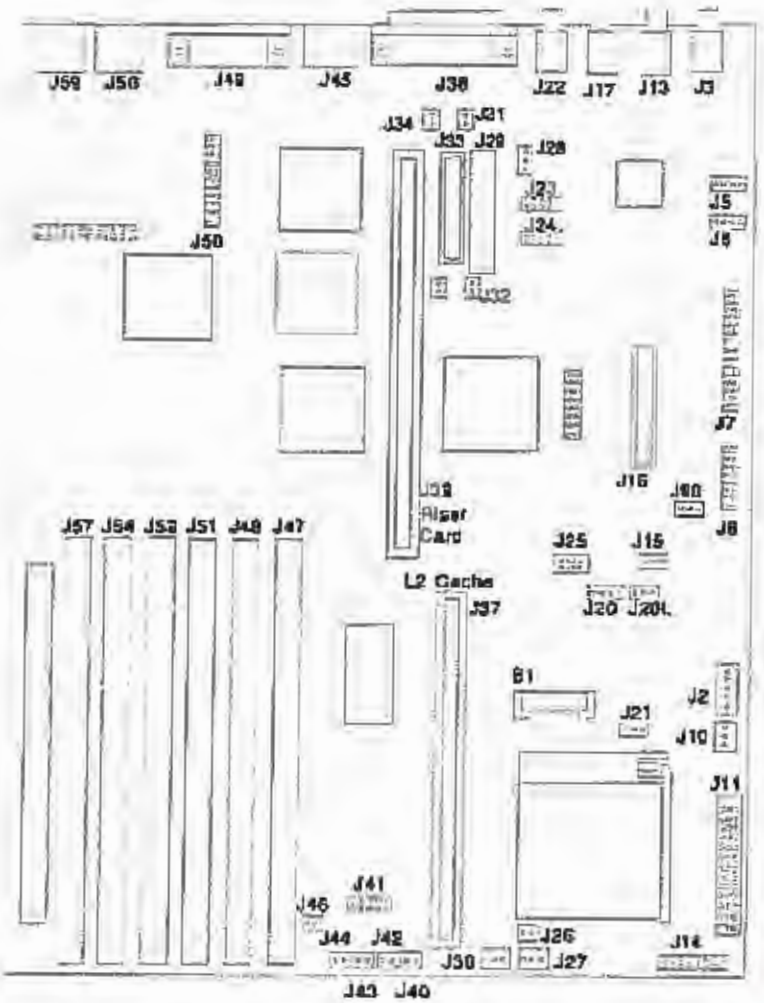
Operational requirements

- A system console
- AIX® version 4.2 or later.

2.2. Technical Architecture

2.2.1. The S Series Basic Boards

The Escala **S100 Planar Board** is designed as follows:

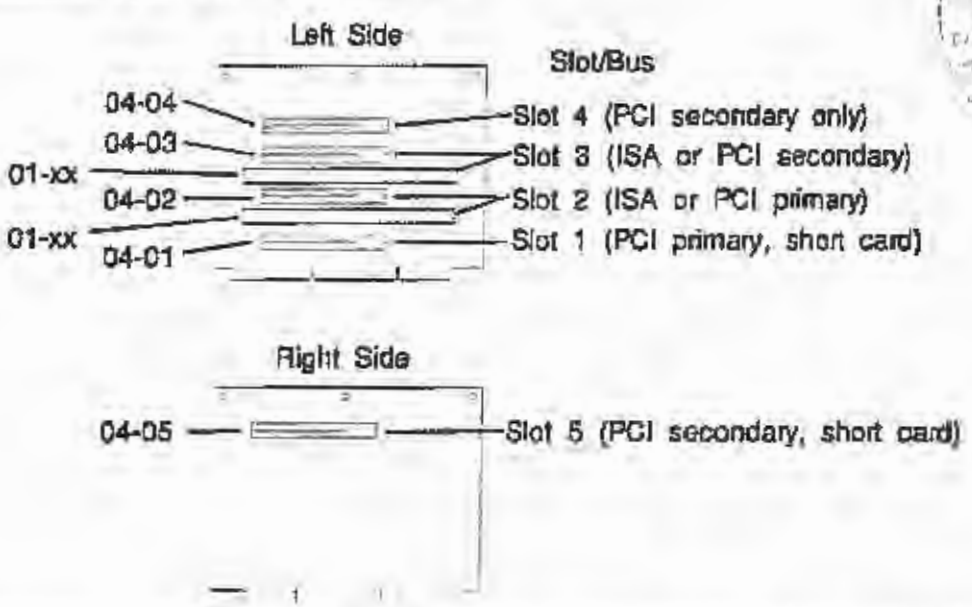


With the corresponding components:

J3	Audio input connector
J13	Audio output connector
J17	Microphone jack

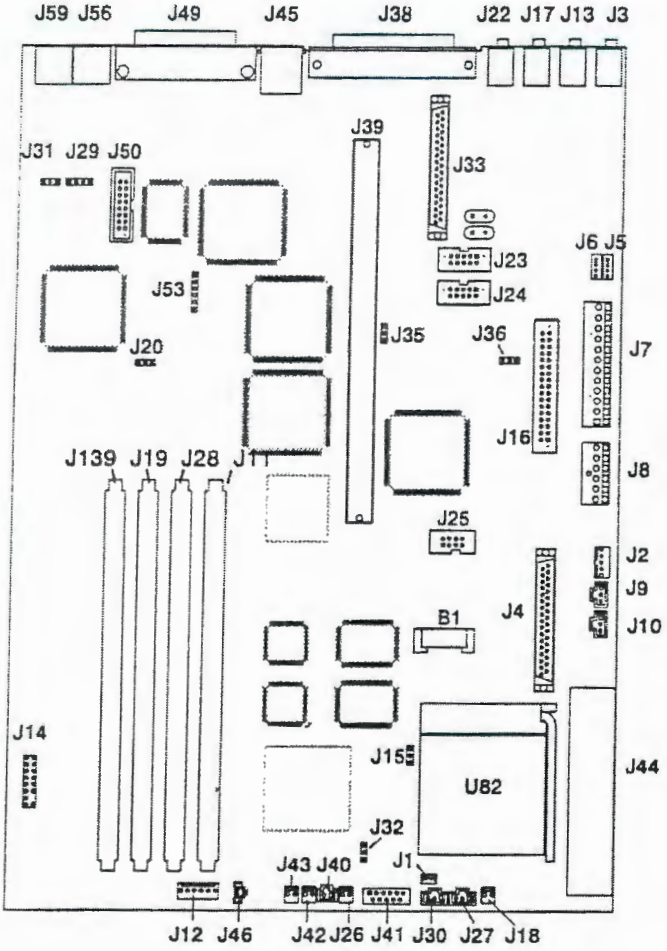
J22	Headphone jack
J38	External SCSI connector
J45	Ethernet twisted pair connector
J49	Parallel port connector
J56	Mouse port connector
J59	Keyboard port connector
J24	Serial port connector 1
J23	Serial port connector 2
J5, J6	CD-ROM audio connectors
J15	Automatic Power-up Jumper
J25, J20, J20L	Tablet port connectors
B1	Battery connector
J2	5x5 Auxiliary 5v connector
J10	Media Fan connector
J11	Voltage Regulator Card connector
J21	Privileged-Access Password jumper
J57	Memory connector F
J54	Memory connector E
J52	Memory connector D
J51	Memory connector C
J48	Memory connector B
J47	Memory connector A
J41	Op Panel Connector
J16	Diskette drive connector
J50	Ethernet AUI
J7	Power connector
J8	Power connector
J90	Power-On Password jumper
J39	Riser card connector
J37	L2 Cache Card connector
J33	Internal SCSI 16-bit connector
J29	Internal SCSI 8-bit connector (not supported)
J28, J31, J32, J34	SCSI security jumpers
J14	CPU ESP connector
J26	CPU fansink connector
J27	System fan connector
J30	System fan connector
J40	Power Switch connector
J42	Power Indicator LED connector
J43	Hard disk activity LED connector
J46	Internal Speaker connector

With a representation of the S100 **RISER board:**



Note: The xx digits in the ISA slot location codes are determined by the order in which the ISA adapters are configured.

The Escala **S120 Planar Board** is designed as follows:

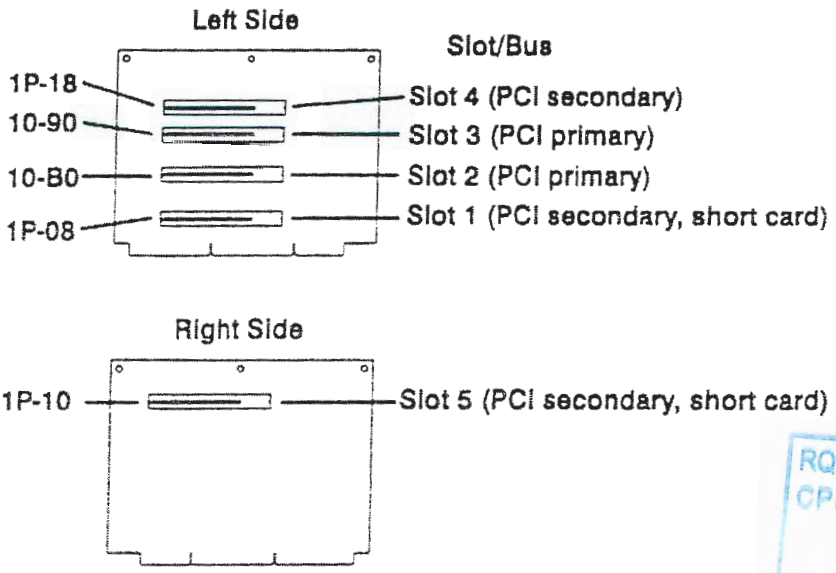


With the corresponding components:

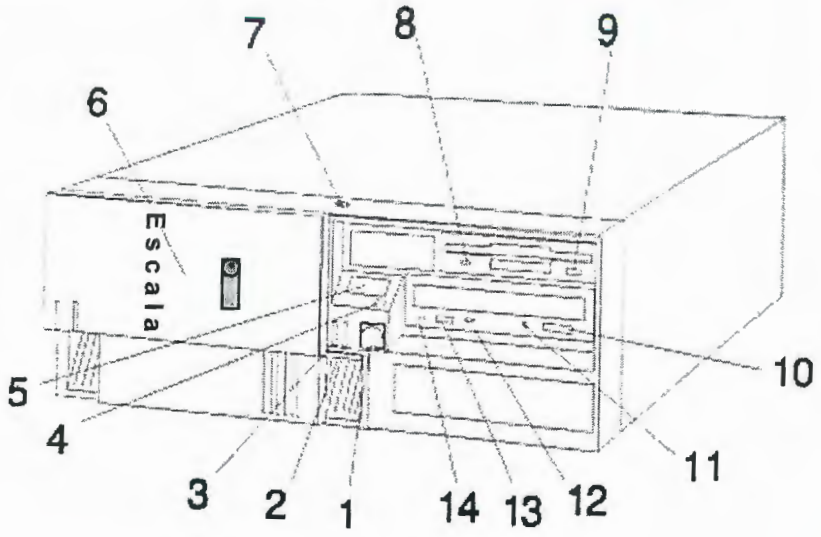
B1	Battery Connector
J2	5x5 Auxiliary 5v connector
J3	Audio input connector
J4	Internal SCSI connector #2
J5, J6	CD-ROM audio connectors
J7, J8	Power connector
J10	Media Fan connector
J11	Memory connector 1
J13	Audio output connector
J15	Remote Power-up Jumper
J16	Diskette drive connector
J17	Microphone jack
J18	Reset Connector
J19	Memory connector 3
J20	Power-on Password jumper
J22	Headphone jack

J23	Serial port connector 2
J24	Serial port connector 1
J25	Tablet port connector
J26	CPU fansink connector
J27	System fan connector
J28	Memory connector 2
J30	System fan connector
J32	Privileged-Access Password Jumper
J33	Internal SCSI 16-bit connector
J35	SCSI security jumper
J36	SCSI security jumper
J38	External SCSI connector
J39	Riser card connector
J40	Power Switch connector
J41	Op Panel Connector
J42	Power Indicator LED connector
J43	Hard disk activity LED connector
J44	Voltage Regulator connector
J45	Ethernet twisted pair connector
J46	Internal Speaker connector
J49	Parallel port connector
J50	Ethernet AUI
J53	Ethernet EPROM connector
J56	Mouse port connector
J59	Keyboard port connector
J139	Memory connector 4

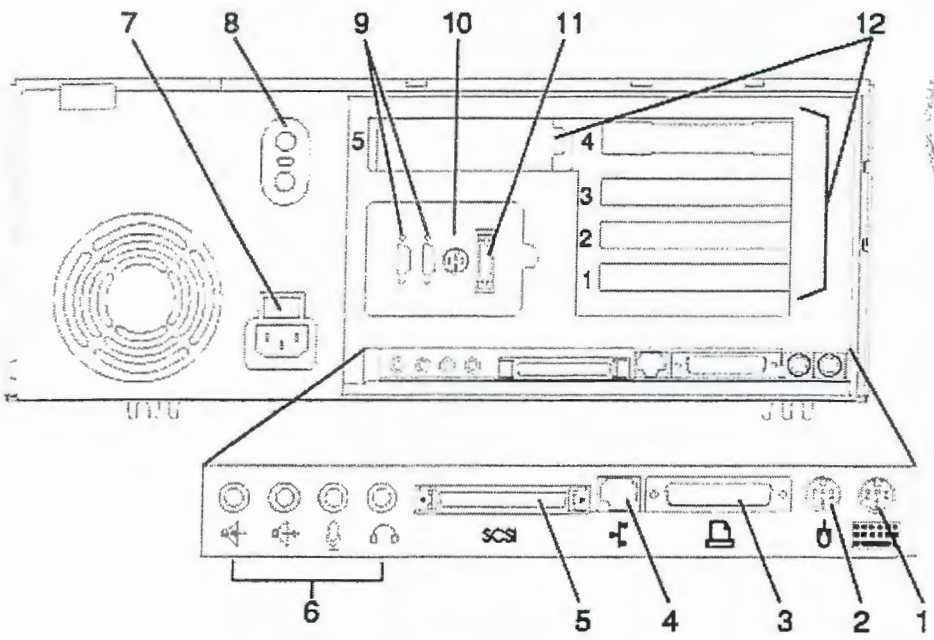
With a representation of the **S120 RISER board**:



2.2.2. A front representation of the Escala S Series:



1 Power Switch: Turns computer power on and off.
2 Power-On Light: Glows when computer is on.
3 Hard Disk Drive In-Use Light: Glows when computer is reading from or writing to the hard disk.
4 Reset Button: Function depends upon the operating system installed.
5 Operator Panel Display: Function depends upon the operating system installed; may display current status of system unit startup, or diagnostic information in the event of a hardware problem.
6 Media Bay Cover: Covers the diskette and CD-ROM drives when they are not in use.
7 Cover Lock: Security feature. Prevents the cover from being removed and locks the media bay cover in the closed position.
8 Diskette-Drive In-Use Light: Glows when computer is reading from or writing to a diskette.
9 Diskette Eject Button: Releases diskette from 3.5-inch diskette drive.
10 CD-ROM Eject Button: Releases the CD-ROM from the CD-ROM drive.
11 CD-ROM Emergency Eject: Ejects CD-ROM from the CD-ROM drive if power is not available.
12 CD-ROM Status Light: Indicates when the CD-ROM drive is active.
13 CD-ROM Volume Control: Controls the volume for the CD-ROM headphone jack.
14 CD-ROM Headphone Jack: CD-ROM Headphone connector.



2.2.3. A rear representation of the Escala S Series:

1 Keyboard Port: For keyboard connection.
2 Mouse Port: For mouse connection.
3 Parallel Port: For connecting a parallel printer or other parallel devices.
4 10BaseT (on Escala S100) or 100Base T (on Escala S120) Ethernet Port: For attaching your computer to an Ethernet/Twisted pair connection through a 10baseTconnector.
5 External SCSI Port: For connecting external SCSI devices.
6 Audio Ports:
  Headphone.
  Microphone.
  Audio line out.
  Audio line in.
7 Voltage-Selection Switch: Select either 115-V or 230-V setting.
8 Security tether attachment: Attachment point for a security tether.
9 9-Pin Serial Ports: For a TTY terminal, Modem, or other serial devices.
10 Tablet Port: For attaching a digitizing tablet to your computer.
11 10Base5 Ethernet Port: For attaching your computer to an Ethernet thick connection (or Ethernet thin connection, using an optional transceiver) through a 10base5 connector.
12 Expansion Slots: For adding ISA and PCI adapters.

3. ESCALA E620/E604e Server

3.1. Technical Features

The ESCALA E model features a single PowerPC 620 RISC processor at 180MHz or a single PowerPC 604e RISC processor at 225MHz or at 360 MHz (maximum two CPU boards).

The processor PowerPC 604e @225MHz has 32 KB internal cache and 1MB L2 cache for fast data transfer between the processor and memory for balanced system performance.
The processor PowerPC 604e @360MHz has 32 KB internal cache and 4MB L2 cache.
The processor PowerPC 620 @180MHz has 32 KB internal cache and 4MB L2 cache.

This Model also includes an Ultra SCSI bus for Disks, 2 memory slots (a riser memory board can be plugged on each memory slot), 7 I/O slots are available with the optional PCI Extender board (7 PCI 32 bit slots, 2 shared PCI/ISA slots) or 4 I/O slots with the optional PCI Entry Extender Board (2 PCI 64 bit, 2 ISA slots), and 5 Disks/Media Areas are available (the Area N° 1 is reserved for Media, the Area N°2 is configurable either for Media or for Disks, the other Areas are reserved for Disks).
Up to 2 Media, up to 2 disks (1.6" high) or up to 3 disks (1" high) can be plugged on one Area.

The maximum memory configurable is 2 GB (8x256MB)
The maximum internal disks capacity is 218.4GB (12x18.2GB) using 4 Areas in the Basic Cabinet
This maximum internal disks capacity is 655.2GB (3x12x18.2GB) using 2 expansion disks Cabinets.

Standard Features

- 1 single CPU module PowerPC 620 @180MHz - 4MB L2 cache
  or 1 single CPU module PowerPC 604e @225MHz - 1MB L2 cache
  or 1 single CPU module PowerPC 604e @360MHz - 4MB L2 cache
- 1 slot for additional CPU module
- 1 Ultra SCSI bus for Disks & Media
- 64MB memory (up to 2GB)
- 4.2GB Disk minimum (up to 218.4GB) - RAID functionality option
- Disk Hot Swapping
- 1 Ethernet Port (10 Mb/s)
- 1 CD-ROM disk Drive
- 1 SVGA Adapter with 1MB Video Memory RAM
- Keyboard and Mouse ports
- 3 Asynchronous ports + 1 Centronics port

Options

Optional features include:

- PCI Entry Extender Board
  - 4 I/O Slots:
    -2 PCI 64 bit slots
    -2 ISA slot
- PCI Extender Board
  - 7 I/O Slots:
    -7 PCI 32 bit slots
    -2 PCI/ISA slots (the 2 PCI slots overlapped with the 7 PCI 32 slots)
- Redundant Power Supply
- Internal Ultra SCSI RAID Adapter
- System Memory expansion up to 2GB
- Internal disk expansion up to 218.4GB
- Expansion Disks/Media Cabinet (218.4GB disk capacity)
- Internal media devices on Area N°1 and N°2 (up to 4) media
- External disk storage and media devices, including
  - DAS1300, DAS2900, DAS5300 and DAS5700 RAID Subsystems
  - EMC Symmetrix 3000 subsystem
- LAN, WAN, and asynchronous communications adapters
- Graphics adapter, graphics display, keyboard and mouse
- Additional 1 MB Video Memory RAM for standard SVGA Graphics

Operational requirements

- A system console
- AIX® version 4.2 or later.

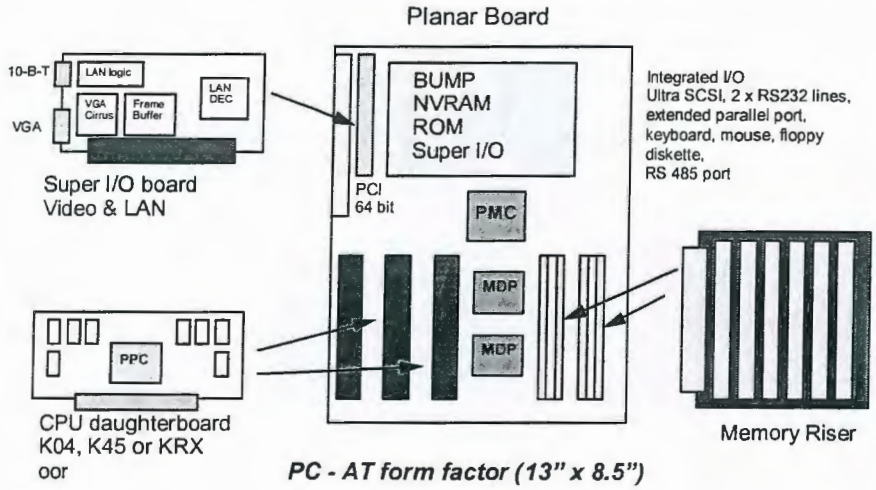
3.2. Technical Architecture

3.2.1. The E620/E604e Basic Boards

The Escala E Series Planar Board is designed to house:

- The CPU Daughterboards (up to 2)
- The Memory banks or a Memory Riser
- The Super I/O board Video & LAN
- An optional PCI Entry Extender or PCI Extender (plugged on the PCI slot)

Escala - Serie E basic boards



PC - AT form factor (13" x 8.5")

The Planar system motherboard is the heart of the system and supports:

- 1-2 CPU daughterboards
  - Supports both PowerPC 604e / 620 processors
- Up to 2 GB memory with standard DIMMs
- Integrated I/O on motherboard
  - Ultra SCSI, 2 x RS232 lines, extended parallel port, keyboard, mouse, floppy diskette, RS 485 port
- System I/O (PCI controller based)
  - SVGA graphics, 10-Base-T Ethernet
- Dedicated maintenance processor and facilities
  - Bring Up MicroProcessor (BUMP)
  - JTAG & I^2C bus control of hardware resources
  - Front panel and switches scanning

The Planar Board is a PC baby-AT size board providing a low cost entry configuration based on an industry standard form factor.

The Super I/O board Video and LAN adapter

The main system I/O is supplied by means of a single 64 bit PCI adapter (developed by Bull) called the Video & LAN Adapter. This adapter supports SVGA graphics (Cirrus Logic CL-GD 5436) with 1 MB frame buffer (an optional 1 MB frame buffer is available) and Ethernet 10-Base-T (DEC 21140 or 21040).

The I/O logic is deliberately not native on the motherboard to increase the flexibility for customers, allowing them to develop or integrate a specific PCI card that best matches their need and application requirements.

PCI Bus implementation details

The Escala E Series PCI bus is implemented by means of a Bull developed ASIC called the PMC (PCI and Memory Controller). On the PCI side this ASIC is a PowerPC 6xx bus to PCI channel bridge with the PCI bus being implemented as a 64 bit channel running at 33 MHz and being compliant with the PCI bus specification.

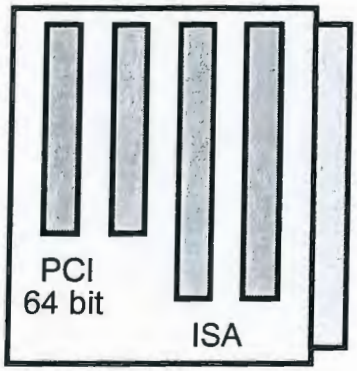
To add additional PCI slots to the Escala E Series Planar Board it is necessary to connect a system extender card. The 2 standard PCI extenders are described in the following paragraph.

3.2.2. The System Extender Cards

As previously mentioned it is possible to extend the PCI and incidentally also the ISA I/O slot capacities of the Escala E Series Planar Board, by the use of dedicated extender cards.

The PCI Entry Extender Card

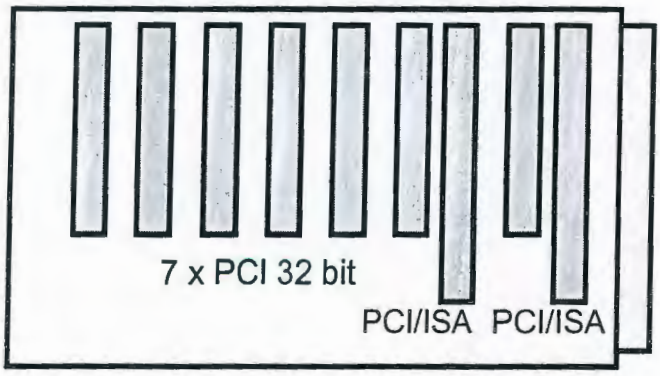
PCI Entry Extender Card



The PCI Entry Extender Card adds an additional 2 x 64 bit PCI slots and an extra 2 x ISA slots to the existing single 64 bit PCI slot included on the Escala E Series Planar Board.

The PCI Extender Card

PCI Extender Card



The Escala E Series Extender Card adds an additional 7 x 32 bit PCI slots and an extra 2 x PCI/ISA slots to the existing single 64 bit PCI slot included on the Planar Board. Please note however, that the 2 x PCI/ISA slots are physically overlapped with the last 2 PCI slots. This means that a maximum of 7 slots may be occupied at any one time, i.e. the 2 x PCI/ISA and 2 x PCI are mutually exclusive.

4. ESCALA E230 and E250 Server

4.1. Technical Features

The ESCALA E230 model features a single PowerPC RS64-II processor at 262 MHz. It contains 64KB of internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance.

The ESCALA E250 model features a single PowerPC RS64-III processor at 400 MHz. It contains 128KB of internal cache and 2MB L2 cache for fast data transfer between the processor and memory for balanced system performance.

These models also include a SCSI-2 Ultra Wide bus for media and an Ultra2 SCSI bus for disks, 4 memory slots (a riser memory board can be plugged on each memory slot), 9 I/O slots are available (8 PCI slots and 1 shared PCI/ISA1slot), and 5 Disks/Media Areas are available (the Area N°1 is reserved for Media, the Area N°2 is configurable either for Media or for Disks, the other Areas are reserved for Disks).
Up to 2 Media, up to 2 disks (1.6" high) or up to 3 disks (1" high) can be plugged on one Area.

The maximum memory configurable is 4 GB (8x512MB)
The maximum internal disk capacity is 218.4GB (12x18.2GB) using 4 Areas in the Basic Cabinet
This maximum internal disk capacity is 655.2GB (3x12x18.2GB) using 2 expansion disk Cabinets.

Basic Features

- **E230:** 1 single CPU module PowerPC RS64-II @262MHz - 4MB L2 cache
- **E250:** 1 single CPU module PowerPC RS64-III @400MHz - 2MB L2 cache
- 1 slot for an additional CPU module
- 1 Ultra2 SCSI bus for Disks
- 1 SCSI-2 Ultra Wide bus for Media
- 9 I/O Slots :
  - 4 PCI 64 bit slots
  - 4 PCI 32 bit slots
  - 1 PCI/ISA slot
- 256MB memory (up to 4GB)
- 9.1GB Disk minimum (up to 218.4GB) - RAID functionality option
- Disk Hot Swapping
- 1 Ethernet Port (10/100 Mb/s)
- 1 CD-ROM disk Drive
- **E230:** 1 SVGA Adapter with 2MB Video Memory RAM
- Keyboard and Mouse ports
- 3 Asynchronous ports + 1 Centronics port.

Options

Optional features include:

- Internal Ultra SCSI RAID Adapter
- System Memory expansion up to 4GB
- Internal disk expansion up to 218.4GB
- Expansion Disks/Media Cabinet (218.4GB disk capacity)
- Internal media devices on Area N°1 and N°2 (up to 4) media
- External disk storage (based on SCSI or Fibre Channel) and media devices, including
  - DAS1300, DAS2900, DAS5300 and DAS5700 RAID subsystems
  - EMC Symmetrix 3000 subsystems
- LAN, WAN, and asynchronous communications adapters
- Graphics adapter, graphics display, keyboard and mouse
- Redundant power supply.

Operational requirements

- A system console.
- **E230:** AIX version 4.3.2 or later.
- **E250:** AIX version 4.3.3 or later.

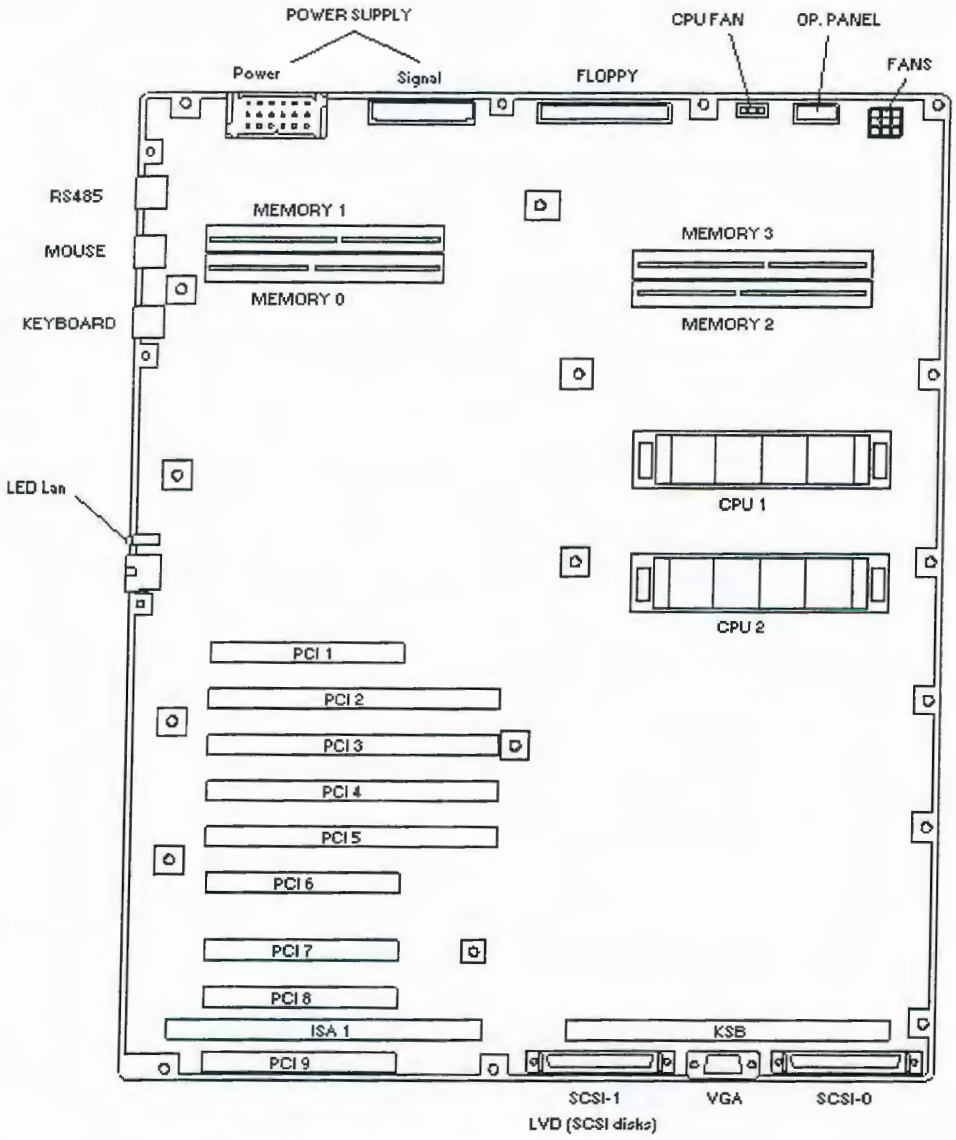
4.2. Technical Architecture

4.2.1. The Escala E230 and E250 Basic Boards

The Escala E230 and E250 system board is the heart of the system and supports:

- 1-2 CPU daughterboards
- Standard memory DIMMs
- 1-2 I/O agents
  - 1st agent is Bull Dual PCI bridge (DPCI)
  - 2nd agent DPCI or alternative
- Dual PCI busses
  - Up to 9 I/O cards (9 PCI & 1 ISA with 1 shared slot)
  - Basic PCI = 4 x 64 bit & 5 x 32 bit slots @ 33 MHz
  - 1 ISA slot shared with a 32 bit PCI slot
- BUMP & Super I/O daughterboard
- Connectors daughterboard
- Operator panel
- Integrated support for:
  - Ultra2 SCSI, Ultra Wide SCSI, Ethernet 10/100, SVGA graphics (E230 only)

The Escala E230 and E250 Planar Board



Note: The E250 planar board does not have the VGA connector.

The BUMP and Super I/O daughterboard

The BUMP and Super I/O daughterboard contains the control logic used during the system start-up phase. It also contains a dedicated maintenance microprocessor used to provide additional service functionality both during system boot and operational phases.

The BUMP and Super I/O daughterboard supports:

- Bring Up MicroProcessor (BUMP)
  - JTAG & I²C bus control of hardware resources
  - Front panel and switches scanning
  - NVRAM.
- Super I/O
  - 3x RS 232 ports, parallel port, floppy disk controller, keyboard & mouse ports, RS 485 port.

The Connectors daughterboard

The Connectors daughterboard is a small board containing integrated I/O connectors:

- Ethernet
- Graphics
- Keyboard
- Mouse
- 3 x RS 232
- Parallel
- RS 485

The Operator Panel

The operator panel supports:

- Front panel and switches
- LED display for AIX boot status
- Floppy disk drive

5. ESCALA T620/T604e Server

Note: The Escala T620 has been discontinued.

5.1. Technical Features

The ESCALA T620/T604e model features a single PowerPC 620 RISC processor at 180 MHz (two CPU boards max.) or a single PowerPC 604e RISC processor at 225 MHz or at 360 MHz (maximum four CPU boards).
The processor PowerPC 604e @225MHz has 32 KB internal cache and 1MB L2 cache (optional 4MB L2 cache) for fast data transfer between the processor and memory for balanced system performance.
Both processors PowerPC 620 @180MHz and 604e @360MHz have 32 KB internal cache and 4MB L2 cache.

This model also includes a SCSI-2 Fast/Wide bus for Media and an Ultra SCSI bus for Disks, 4 memory slots (a riser memory board can be plugged on each memory slot), 9 I/O slots are available (6 PCI slots, 2 shared PCI/ISA slots and 1 ISA slot), and 5 Disks/Media Areas are available (the Area N°1 is reserved for Media, the Area N°2 is configurable either for Media or for Disks, the other Areas are reserved for Disks).
Up to 2 Media, up to 2 disks (1.6" high) or up to 3 disks (1" high) can be plugged on one Area.

The maximum memory configurable is 3 GB (6x512MB)
The maximum internal disk capacity is 218.4GB (12x18.2GB) using 4 Areas in the Basic Cabinet
This maximum internal disk capacity is 655.2GB (3x12x18.2GB) using 2 expansion disk Cabinets.

Standard Features

- 1 single CPU module PowerPC 620 @180MHz - 4MB L2 cache *(discontinued)*
  or 1 single CPU module PowerPC 604e @225MHz - 1MB L2 cache
  or 1 single CPU module PowerPC 604e @360MHz - 4MB L2 cache
- 3 slots for additional CPU module
- 1 Ultra SCSI bus for Disks
- 1 SCSI-2 Fast/Wide bus for Media
- 9 I/O Slots :
  - -5 PCI 64 bit slots
  - -1 PCI 32 bit slots
  - -2 PCI/ISA slots
  - -1 ISA slot
- 128MB memory (up to 3GB)
- 4.2GB Disk minimum (up to 218.4GB) - RAID functionality option
- Disk Hot Swapping
- 1 Ethernet Port (10/100 Mb/s)
- 1 CD-ROM disk Drive
- 1 SVGA Adapter with 1MB Video Memory RAM
- Keyboard and Mouse ports
- 3 Asynchronous ports + 1 Centronics port

Options

Optional features include:

- Redundant Power Supply
- Internal Ultra SCSI RAID Adapter
- System Memory expansion up to 3GB
- Internal disk expansion up to 218.4GB
- Expansion Disks/Media Cabinet (218.4GB disk capacity)
- Internal media devices on Area N°1 and N°2 (up to 4) media
- External disk storage (based on SCSI or Fibre Channel) and media devices, including
  - DAS1300, DAS2900, DAS5300 and DAS5700 RAID subsystems
  - EMC Symmetrix 3000 subsystems
- LAN, WAN, and asynchronous communications adapters
- Graphics adapter, graphics display, keyboard and mouse
- Additional 1 MB Video Memory RAM for standard SVGA Graphics

Operational requirements

- A system console.
- AIX® version 4.2 or later.

5.2. Technical Architecture

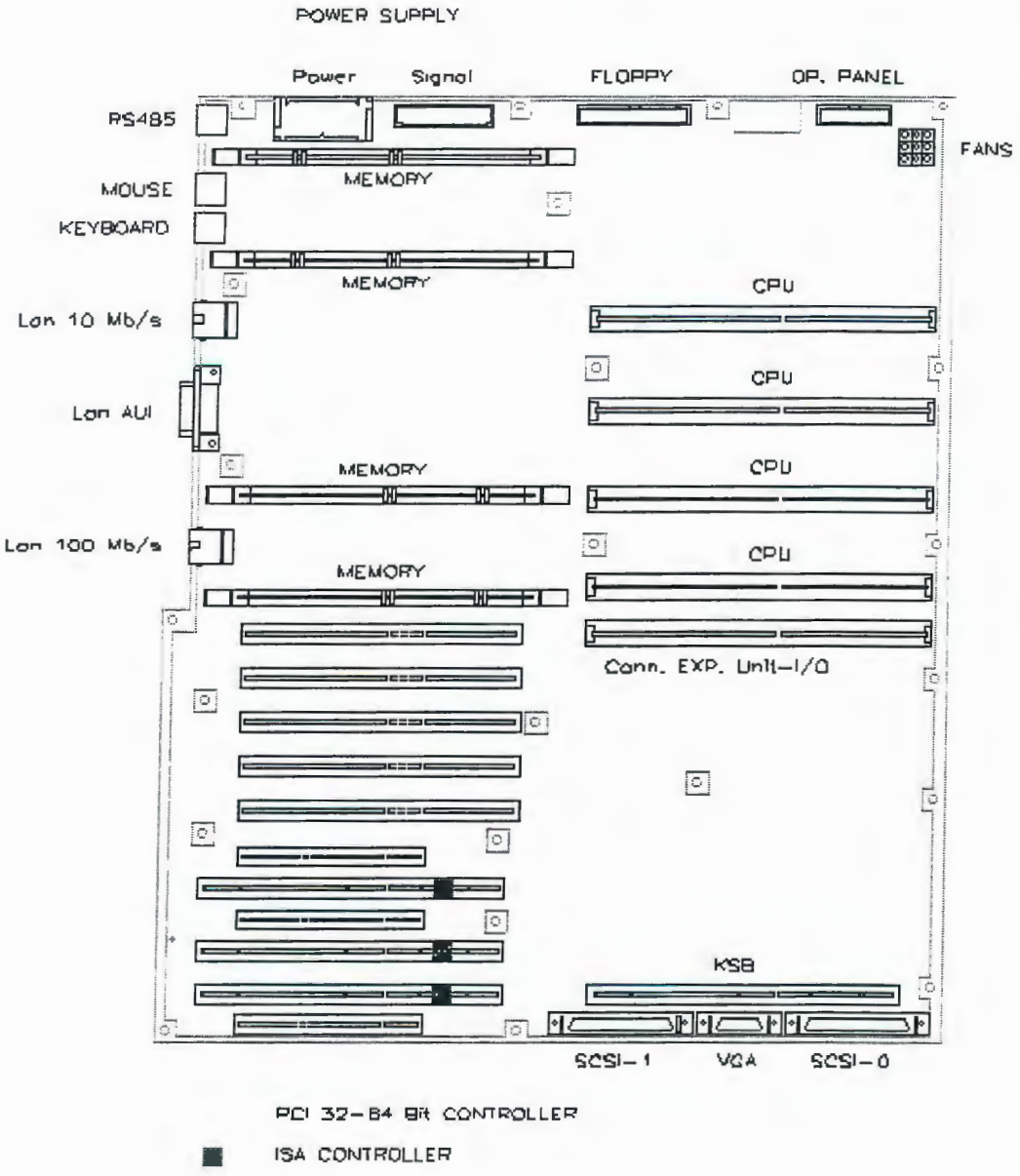
5.2.1. The T604e/T620 Model Basic Boards

The Escala T604e/T620 system motherboard is the heart of the system and supports:

- 1-4 CPU daughterboards
- Standard memory DIMMs
- 1-2 I/O agents
  - 1st agent is Bull Dual PCI bridge (DPCI)
  - 2nd agent DPCI or alternative
- Dual PCI busses
  - Up to 9 I/O cards (8 PCI & 3 ISA with 2 shared slots)
  - Basic PCI = 5 x 64 bit & 3 x 32 bit slots @ 33 MHz
  - 3x ISA slots where 2 slots are shared with the 32 bit PCI slots
- BUMP & Super I/O daughterboard
- Connectors daughterboard
- Operator panel
- Integrated support for 2 x UltraSCSI, Ethernet 10/100, SVGA graphics

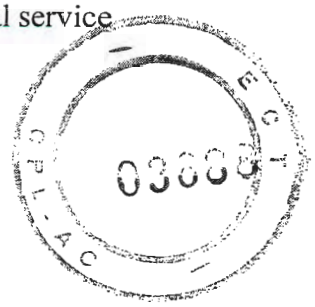
The Escala T604e/T620 Planar Board

03039



The BUMP and Super I/O daughterboard

The BUMP and Super I/O daughterboard contains the control logic used during the system start-up phase. It also contains a dedicated maintenance microprocessor used to provide additional service functionality both during system boot and operational phases.



The BUMP and Super I/O daughterboard supports:

- Bring Up MicroProcessor (BUMP)
  - JTAG & I²C bus control of hardware resources
  - Front panel and switches scanning
  - NVRAM
- Super I/O
  - 3x RS 232 ports
  - Parallel port
  - Floppy disk controller
  - Keyboard & mouse ports
  - RS 485 port

The Connectors daughterboard

The Connectors daughterboard is a small board containing integrated I/O connectors:

- Ethernet
- Graphics
- Keyboard
- Mouse
- 3 x RS 232
- Parallel
- RS 485

The Operator Panel

The operator panel supports:

- Front panel and switches
- LED display for AIX boot status
- Floppy disk drive

6. ESCALA T430 and T450 Server

6.1. Technical Features

The ESCALA T430 model features a single PowerPC RS64-II processor at 262 MHz. It contains 64KB of internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance.

The ESCALA T450 model features a single PowerPC RS64-III processor at 400 MHz. It contains 128KB of internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance.

These models also include a SCSI-2 Ultra Wide bus for Media and an Ultra2 SCSI bus for Disks, 4 memory slots (a riser memory board can be plugged on each memory slot), 9 I/O slots are available (8 PCI slots and 1 shared PCI/ISA1slot), and 5 Disks/Media Areas are available (the Area N°1 is reserved for Media, the Area N°2 is configurable either for Media or for Disks, the other Areas are reserved for Disks).
Up to 2 Media, up to 2 disks (1.6" high) or up to 3 disks (1" high) can be plugged on one Area.

The maximum memory configurable is 8 GB (8x1GB)
The maximum internal disk capacity is 218.4GB (12x18.2GB) using 4 Areas in the Basic Cabinet
This maximum internal disk capacity is 655.2GB (3x12x18.2GB) using 2 expansion disk Cabinets.

Standard Features

- **T430**: 1 single CPU module PowerPC RS64-II @262MHz - 4MB L2 cache
- **T450**: 1 single CPU module PowerPC RS64-III @400MHz - 4MB L2 cache
- 3 slots for additional CPU modules
- 1 Ultra2 SCSI bus for Disks
- 1 SCSI-2 Ultra Wide bus for Media
- 9 I/O Slots :
  - 4 PCI 64 bit slots
  - 4 PCI 32 bit slots
  - 1 PCI/ISA slot
- 256MB memory (up to 8GB)
- 9.1GB Disk minimum (up to 218.4GB) - RAID functionality option
- Disk Hot Swapping
- 1 Ethernet Port (10/100 Mb/s)
- 1 CD-ROM disk Drive
- 1 SVGA Adapter with 2MB Video Memory RAM
- Keyboard and Mouse ports
- 3 Asynchronous ports + 1 Centronics port
- Bivolt redundant power supply.

Options

Optional features include:

- Internal Ultra SCSI RAID Adapter
- System Memory expansion up to 8GB
- Internal disk expansion up to 218.4GB
- Expansion Disks/Media Cabinet (218.4GB disk capacity)
- Internal media devices on Area N°1 and N°2 (up to 4) media
- External disk storage (based on SCSI or Fibre Channel) and media devices, including
  - DAS1300, DAS2900, DAS5300 and DAS5700 RAID subsystems
  - EMC Symmetrix 3000 subsystems
- LAN, WAN, and asynchronous communications adapters
- Graphics adapter, graphics display, keyboard and mouse.

Operational requirements

- A system console.
- **T430:** AIX version 4.3.2 or later.
- **T450:** AIX version 4.3.3 or later.

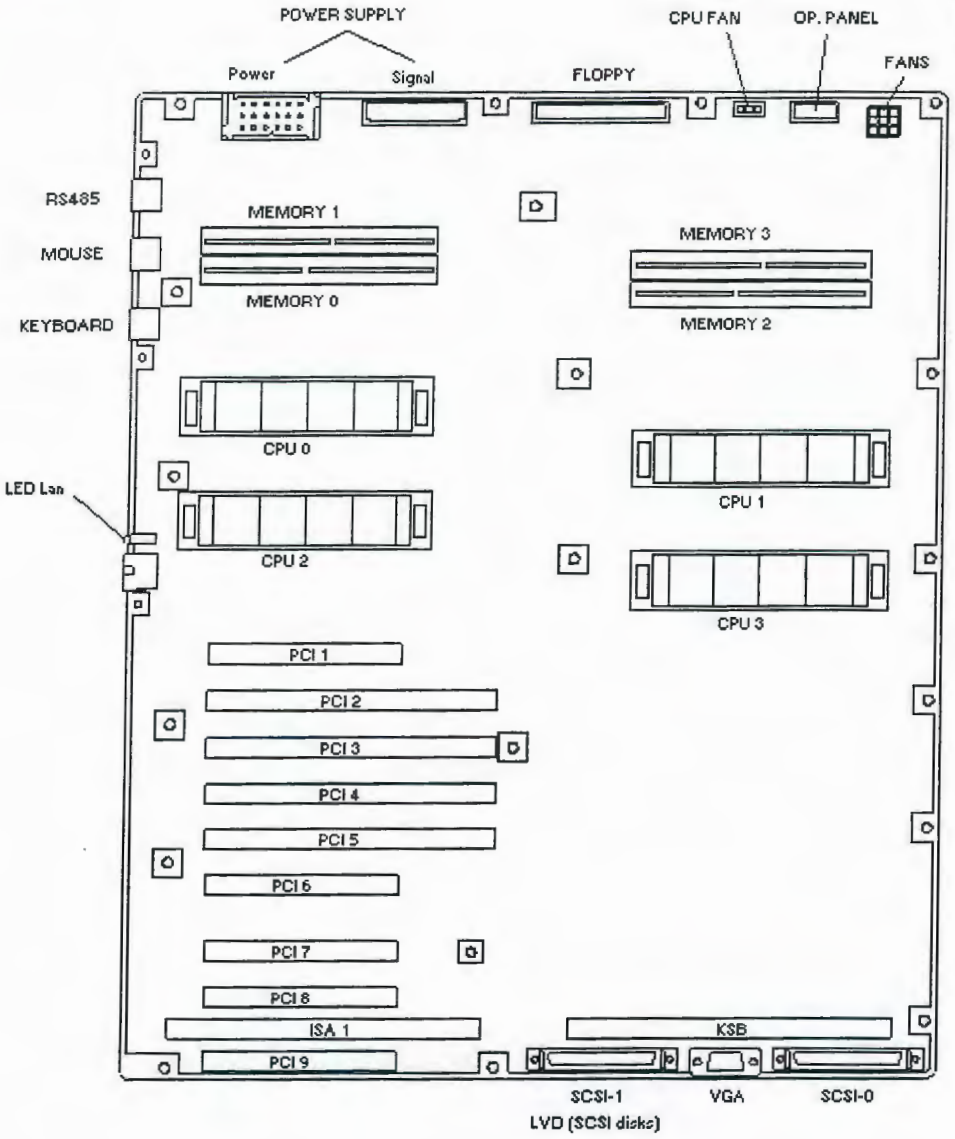
6.2. Technical Architecture

6.2.1. The Escala T430 and T450 Basic Boards

The Escala T430 and T450 system board is the heart of the system and supports:

- 1-4 CPU daughterboards
- Standard memory DIMMs
- 1-2 I/O agents
  - 1st agent is Bull Dual PCI bridge (DPCI)
  - 2nd agent DPCI or alternative
- Dual PCI busses
  - Up to 9 I/O cards (9 PCI & 1 ISA with 1 shared slot)
  - Basic PCI = 4 x 64 bit & 5 x 32 bit slots @ 33 MHz
  - 1 ISA slot shared with a 32 bit PCI slot
- BUMP & Super I/O daughterboard
- Connectors daughterboard
- Operator panel
- Integrated support for:
  - Ultra2 SCSI, Ultra Wide SCSI, Ethernet 10/100, SVGA graphics

The Escala T430 and T450 Planar Board



The BUMP and Super I/O daughterboard

The BUMP and Super I/O daughterboard contains the control logic used during the system start-up phase. It also contains a dedicated maintenance microprocessor used to provide additional service functionality both during system boot and operational phases.

The BUMP and Super I/O daughterboard supports:

- Bring Up MicroProcessor (BUMP)
  - JTAG & I²C bus control of hardware resources
  - Front panel and switches scanning
  - NVRAM.
- Super I/O
  - 3x RS 232 ports, parallel port, floppy disk controller, keyboard & mouse ports, RS 485 port.

The Connectors daughterboard

The Connectors daughterboard is a small board containing integrated I/O connectors:

- Ethernet
- Graphics
- Keyboard
- Mouse
- 3 x RS 232
- Parallel
- RS 485

The Operator Panel

The operator panel supports:

- Front panel and switches
- LED display for AIX boot status
- Floppy disk drive

7. Power Kits, Upgrade Kits, and Extension Kits

Powering-up and upgrading an existing model is a very convenient and cost effective way to increase the processing power of an existing ESCALA configuration.
Model scalability offers a high degree of flexibility in increasing the performance level and total number of users of the system that helps customers with commercial applications to take advantage of the performance of the new processors while protecting their investment.

7.1. Power Kits

Power Kits allow to enhance existing models by adding CPU boards (Escala E & T Series only).
The CPU boards must be of the same type.

7.1.1. Power Kit 604e @225MHz CPU board - 1MB L2 cache (CPUG020)

The Power Kit contains the following items:

- 1 Single CPU board PowerPC 604e @225MHz - 1MB L2 cache

Operational requirements

- ESCALA E604e (CPXG185, CPXG186)
- ESCALA T604e (CPXG154, CPXG176)

Limitations

- Maximum two CPU boards for Escala E Series
- Maximum four CPU boards for Escala T Series

7.1.2. Power Kit 604e @360MHz CPU board - 4MB L2 cache (CPUG031)

The Power Kit contains the following items:

- 1 Single CPU board PowerPC 604e @360MHz - 4MB L2 cache

Operational requirements

- ESCALA E604e (CPXG185, CPXG186)
- ESCALA T604e (CPXG154, CPXG176)

The ambient temperature has to be limited up to 38°C for the PowerPC 604e @360MHz

Limitations

- Maximum two CPU boards for Escala E Series
- Maximum four CPU boards for Escala T Series

7.1.3. Power Kit 620 @180MHz CPU board - 4MB L2 cache (CPUG037)

The Power Kit contains the following items:

- 1 Single CPU board PowerPC 620 @180MHz - 4MB L2 cache

Operational requirements

- ESCALA E620 (CPXG185, CPXG186)

Limitations

- Maximum two CPU boards for Escala E Series

AUTONUMLGLSYMBOL

7.1.5. Power Kit RS64-II@262MHz CPU board - 4MB L2 cache (CPUG038)

The Power Kit contains the following items:

- 1 single CPU board PowerPC RS64-II@262MHz - 4MB L2 cache.

Operational requirements

- Escala E230 (CPXG228, CPXG229).
- Escala T430 (CPXG224).

Limitations

- Two CPU boards maximum for the Escala E230.
- Four CPU boards maximum for the Escala T430.

7.1.6. Power Kit RS64-III@400MHz CPU board - 2MB L2 cache (CPUG044)

The Power Kit contains the following items:

- 1 single CPU board PowerPC RS64-III@400MHz - 2MB L2 cache.

Operational requirements

- Escala E250 (CPXG230, CPXG231).

Limitations

- Two CPU boards maximum for the Escala E250.

7.1.7. Power Kit RS64-III@400MHz CPU board - 4MB L2 cache (CPUG043)

The Power Kit contains the following items:

- 1 single CPU board PowerPC RS64-III@400MHz - 4MB L2 cache.

Operational requirements

- Escala T450 (CPXG224).

Limitations

- Four CPU boards maximum for the Escala T450.

7.2. Upgrade Kits

An Upgrade Kit contains one or more of the following items:
- CPU Board replacement
- installation instructions.

Note: Parts removed on the original model become the property of BULL.
The CPU boards must be of the same type.

7.2.1. Upgrade Kit from 604e @200/233MHz - 1MB L2 cache to 604e@332MHz - 1MB L2 cache (CPKG157)

Valid on the Escala S100 only, this Upgrade Kit contains the following items:

- 1 Single CPU board PowerPC 604e @332MHz - 1MB L2 cache
- Installations instructions
- See above Note about Upgrade Kit

Parts removed becoming property of Bull:

- 1 Single CPU board PowerPC 604e @200/233MHz - 1MB L2 cache

System requirements

- ESCALA S100

7.2.2. Upgrade Kit from 604e @225MHz - 1MB L2 cache to 604e@360MHz - 4MB L2 cache (CPKG156)

Valid for Escala E & T Series only, this Upgrade Kit contains the following items:

- 1 Single CPU board PowerPC 604e @360MHz - 4MB L2 cache
- Installations instructions
- See above Note about Upgrade Kit

Parts removed becoming property of Bull:

- 1 Single CPU board PowerPC 604e @225MHz - 1MB L2 cache

System requirements

- ESCALA E604e
- ESCALA T604e

The ambient temperature has to be limited up to 38°C for the PowerPC 604e @360mhz

7.2.3. Upgrade Kit from Single 604e to Single 620

Valid for the Escala E Series only, this Upgrade Kit contains the following items:

- 1 Single CPU board PowerPC 620 @180MHz - 4MB L2 cache
- Installations instructions
- See above Note about Upgrade Kit

Parts removed becoming property of Bull:

- 1 Single CPU board PowerPC 604e

System requirements

- ESCALA E604e
- AIX 4.3

Note: For E Series: CPKG176-0000: basic kit for the first CPU board and optionally CPKG177-0000 if additional CPU boards are on site.
SYMBOLSYMBOL

7.2.4. Upgrade Kit from RS64-II to RS-64-III – 2MB L2 Cache (CPKG194)

Valid for the Escala E Series only, this Upgrade Kit contains the following items:

- 1 single CPU board PowerPC RS64-III@400MHz - 2MB L2 cache.
- Installations instructions.

Parts removed becoming property of Bull:

- 1 single CPU board PowerPC RS64-II@262 MHz – 4 MB L2 cache.

System requirements

- ESCALA E230.
- AIX 4.3.3 or later.

7.2.5. Upgrade Kit from RS64-II to RS-64-III – 4MB L2 Cache (CPKG192)

Valid for the Escala T Series only, this Upgrade Kit contains the following items:

- 1 single CPU board PowerPC RS64-III@400MHz - 4MB L2 cache.
- Installations instructions.

Parts removed becoming property of Bull:

- 1 single CPU board PowerPC RS64-II@262 MHz – 4 MB L2 cache.

System requirements

- ESCALA T430.
- AIX 4.3.3 or later.

7.2.6. Upgrade Kit from T604e/T620 to T430

Discontinued: 31/05/2000.

7.2.6.1. Basic Upgrade Kit from Escala T to Escala T430

This upgrade kit allows you to upgrade from an Escala T604e/T620 to an Escala T430 reconnecting the existing disks, media and communication and disk adapters. The resulting upgraded T604e/T620 will have the same memory and CPU capability as an Escala T430.

The basic kit includes:

- 1 Escala T430 base cabinet.
- 1 single CPU board with an RS64-II processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- T604e or T620 base cabinet.
- 1 single PowerPC 604e or 620 CPU board.
- Memory on the T604e/T620. The client has to acquire new memory for the upgraded machine.

7.2.6.2. Swapping additional Single 604e/620 CPU boards

This kit allows you to swap additional single 604e/620 CPU boards for single RS64-II CPU boards when upgrading from Escala T to Escala T430.

It contains the following items:

- 1 single CPU board with an RS64-II@262 MHz processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
- 1 single PowerPC 620 CPU board.

7.2.6.3. System Requirements

- Escala T604e or T620.
- AIX 4.3.2 or later.

7.2.7. Upgrade Kit from T604e/T620 to T450

7.2.7.1. Basic Upgrade Kit from Escala T to Escala T450

This upgrade kit allows you to upgrade from an Escala T604e/T620 to an Escala T450 reconnecting the existing disks, media and communication and disk adapters. The resulting upgraded T604e/T620 will have the same memory and CPU capability as an Escala T450.

The basic kit includes:

- 1 Escala T450 base cabinet.
- 1 single CPU board with an RS64-III processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- T604e or T620 base cabinet.
- 1 single PowerPC 604e or 620 CPU board.
- Memory on the T604e/T620. The client has to acquire new memory for the upgraded machine.

7.2.7.2. Swapping additional Single 604e/620 CPU boards

This kit allows you to swap additional single 604e/620 CPU boards for single RS64-III CPU boards when upgrading from Escala T to Escala T450.

It contains the following items:

- 1 single CPU board with an RS64-III@400 MHz processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
- 1 single PowerPC 620 CPU board.

7.2.7.3. System Requirements

- Escala T604e or T620.
- AIX 4.3.3 or later.

7.2.8. Upgrade Kits from E604e/E620 to E230

7.2.8.1. Basic Upgrade Kits from Escala E to Escala E230

These upgrade kits allow you to upgrade from an Escala E604e/E620 to an Escala E230 reconnecting the existing disks, media and communication and disk adapters. The resulting upgraded E604e/E620 will have the same memory and CPU capability as an Escala E230.

Two basic kits are available:

- A basic kit to upgrade an Escala E604e/E620 **without** redundant power supply to an Escala E230 **without** redundant power supply.
- A basic kit to upgrade an Escala E604e/E620 **with** redundant power supply to an Escala E230 **with** redundant power supply.

The basic kits include:

- 1 Escala E230 base cabinet. This may be delivered with redundant power supply, depending on the existing E604e/E620 configuration.
- 1 single CPU board with an RS64-II processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- E604e or E620 base cabinet.
- 1 single PowerPC 604e or 620 CPU board.
- Memory on the E604e/E620. The client has to acquire new memory for the upgraded machine.

7.2.8.1. Swapping additional Single 604e/620 CPU boards

This kit allows you to swap additional single 604e/620 CPU boards for single RS64-II CPU boards when upgrading from Escala E to Escala E230.

It contains the following items:

- 1 single CPU board with an RS64-II@262 MHz processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
- 1 single PowerPC 620 CPU board.

7.2.8.2. System Requirements

- Escala E604e or E620.
- AIX 4.3.2 or later.

7.2.9. Upgrade Kits from E604e/E620 to E250

This upgrade kit will be available in the fourth quarter of the year 2000.

7.2.9.1. Basic Upgrade Kits from Escala E to Escala E250

These upgrade kits allow you to upgrade from an Escala E604e/E620 to an Escala E250 reconnecting the existing disks, media and communication and disk adapters. The resulting upgraded E604e/E620 will have the same memory and CPU capability as an Escala E250.

Two basic kits are available:

A basic kit to upgrade an Escala E604e/E620 **without** redundant power supply to an Escala E250 **without** redundant power supply.

- A basic kit to upgrade an Escala E604e/E620 **with** redundant power supply to an Escala E250 **with** redundant power supply.

The basic kits include:

- 1 Escala E250 base cabinet. This may be delivered with redundant power supply, depending on the existing E604e/E620 configuration.
- 1 single CPU board with an RS64-III processor and 2MB of L2 cache.
- 1 POWER GXT130P graphics accelerator.
- Installation instructions.

Parts removed becoming property of Bull

- E604e or E620 base cabinet.
- 1 single PowerPC 604e or 620 CPU board.
- Memory on the E604e/E620. The client has to acquire new memory for the upgraded machine.

7.2.9.2. Swapping additional Single 604e/620 CPU boards

This kit allows you to swap additional single 604e/620 CPU boards for single RS64-III CPU boards when upgrading from Escala E to Escala E250.

It contains the following items:

- 1 single CPU board with an RS64-III@400 MHz processor and 2MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
- 1 single PowerPC 620 CPU board.

7.2.9.3. System Requirements

- Escala E604e or E620.
- AIX 4.3.3 or later.

8. ESCALA E & T Series: High Availability Solutions

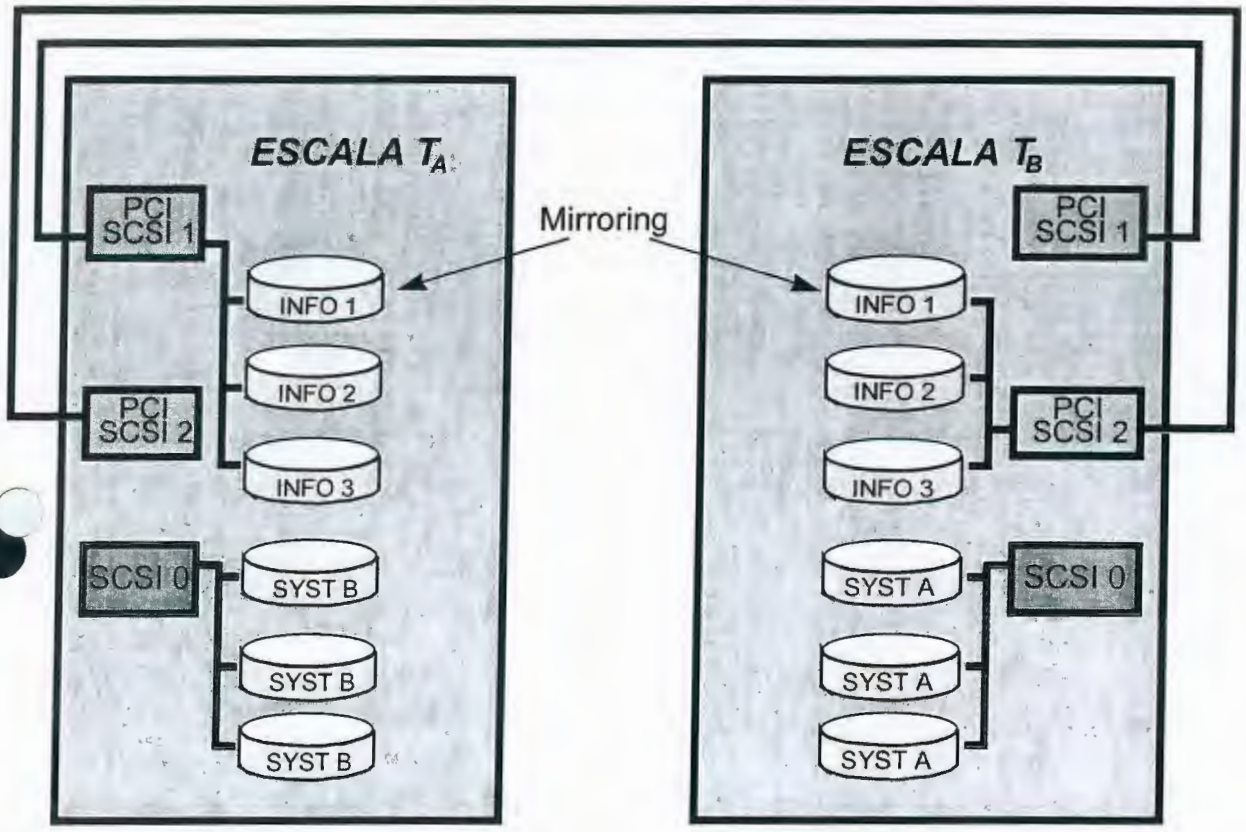
AUTONUMLGL

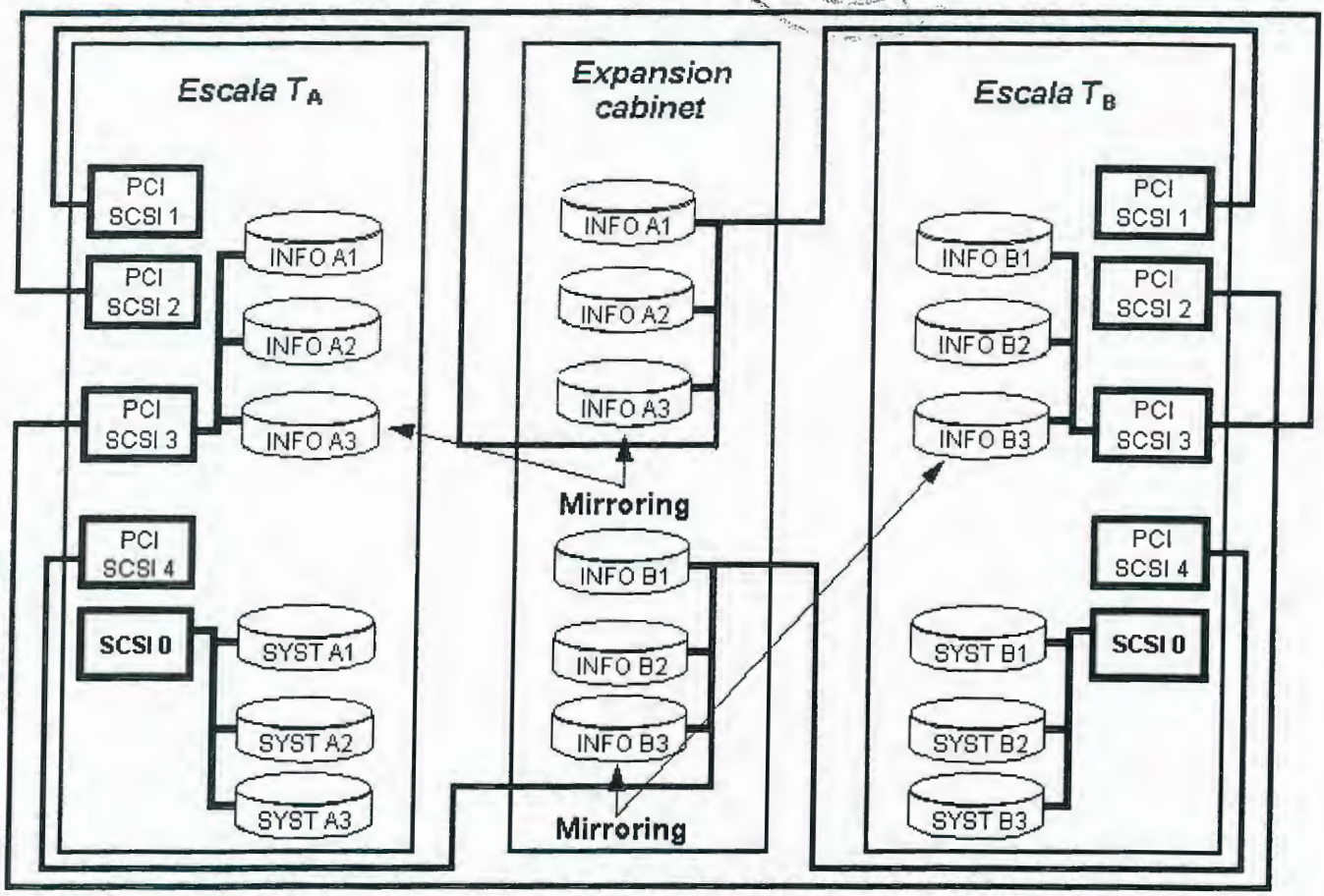
Escala E & T models have been designed to provide high availability, and numerous reliability and serviceability features.

These models use high availability technologies as:

- ECC for memory and on all data and address paths
- System monitoring
- Hot-Swap disks
- Optional internal RAID
- Redundant power supply
- Native HA and HA with shared Disks Cabinet or RAID DAS Cabinet

The Native HA provides a unique high availability level for the Customer Applications and Data.
.e internal Disks of the Escala Model can be mirrored on the internal Disks of another Escala Model.
the Native HA architecture, there is no need of a dedicated RAID DAS Cabinet.





The base of the native HA feature is the RAID 1 software provided by the AIX® mirroring, along with the double master UltraWide SCSI bus. In normal operations, both systems are running their own part of the application workload. If one of the two systems fails despite all internal RAS protections, thanks to HA-CMP software, the second system running the other part of the application is able to take over the workload of the first system.

Note: the PCI SCSI-3 Ultra-Wide RAID Adapter - DPT can't be used for Native HA.

If additional disk space is required, an expansion cabinet can be added to the native HA, providing up to [2x(6x18)]GB of HA disk capacity.

Chapter 3: Cabinet Subsystems

This chapter describes the ESCALA E and T Series Cabinet Subsystems.

1. AUTONUMLGLCabinets Subsystems Summary Table

	S100	S120	E604e/E620	E230/E250	T604e/T620	T430/T450
DAS5700			y	y	y	y
DAS5720	-	-	EOC 31/12/99	EOC 31/12/99	EOC 31/12/99	EOC 31/12/99
DAS5300			y	y	y	y
DAE5000	-	-	y	y	y	y
DAS2900	-	-	y	y	y	y
DAS3500	-	-	-	-	EOC=30/06/99	EOC=30/06/99 (1)
DAS3200	-	-	EOC=30/09/99	EOC=30/09/99 (1)	EOC=30/09/99	EOC=30/09/99 (1)
DAS1300	-	-	y	y	y	y
EMC Symmetrix 3000	-	-	y	y	y	y
DLT 4000	y	y	y	y	y	y
DLT 7000	-	-	y	y	y	y

(1) Available through reconnection only, when upgrading from T604e/T620 to T430/T450 and from E604e/620 to E230/E250.

2. Cabinets Subsystems

2.1. Common features of the fibre DAE/DAS5000 Series

2.1.1. Highlights

The 5000 Series constitutes a powerful, highly scalable, family of fibre channel storage solutions. It provides JBOD or RAID capabilities, terabytes of disk storage capacity, high transfer rates, flexible configurations, and high availability. These storage systems are ideal solutions for today's sophisticated enterprise. The main customer benefits are:

- high performance
- scalability and flexibility
- low foot print with capability to mix servers and storage in the same packaging (rack only)
- capability to build high availability solutions with AIX servers
- easy to use management tools

This line of disk subsystems is based on a common modular architecture, reusing the same components across the complete range. These basic building blocks are:

disks	dual ports fibre channel disks
DAE enclosure	a 10 disk module, which can be chained to provide the required capacity
iDAE	Intelligent DAE, a DAE module with one or two RAID Storage Processors (SP) designed for mid-range disk
DPE	a high end mono or dual RAID Storage Processors with up to 10 disks.

2.1.2. Disks

2.1.2.1. Overviews

The disk drives integrated in the 5000 Series are fibre channel, dual-ported drives. The disk size is 9 GB, 18GB and 36 GB (DAS 5000 Series only).

2.1.2.2.Disk formatting

The disk formatting depends on the disk subsystem in which they are integrated: it is either 520 bytes per sector (for RAID subsystems), or 512 bytes per sectors (JBOD). Thus, it is not possible to move disks from a JBOD subsystem to RAID subsystem. Reformatting is required. (and could be proposed in SFR). Changing disks formatting is not possible with the tools shipped with the disk subsystems, and can not be performed at customer site.

2.1.2.3.Technical specifications:

	9 GB – 10 K rpm	18 GB – 10K rpm	36 GB – 10K rpm (1)
Capacity (RAID formatting)	8.8 GB	18.0 GB	35.458 GB
Capacity (JBOD formatting)	9.1 GB	18.2 GB	36 GB
Form factor	3.5"	3.5"	3.5"
Height	1.0"	1.0"	40.6 mm
Rotational speed	10 000 rpm	10 000 rpm	10 000 rpm
Interface	Fibre Channel	Fibre Channel	Fibre Channel
Data buffer	1 MB	1 MB	1 MB
# of segments	up to 16	up to 16	
Transfer rates			
Buffer to/from media	17.2 – 25.3 MB/s	17.2 – 25.6 MB/s	18 – 28 MB/s
SP or HBA to/from buffer (1)	100 MB/s (max)	100 MB/s (max)	100 MB/s (max)
Access time			
average seek	5.2 ms read	5.7 ms read	5.7 ms read
	6.0 ms write	6.5 ms write	6.5 ms write
Rotational latency	2.99 ms	2.99 ms	2.99 ms
Connector	40-pin, FC-SCA-2	40-pin, FC-SCA-2	40-pin, FC-SCA-2
Monitoring protocol	SES/SFF-8067	SES/SFF-8067	

(1) DAS 5000 Series only.

MTBF

- 9 GB, 10K rpm 1,000,000 h
- 18 GB, 10K rpm 1,000,000 h
- 36 GB, 10K rpm 1,000,000 h

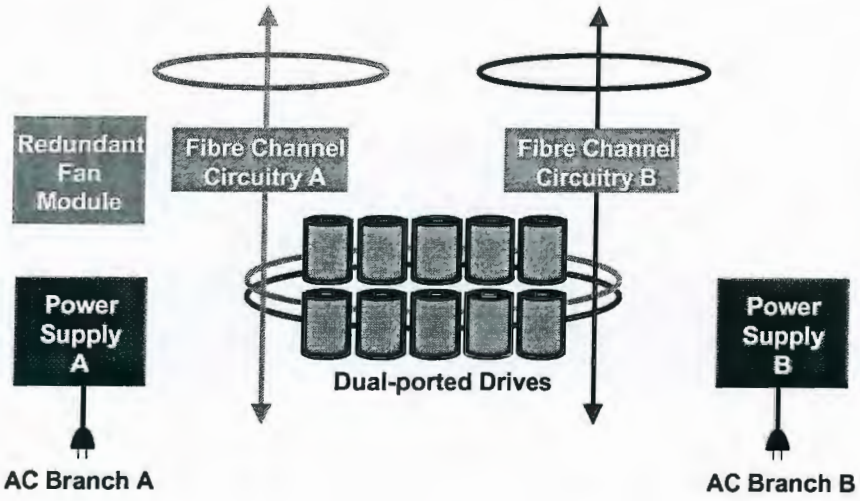
SYMBOLSYMBOL

2.1.3. DAE enclosure

2.1.3.1. Overview

The **DAE** (Disk-Array Enclosure) is a 10-slot enclosure without RAID capabilities (no SPs), playing the role of the capacity building block. This enclosure is the base of the modular and is available in rackmount or deskside versions. Several enclosures can be chained to create larger configurations.

The figure below summarizes the hardware architecture of a DAE enclosure. A DAE contains at least one Fibre Channel loop. The hardware to implement the second FC-AL loop is optional. Individual hardware components are discussed later in this document.



The DAE components include:

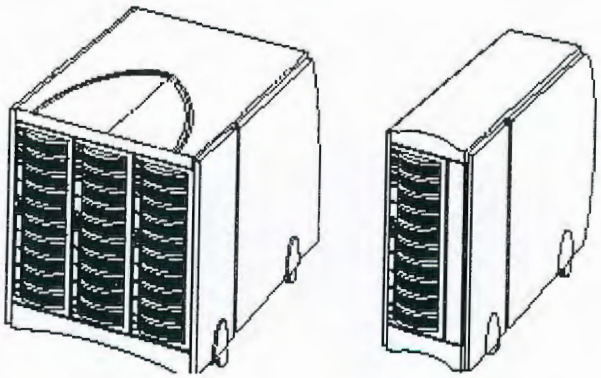
- One or two LCCs (Link Controller Cards, shown as "fibre channel circuitry" in the figure above) to implement one or two FC-AL loops.
- Up to 10 fibre channel dual ported disk modules
- One or two power supplies each with its own power cord
- One redundant fan module to cool the disks

All these components can be replaced under power.

2.1.3.2. Deskside packaging

The DAE enclosures can be installed in a 30 disks deskside cabinet (with 3 DAE enclosures), or in a 10 disks cabinet (with a single DAE enclosure).

30-slot deskside 10-slot deskside



2.1.3.3. Host connectivity and management

The DAE offers one Fibre Channel DB/9 copper connectors per LCC for the connection to servers, hubs, converters, other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

The DAE is an unmanaged equipment.

2.1.3.4. Architecture: SP, LCC, disks, memory

2.1.3.4.1. LCC (Link Control Cards)

DAE enclosures can be equipped with one or two LCCs. The LCC receives and electrically terminates the incoming FC-AL signal from the host or other kind up "up stream" devices. The LCC passes the input signal to its disk drives and then conducts the output signal, via cables, to an LCC of the next DAE in the loop (if any). In addition, each LCC monitors the environmental status of the enclosure.

When enclosures are equipped with two LCCs, two distinct internal fibre channel loops can be implemented, and in the event of an LCC failure, access remains possible through the other LCC.

Each LCC contains two connectors. One is reserved for the connection to another DAE. The other can be used to connect another DAE or other type of devices, like servers, iDAE enclosures or DPE enclosures. Technically, the number of DAE enclosures which can be chained is limited to 12, resulting in a 120 disks configuration, compatible with the limitations of the Fibre Channel loop. The distance between chained DAE enclosures is limited to 10m with copper cables.

2.1.3.4.2. Power Supplies

DAE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if one is present. Each supply is equipped with its own power cord, making the connection to two different power sources possible.

2.1.3.4.3. Cooling Fans

DAE enclosures are equipped with a drive fan pack that cools the disk modules. The fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increase to compensate. If needed (for example to change a failed power supply), a fan pack can be removed for exchange operation while the storage system continues to operate. The exchange operation, however, must not exceed two minutes, otherwise disks shut down.

2.1.3.4.4. Disk drives

The DAE enclosures use the same disks than the other enclosures of the 5000 Series. Only the formatting differs. The minimum number of disks per DAE enclosure depends on the number of LLCs. The maximum is always 10 disks:

	Minimum	Maximum
1 LCC	2	10
2 LCC	4	10

2.1.3.5. Summary of high availability features

- dual port disks,
- dual loops / LCCs
- dual Power supply with independent power cords
- redundant fans.
- no electronics in the chassis or back plane
- all active components are hot pluggable

2.1.3.6. Performance figures

The performance of the DAE enclosure are the performance of the individual disks which are in the enclosure.

2.1.3.7. Technical specifications

Interface to host

Fibre Channel interfaces of 100 MB/s (1 LCC) or 200 MB/s (2 LCCs).
9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA)

Dimensions (approximate)

10-slot DAE deskside:
- Height - 26.8 in. (68.0 cm)
- Width - 9.8 in. (24.8 cm)
- Depth - 29.4 in. (74.7 cm)
- Weight - 132lb. (60 kg) max.

30-slot DAE deskside:
- Height - 26.8 in. (68.0 cm)
- Width - 20.6 in. (52.2 cm)
- Depth - 29.4 in. (74.7 cm)
- Weight - DAE-only: 316lb. (144 kg) max

Power requirements
- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies)

Deskside
- Current Draw: At 100 v ac input – 30-slot DAE: 12A; 10-slot DAE: 4A
- Power consumption: input – 30-slot DAE: 1200VA; 10-slot DAE: 400VA

Operating environment
- Temperature: 50 - 104 degrees F (10 - 40 degrees C)
- Temperature Gradient: 10 degrees C/hr
- Relative Humidity: 20% - 80% (non-condensing)
- Elevation: 10,000 ft (3048m) @ 37°C
- Operating Shock: 3 G @ 11 ms, ½ sine pulse
- Operating Vibration: .25 G @ 5 - 500 Hz

Other
- Electromagnetic emissions: FCC Class A, EN55022 Class A, CE Mark, VCCI Class 1
- Safety: UL 1950, CSA C22.2-950, EN 60950

MTBF
- Drive Fan pack: 667 000 h
- DAE LCC: 781 000 h
- DAE power supply 162 000 h
- DAE midplane: 4 761 000 h

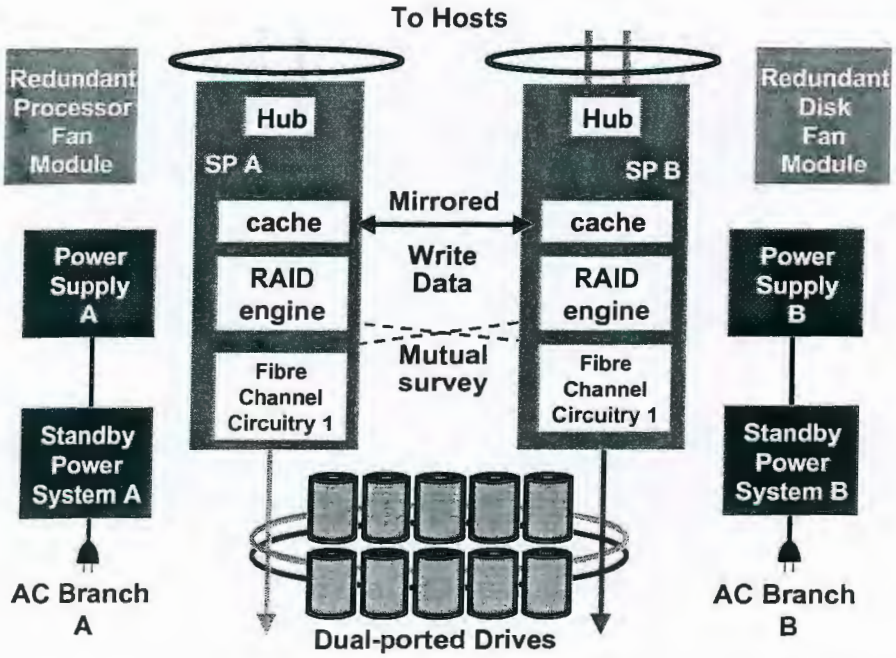
2.1.4. iDAE enclosure

2.1.4.1. Overview

The **iDAE** (Intelligent DAE) is a 10-slots enclosure DAE with RAID functionality provided by one or two SPs (Storage Processors), which replace the LCC cards of the basic DAE. It has been designed to build mid range disk subsystems, with up to 30 disks. It is a "full Fibre Channel" RAID subsystem, using Fibre Channel for both host connect (i.e. font-end) and internal disks connection (i.e. back-end).

Entry price configurations can be defined with the minimum of hardware redundancy, to enable cost attractive solutions. Upgrade to a fully redundant high availability configuration is a simple matter of adding redundant hardware components (described below). All these components are designed for non-disruptive removal and insertion, and can be replaced under power.

The figure below summarizes the hardware architecture of a iDAE enclosure. A iDAE contains at least one SP. The second SP is optional. Individual hardware components are discussed later in this document.



The iDAE components include:

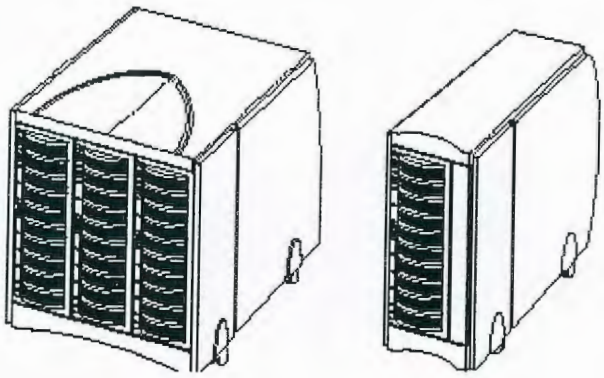
- One or two SPs (Storage Processors), with Fibre Channel circuitry, to manage the internal loops of the RAID subsystem.
- Up to 10 fibre channel dual ported disks
- One or two power supplies each with its own power cord
- One redundant fan module to cool the disks and another to cool the SPs
- To implement write caching, one or two SPSs (Standby Power Supplies – also called BBUs, i.e. Battery Backup Units)

All these components can be replaced under power.

2.1.4.2. Deskside packaging

The iDAE enclosures can be installed in a 30 disks deskside cabinet (1 iDAE and 2 DAE enclosures), or in a 10 disks cabinet (with a single DAE enclosure).

30-slot deskside 10-slot deskside



2.1.4.3. Host connectivity and management

The iDAE offers two Fibre Channel DB/9 copper connectors per Storage processors for the connection to servers, hubs, converters, other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

The two ports correspond to a single fibre channel loop. The typical usage is the direct connection of two servers on a single SP. The use of the two connectors to chain multiple devices (servers, SPs or other disk subsystems, …) is not recommended.

The iDAE can be managed in-band, (i.e. through the host fibre channel interfaces), from any server connected to the iDAE, using the Navisphere software. This mode of management is manageable as long as the server can access to a LUN.

A RS232 with RJ11 connector is also available. It allows iDAE management with Navisphere when, in sequence of administrator errors (or of highly improbable failures), there is no more LUN achable. RJ11/DB9M, plus DB9F/DB25M converters and a RS232 6m DB25F/DB25F cable are shipped with each iDAE.

2.1.4.4. Architecture: SP, LCC, disks, memory

2.1.4.4.1. SPs (Storage Processors) and host interface

The SP provides the following features to the disk subsystem:

- RAID processing
- host interface management
- backend management
- memory
- built-in hub for external connection
- Fibre Channel circuitry for backend.

Each SP has 3 fibre channel connectors.

Port A and port B connectors correspond to a built-in hub, offering a 100 MB/s logical connection. Using these connectors, 2 devices (like HBA within servers) can be connected to the same SP, without any external devices. They share the 100 MB/s of bandwidth. Above two devices, an external hub must be used.

The host interface offers DB9 / copper connections up to 30m. MIAs are supported, to enable longer distances using multimode optical fibers.
The host interface implements the FCP-SCSI-3 protocol. Command tag queuing is implemented.

The third connector is a DB9 expansion connector (EXP) which enables the connection to an additional DAE enclosure. It is not possible to chain more than 2 DAEs. When iDAE is equipped with two SPs, two distinct internal fibre channel loops are available, and the chained DAEs must be equipped with dual LCCs. In the event of a failure, disk access remains possible through the other SP. The distance between iDAE and DAE or between chained DAE enclosures is limited to 10m with copper cables.

2.1.4.4.2. Power Supplies (and PDUs)

iDAE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if present. Each power supply is equipped with its own power cord, making the connection to two different power sources possible.

2.1.4.4.3. Standby Power Supply (SPS)

The SPS protects the iDAE against external power supply failures, an enable to properly stop a disk subsystem in case of power outage.

SPS are optional, but at least one SPS must be installed to use the write cache. Optionally, a second SPS can be installed to provide higher availability.

The SPS is also named BBU (Battery Backup Units).

2.1.4.4.4. Cooling Fans

iDAE enclosures are equipped with a drive fan pack that cools the disks and the SPs. The fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increases to compensate. If needed, a fan pack can be removed for exchange operation while the storage system continues to operate (the exchange operation, however, must not exceed two minutes, otherwise disks and SPs shut down).

2.1.4.4.5. Disk drives

The iDAE enclosures use the same disk than the other enclosures of the 5000 Series. The minimum number of disks per iDAE enclosure depends on the number of SP. The maximum is always 10 disks:

	Minimum	Maximum
1 SP	3	10
2 SP	5	10

Disks are formatted with 620 bytes per sectors.

2.1.4.4.6. Memory

Each SP can have 64 or 128 MB of memory.

The Flare (micro code running on the SP) requires 15 to 18 MB. The remaining 110 MB of memory can be used as a read cache, or write cache, or a mixture of both, to improve performances of the subsystem. To ensure data consistency in case of failure, **the write cache is always mirrored**, and the following hardware configuration must be used:

- Two SPs per iDAE
- Two power supplies and two LCCs in the iDAE and in each DAE
- Disk slots 0 through 4 of the iDAE enclosure must be populated.
- One SPS with a fully charged battery (two SPSs provide higher availability)
- Identical cache memory in both SPs (64 or 128 MB per SP)

It is not possible to use write caching without mirroring across SPs, and without the hardware configuration described above. For example, it is not possible to configure a write cache on a iDAE with a single SP.

The usable cache size is computed as described in the next table:

	1 SP	2 SP
Raw memory per SP (64 MB or 128 MB)	M	M
Write cache	0	W < M
Read cache	M	2 x (M – W)
Total	M	W + 2 x (M – W)

M is the amount of available raw memory per SP
W is the value configured for the write cache size.

Because of the mirroring, the usable write cache is not multiplied by the number of SPs.

2.1.4.5. Summary of high availability features

- dual port disks,
- dual loops / LCCs
- dual Power supply with independent power cords
- redundant fans.
- no electronics in the chassis or back plain
- all active components are hot pluggable
- RAID protection
- redundant SP
- mirrored write cache

2.1.4.6. Supported Fibre Channel topologies

The Fibre channel host interfaces of the iDAE supports the following topologies:

- Private loops (using the internal hub of the SPs or external hubs)

2.1.4.7. RAID features

The RAID features of the iDAE are:

- supports of RAID 0, RAID 1, RAID 1/0, RAID 3, RAID 5 and "individual disk" modes

LUN type:	*Possible number of disks in the LUN:*
RAID 0:	3 to 16 disks
RAID 1:	2 disks
RAID 1/0:	4 to 16 disks (must be an even number)
RAID5:	3 to 16 disks

  each disk module in a LUN must have the same capacity (otherwise, disk storage space is wasted)
- any combination of RAID levels can exist in the same subsystem
- up to 32 LUNs configurable (either individual disks or RAID volumes)
- 2 global hot spares, with rebuild priority adjustment (configurable threshold for the minimum number of IO reserved for server use during rebuild). The capacity of a hot spare disk must be at least as great as the capacity of the largest disk module that it might replace.

Caution:
The RAID groups, LUN expansion Defragmentation features announced by Clariion on NT are not yet supported on AIX.

2.1.4.8. Performance figures

- 8400 IO/s from SP cache, with dual SP
- 120 MB/s with dual SP

These values are measured from SP cache to servers. They represent the processing power of the SP, and the maximum performances which could be obtained with optimal configuration. In real configurations, performances are lower, and mainly depends on the number of disks: few disks means low throughput and low read/write IO rates.

2.1.4.9. Technical specifications

03058

Interface to host

Fibre Channel interfaces of 100 MB/s (1 SP) or 200 MB/s (2 SPs).
9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA).

Fibre Channel related standards:

- FC-PH, rev 4.4
- FC-AL rev 4.5
- Private Loop Direct Attach PLDA rev 1.10
- SCSI Enclosure Services (SES) rev 8a

Dimensions (approximate)

10-slot iDAE deskside:

- Height - 26.8 in. (68.0 cm)
- Width - 9.8 in. (24.8 cm)
- Depth - 29.4 in. (74.7 cm)
- Weight - 132lb. (60 kg) max.

30-slot iDAE deskside:

- Height - 26.8 in. (68.0 cm)
- Width - 20.6 in. (52.2 cm)
- Depth - 29.4 in. (74.7 cm)
- Weight - DAE-only: 316lb. (144 kg) max

Power requirements

- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies)

Deskside

- Current Draw: At 100 v ac input – 30-slot DAE: 12A; 10-slot DAE: 4A
- Power consumption: input – 30-slot DAE: 1200VA; 10-slot DAE: 400VA

Operating environment

- Temperature: 50 - 104 degrees F (10 - 40 degrees C)
- Temperature Gradient: 10 degrees C/hr
- Relative Humidity: 20% - 80% (non-condensing)
- Elevation: 10,000 ft (3048m) @ 37°C
- Operating Shock: 3 G @ 11 ms, ½ sine pulse
- Operating Vibration: .25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC part 15 Class A and B, EN55022 Class A and B, CE Mark, VCCI Class 1 and 2
- Safety: UL 1950, CSA C22.2-950, EN 60950

MTBF

• SP:	125 000 h
• Drive Fan pack:	667 000 h
• SP FAN pack:	162 000 h
• iDAE power supply	4 761 000 h
• iDAE midplane:	4 761 000 h
• SPS:	100 000 h

2.1.5. DPE enclosure

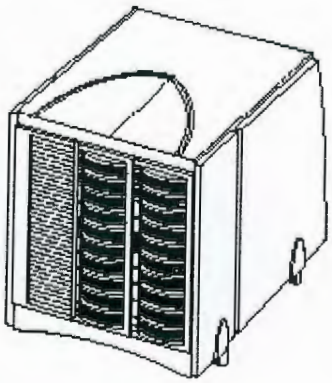
2.1.5.1. Overview

The **DPE** (Disk-Array Processor Enclosure) is a 10-slots enclosure with RAID functionality provided by one or two SPs (Storage Processors). It has been designed to build high end disk subsystems, with up to 120 disks. It is a "full Fibre Channel" RAID subsystem, using Fibre Channel for both host connect (i.e. front-end) and internal disks connection (i.e. back-end).

Configurations can be defined with the minimum of hardware redundancy, to enable cost attractive solutions with high end SPs. Upgrade to a fully redundant high availability configuration is a simple matter of adding redundant hardware components (described below). All these components are designed for non-disruptive removal and insertion, and can be replaced under power.

2.1.5.2. Deskside packaging

The DPE is proposed in the 20 disks cabinet, which includes a DPE (single or dual SP), a DAE enclosure, and optionally BBUs.



2.1.5.3. Host connectivity and management

The DPE offers two Fibre Channel DB/9 copper connectors per Storage processors for the connection to servers, hubs, switches, converters, other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

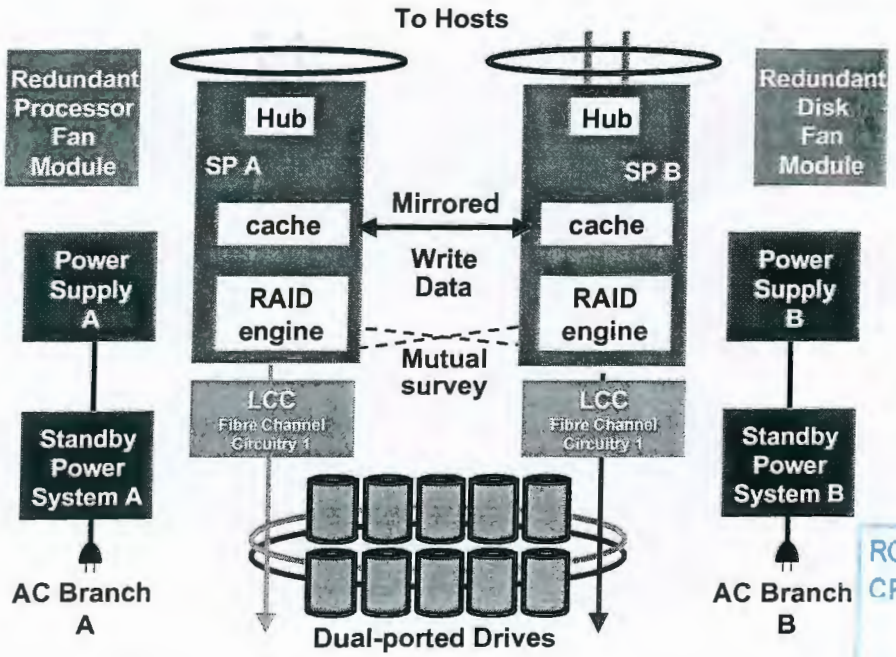
The two ports correspond to a single fibre channel loop. When connecting to a switch, a single connector must be used. In the of cases, both connectors are usable. The typical usage is the direct connection of two servers on a single SP. The use of the two connectors to chain multiple devices (servers, SPs or other disk subsystems, ...) is not recommended.

The DPE can be managed in-band, (i.e. through the host fibre channel interfaces), from any server connected to the DPE, using the Navisphere software. This mode of management is manageable as long as the server can access to a LUN.

RS232 with DB9 connector is also available. It allows DPE management with Navisphere when, in consequence of administrator errors (or of highly improbable failures), there is no more LUN reachable. A DB9/DB25M converter and a RS232 6m DB25F/DB25F cable are shipped with each DPE.

2.1.5.4. Architecture: SP, LCC, disks, memory

The figure below summarizes the hardware architecture of a DPE enclosure. A DPE contains at least one SP and one LCC. The hardware to implement the second FC-AL loop is optional. Individual hardware components are discussed later in this document.



The DPE components include:

- One or two SPs (Storage Processors)
- One or two LCCs (Link Controller Cards, shown as "fibre channel circuitry" in the figure above) to implement one or two FC-AL loops
- Up to 10 fibre channel dual ported disk modules
- One or two power supplies each with its own power cord
- One redundant fan module to cool the disks and another to cool the SPs
- To implement write caching, one or two SPSs (Standby Power Supplies – also called BBUs, i.e. Battery Backup Units)

2.1.5.4.1. SPs (Storage Processors) and host interface

The SP provides the following features to the disk subsystem:

- RAID processing
- host interface management
- backend management
- memory
- built-in hub for external connection.

Each SP has 2 fibre channel connectors. Port A and port B connectors correspond to a built-in hub, offering a 100 MB/s logical connection. Using these connectors, 2 devices (like HBA within servers) can be connected to the same SP, without any external devices. They share the 100 MB/s of bandwidth. Above two devices, an external hub or switch must be used.

The host interface offers DB9 / copper connections up to 30m. MIAs are supported, to enable longer distances using multimode optical fibers.
The host interface implements the FCP-SCSI-3 protocol. Command tag queuing is implemented, with up to 256 tags.

2.1.5.4.2. LCC (Link Control Cards)

DPE enclosures can be equipped with one or two LCCs (depending on the number of SP). The LCC receives and electrically terminates the incoming FC-AL signal from the host or other kind up "up stream" devices. The LCC passes the input signal to its disk drives and then conducts the output signal, via cables, to an LCC of the next DAE in the loop (if any). In addition, each LCC monitors the environmental status of the enclosure.

There is a one-to-one relation between SPs and LCCs. Either the DPE enclosure has one SP and one LCC, or the DPE has 2 SPs and 2 LCCs. When enclosures are equipped with two LCCs, two distinct internal fibre channel loops can be implemented, and all the DAE enclosures chained in the backend must have 2 LCCs each. In the event of a failure, disk access remains possible through the other SP/LCC.

The connector of the LCC of the DPE enclosure is reserved for the connection to another DAE. Technically, up to 11 DAE enclosures can be chained to create a RAID subsystem with an 120 disks capacity (10 in PDE plus 11x10 in DAE enclosures). Interconnection is made with copper cables. The distance between DPE and DAE or between chained DAE enclosures is limited to 10m with copper cables.

2.1.5.4.3. Power Supplies (and PDUs)

DPE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if is present. Each supply is equipped with its own power cord, making the connection to two different power sources possible.

2.1.5.4.4. Standby Power Supply (SPS)

The SPS protects the DPE against external power supply failures, an enable to properly stop a disk subsystem in case of power outage.

SPS are optional, but at least one SPS must be installed to use the write cache. Optionally, a second SPS can be installed to provide higher availability.

The SPS is also named BBU (Battery Backup Units).

2.1.5.4.5. Cooling Fans

DPE enclosures are equipped with a drive fan pack that cools the disk modules. DPE enclosures also include an SP fan pack that cools the SPs. Any type of fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increase to compensate. If needed, a fan pack can be removed for exchange operation while the storage system continues to operate (the exchange operation, however, must not exceed two minutes, otherwise disks and SPs shut down).

2.1.5.4.6. Disk drives

The DPE enclosures use the same disk than the other enclosures of the 5000 Series. The minimum number of disks per DPE enclosure depends on the number of LLCs and SP. The maximum is always 10 disks:

	Minimum	Maximum
1 SP / 1 LCC	3	10
2 SP / 2 LCC	10	10

Disk are formatted with 520 bytes per sectors.

2.1.5.4.7. Memory

Each SP can have 64, 128, 256 or 512 MB of memory.

A few amount is reserved to store the LIC (Licensed Internal Code) running on SPs. The exact size depends on version, and is around 12 MB. The rest of the cache is available for read cache, or write, or a mixture of both, to improve performances of the subsystem. To ensure data consistency in case of failure, **the write cache is always mirrored**, and the following hardware configuration must be used:

- Two SPs per DPE
- Two power supplies and two LCCs in the DPE and in each DAE
- Disk slots 0 through 8 of the DPE enclosure must be populated.
- One SPS with a fully charged battery (two SPSs provide higher availability)
- Identical cache memory in both SPs (64, 128, 256 or 512MB per SP)

It is not possible to use write caching without mirroring across SPs, and without the hardware configuration described above. For example, it is not possible to configure a write cache on a DPE with a single SP.

The usable cache size is computed as described in the next table:

	1 SP	2 SP
Raw memory per SP (64 MB, 128 MB, 256 MB or 512 MB)	M	M
Write cache	0	W < M
Read cache	M	2 x (M – W)
Total	M	W + 2 x (M – W)

M is the amount of available raw memory per SP
W is the value configured for the write cache size.

Because of the mirroring, the usable write cache is not multiplied by the number of SPs.

2.1.5.5. Summary of high availability features

- dual port disks,
- dual loops / LCCs
- dual Power supply with independent power cords
- redundant fans.
- no electronics in the chassis or back plain
- all active components are hot pluggable
- RAID protection
- redundant SP
- mirrored write cache

2.1.5.6. Supported Fibre Channel topologies

The Fibre channel host interfaces of the DPE supports the following topologies:

- Fabric, with point to point connection to the switch
- Private loops (using the internal hub of the SPs or external hubs)

2.1.5.7. RAID features

The RAID features of the DPE are:

- supports of RAID 0, RAID 1, RAID 1/0, RAID 3, RAID 5 and "individual disk" modes

LUN type:	*Possible number of disks in the LUN:*
RAID 0:	3 to 16 disks
RAID 1:	2 disks
RAID 1/0:	4 to 16 disks (must be an even number)
RAID5:	3 to 16 disks

  each disk module in a LUN must have the same capacity (otherwise, disk storage space is wasted)
- any combination of RAID levels can exist in the same subsystem
- up to 32 LUNs configurable (either individual disks or RAID volumes)
- 2 global hot spares, with rebuild priority adjustment (configurable threshold for the minimum number of IO reserved for server use during rebuild). The capacity of a hot spare disk must be at least as great as the capacity of the largest disk module that it might replace.

2.1.5.8. Performance figures

- 22000 IO/s from SP cache, with dual SP
- 120 MB/s with dual SP

These values are measured from SP cache to servers. They represent the processing power of the SP, and the maximum performances which could be obtained with optimal configuration. In real configurations, performances are lower, and mainly depends on the number of disks: few disks means low throughput and low read/write IO rates.

2.1.5.9. Technical specifications

Interface to host

- SPs (Storage Processors): Provide two Fibre Channel interfaces of 100 MB/s each, with a total of 200 MB/s.
- 9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA)).
- Two ports per SP.

Dimensions (approximate)

DPE Deskside (20 disks: DPE + DAE):

- Height - 26.8 in. (68.0 cm)
- Width - 20.6 in. (52.2 cm)
- Depth - 29.4 in. (74.7 cm)
- Weight - DAE-only: 316lb. (144 kg) max. DPE-based with 2 SPSs: 364 lb. (165 kg) max

Power requirements

- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies)

Deskside (20 disks)

- Current Draw: At 100 v ac input – Deskside DPE+DAE
- Power consumption: input – Deskside DPE+DAE: 1200VA;
- SPS 100VA max per unit during charge

Operating environment

• Temperature:	50 - 104 degrees F (10 - 40 degrees C)
• Temperature Gradient:	10 degrees C/hr
• Relative Humidity:	20% - 80% (non-condensing)
• Elevation:	10,000 ft (3048m) @ 37°C
• Operating Shock:	3 G @ 11 ms, ½ sine pulse
• Operating Vibration:	.25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC Class A, EN55022 Class A, CE Mark, VCCI Class 1
- Safety: UL 1950, CSA C22.2-950, EN 60950

MTBF

• SP:	125 000 h
• Drive Fan pack:	667 000 h
• SP FAN pack:	667 000 h
• DPE power supply	162 000 h
• DPE power supply	162 000 h
• DPE LCC:	750 000 h
• DPE midplane:	3 200 000 h
• SPS:	100 000 h

2.1.6. AUTONUMLGLCompanion Software

2.1.6.1. Navisphere for AIX

DPE-and iDAE based storage systems are shipped with the Navisphere manager for AIX application. It provides a graphical facility for configuring, managing and monitoring the RAID subsystems. It is based on the standard AIX WebSM (Web-Based System Manager) framework. A graphical console, or display, or a X-terminal, must be available at the customer site, or must be ordered to use WEB. Navisphere use the fibre channel connections to managed the subsystems. It may optionally use a serial line.

If a Web server is installed on the AIX server, any web browser able to execute Java applets can be used to access to WebSM applications, including Navisphere.

Another mode of operations requires only a Navisphere agent on the AIX server. The manager is located on another server, and cooperates with the agent using TCP/IP protocols through Ethernet or other kind of LAN or WAN networks. This mode of operation require specific licenses to be installed on the same server than the Navisphere manager for AIX. They can be ordered with the noemie software configurator.

2.1.6.2. ATF

RAID subsystems equipped with two SPs can take advantage of the optional ATF (Application Transparent Failover) software for AIX. ATF lets applications continue to run after an SP, adapter or cable or interconnection failure. Without human intervention, ATF can reconfigure the RAID subsystem (e.g. bind the LUNs to the surviving SP), retrieve I/Os in the mirrored write cache and complete them, and finally, on the server it self, route the I/O through a secondary path to the surviving (provided that the server is equipped with two fibre channel adapters).

2.2. DAE5000 (Full Fibre JBOD Disk Array Subsystems)

2.2.1. Highlights

The DAE5000 Series constitutes a powerful, JBOD fibre channel storage solutions. It is based on a DAE enclosure and contains up to 10 disks.

The direct access from servers to the Fibre Channel disks offers very high transfer rates, enabling to operate near full Fibre Channel speed (around 95 MB/s), with a single DAE5000.

The DAE5000 is ideal to increase the storage capacity of AIX servers, without investing in more expensive RAID subsystems. Use of AIX software RAID 1 brings protection against disk failures. Protection against HBA, connection or DAE failures can be obtained using 2 DAE5000 per server.

2.2.2. Configurability and Packaging

The DAE5000 is based on DAE enclosures with a single LCC. A DAE5000 can host from 2 to 10 disks. 2 DAE5000 can be connected per server.

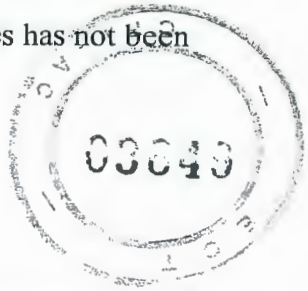
There is no hardware option available for DAE5000.

10 slots deskside cabinet are shipped for the connection to Escala E and T Series deskside servers.

2.2.3. SAN features

Each DAE5000 is connected to a dedicated fibre channel adapter on the AIX server, or to a hub for sharing by 2 servers. Interconnection of DAE5000 is not proposed, due to the high level of performances obtained with the 10 disks enclosure, and the risk of saturation of the fibre channel loop.

The connection to hubs or servers is made with copper cables. Connection to switches has not been qualified. For configurations problems, refer to the SAN Help Desk.



2.3. DAS5300 (Full Fibre RAID Disk Subsystems)

2.3.1. Highlights

The DAS5300 constitutes an entry-level RAID subsystem, offering up to 30 disks slot and 1080 GB of capacity (with 36 GB disks). It is based on iDAE and DAE enclosures. The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP).

The basic packaging, containing 1 SP, and a single power supply, can be upgraded with optional hardware to offer a fully redundant disk subsystem. Several packaging and capacity options allow to build the most suited configuration, while preserving the evolutivity up to 30 disks

The DAS5300 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes.

2.3.2. Configurability and Packaging

2.3.2.1. Deskside packaging

The configurability is summarized in the next table.

	basic configuration (1 SP)	high availability configuration (2 SP)
base cabinet	1 iDAE within 10 slots cabinet or 1 iDAE + 2 DAE within 30 slots cabinet	1 iDAE within 10 slots cabinet or 1 iDAE + 2 DAE within 30 slots cabinet
additional DAE (10 slots cabinet only)	0..2 with a 10 slots base cabinet 0 with a 30 slots base cabinet single LCC/PS DAEs	0..2 with a 10 slots base cabinet 0 with a 30 slots base cabinet dual LCC/PS DAEs
minimum number of disks	3 for 10 disks cabinet 7 for 30 disks cabinet	5 for 10 disks cabinet 13 for 30 disks cabinet
minimum number of disks per additional DAE	2	4
maximum number of	30	30
memory (MB)	64 or 128	64 or 128 same value on both SPs
write cache	not supported	yes
power supply	1 PS - No dual PS option	2
SPS	0	1 additional SPS optional for higher availability
ATF	not applicable	yes

2.3.3. SAN features

One or multiple servers can be connected to a DAS5300, using the connectors of the SP (2 connector per SP). External hubs can be used to increase the connectivity. Connection to switches is not supported. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5300 can be connected to a single HBA on a server using external hubs.

For configurations problems, please refer to the SAN Help Desk.

2.4. DAS5700 (Full Fibre RAID Disk Subsystems)

2.4.1. Highlights

The DAS5700 is the high end of the 5000 Series. It is a highly flexible disk subsystem, with high performance levels, up to 60 or 70 disks slots (depending on the packaging option) and more than 2 TB of capacity (with 36 GB disks). Higher capacities (up to 120 disks, 4 TB) can be proposed in SFR.

The DAS5700 is based on DPE and DAE enclosures. The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP). With the DPE design, optimized for OLTP and RAID 5 processing, and the high number of disk, it is able to sustain a very high IO rate, supporting heavy transactional applications.

The basic packaging, containing 1 SP, and a single power supply, can be upgraded with optional hardware to offer a fully redundant disk subsystem. Several packaging and capacity options allow to build the most suited configuration, while preserving the evolutivity up to 120 disks

The DAS5700 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes. It is well suited for environments requiring high volumes of storage, and high levels of IO performances.

Note: the performances are directly tied to the number of disk within the subsystem. Up to 30 disks, DAS5700 and DAS5300 have comparable performance results..

2.4.2. Configurability and Packaging

2.4.2.1. Deskside packaging

The deskside packaging is the default option shipped with AIX deskside servers. Nevertheless, AIX EPC servers can be connected to a DAS5700 deskside.

The configurability is summarized in the next table.

	basic configuration 1 SP	high availability configuration 2 SP
base cabinet	1 DPE + 1 DAE within a 20 slots cabinet	1 DPE + 1 DAE within a 20 slots cabinet
additional DAEs	0..1 30 slots cabinet 0..2 10 slots cabinet with initial ordering 0..4 10 slots cabinet with add-ons single LCC/PS DAEs	0..1 30 slots cabinet 0..2 10 slots cabinet with initial ordering 0..4 10 slots cabinet with add-ons dual LCC/PS DAEs
minimum number of disks in the base cabinet	5	14
minimum number of disks per additional DAE	2	4
maximum number of disks	60	60
memory (MB)	64, 128, 256, 512	64, 128, 256, 512 same value on both SPs
write cache	not supported	yes
power supply	1 PS - No dual PS option	2
SPS	optional	1 additional SPS optional for higher availability
ATF	not applicable	yes

2.4.3. SAN features

One or multiple servers can be connected to a DAS5700, using the connectors of the SP (2 connector per SP). External hubs or switches can be used to increase the connectivity. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5700 can be connected to a single HBA on a server using external hubs.

For configurations problems, please refer to the SAN Help Desk.

2.5. DAS5720 (Full Fibre RAID Disk Array Subsystems)

2.5.1. Highlights

End of commercialization is planned for 31 December 1999.

The DAS5720 is a bundled product based on a dual SP DPE enclosure and a single DAE. It is configured to offer a very attractive price for high availability configurations, with medium storage resource requirement. It is limited to 20 disks. The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP).

The DAS5720 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes.

2.5.2. Configurability and Packaging

2.5.2.1. Deskside packaging

The deskside packaging is the default option shipped with AIX deskside servers. Nevertheless, AIX EPC servers can be connected to a DAS5720 deskside.

The configurability is summarized in the next table.

	high availability configuration 2 SP
base cabinet	1 DPE + 1 DAE within a 20 slots cabinet
additional DAE	0
minimum number of disks	9. The DAE of the base cabinet is not connected to the DPE enclosure
minimum number of disks per additional DAE	4 when the DAE of the base cabinet is reconnected to the DPE
maximum number of disks	20
memory (MB)	64, same value on both SPs
write cache	yes
power supply	2
SPS	1 additional SPS optional for higher availability
ATF	yes

2.5.3. SAN features

One or multiple servers can be connected to a DAS5720, using the connectors of the SP (2 connector per SP). External hubs or switches can be used to increase the connectivity. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5720 can be connected to a single HBA on a server using external hubs.

For configurations problems, please refer to the SAN Help Desk.

2.6. DAS 1000, 2000 and 3000 Series Disk Array Subsystems

2.6.1. Highlights

The DAS 1000, DAS 2000 and DAS 3000 DAS Series, are standalone SCSI-2 based disk array subsystems available in both rackmounted and deskside configurations (DAS3500 subsystems use SCSI disks but provides FC-AL fibre channel attachment to servers). The DAS 1000, DAS 2000 and DAS 3000 Series extend Bull's ESCALA disk offering with a scaleable, "worry free" storage solution, for customers who need both high availability and high capacity for mission critical applications. The DAS 2000 and DAS 3000 Series consist of models DAS2900 and DAS3200/DAS3500, near fault tolerant storage subsystems with highly competitive performance and price. The DAS2x00 and DAS3x00 are recommended for high availability software applications requiring large capacity disk

storage. The new DAS2900 and DAS3200/DAS3500 models, based on Power PC technology provide 50% more performance. The DAS 1000 Series consists of model DAS1300, a redundant subsystem providing half of the DAS2900 maximum capacity.
The DAS3200/DAS3500 provides 50"% more disk capacity than the DAS2900.
The **DAS1300, DAS2900** and **DAS3200/DAS3500** are new generation subsystems that provide availability, and high performance with caching options.

	DAS1300	DAS2900	DAS3200/DAS3500
Disk modules	10	20	30
Embedded memory per SP Cache and buffers	Yes (optional) 32, or 64 MB	Yes (optional) 32 or 64 MB	Yes (optional) 32 or 64 MB
RAID levels	0, 1, 3, 5, 1/0	0, 1, 3, 5, 1/0	0, 1, 3, 5, 1/0
Global spare	Yes	Yes	Yes
HW Redundancy	Yes	Yes (near fault tolerant)	Yes (near fault tolerant)

Note: The DAS3500 has been discontinued as of 30 June 1999.
The DAS3200 will be discontinued as of 30 September 1999.)

Major features of the 1000, 2000 and 3000 Series models include:

- High availability design
- RAID technology based storage subsystems
- Write cache memory for high performance needs
- Scalable host connectivity with the Fibre Channel connectivity on DAS3500
- Scaleable storage subsystems (capacity and performance)
- Small footprint
- Low cost of ownership

The major components of the 1000, 2000 and 3000 Series are:

- Storage-Control Processor (SP) with optional single or mirrored cache memory
- disks modules (3.5" SCSI-2, high performance, single ended drives)
- disk array cabinet (10 drives chassis for DAS1300, 20 drives chassis for DAS2900, 30 drives chassis for DAS3200/DAS3500)
- redundant power subsystem
- redundant cooling subsystem
- Battery Backup Unit for cache security

2.6.2. The Storage Control Processor (SP)

The Storage Control Processors (SP) are the main components of the DAS1300, DAS2900 and DAS3200/DAS3500. One or two SPs can be configured in a disk array cabinet. The DAS1300 Storage Processor design is based on a 25MHz AMD 29000 RISC processor, 4MB of instruction and data memory, three or six SCSI-2 interface controllers, power regulator, and RS232 interface. The new DAS2900 and DAS3200/DAS3500 Storage Processor is based on Power PC technology, with a basic 8 MB memory.

The Storage Control Processor serves a number of functions including the RAID 0, 1, 1/0, 3, and 5 modes of operation, as well as individual disk operation. The SP continuously monitors the status of the other major components concurrently with the temperature within the storage subsystem and notifies the host in the event of a failure.

The DAS 1000, 2000 and 3000 Series are optimized to provide high I/O throughput in server environments. They can support two Storage Control Processors (dual active) within the same cabinet. Dual active SPs induce higher overall I/O performance by minimizing bus contention and paralleling data access.
The two SPs can be interfaced directly to a host resident SCSI-2 adapter (or Fibre Channel Adapter for the DAS3500) or daisy chained on the SCSI bus. Each SP is configured as a unique SCSI ID and can support up to 32 logical units (LUNs) each. A LUN would be equivalent to a RAID stripe. The disk drives within the array can be logically connected to any of the Storage-Control Processors. However, dynamically shared access to a drive group is not supported.
In the event of an SP failure, access to data is insured due to the dual ported subsystem architecture with active dual initiator.

The Storage-Control Processor can house a modular memory for write cache option (see 1.1.10).

2.6.3. The 3.5" SCSI-2 Disk Modules

All DAS models support high performance 4.2GB (7200RPM) and 8.8GB (7200RPM) disk drives. Up to 30 Winchester disk units can be configured in the 3000 Series, up to 20 disk units in the 2000 Series, up to 10 disk units in the DAS 1000 Series. The disks within the storage system can be configured as either individual disks, RAID 0 groups, RAID 1 or RAID 1/0 pairs, RAID 3 or RAID 5 groups. Any or all of these modes of operation can be configured concurrently. This allows the tuning of the DAS 1000, 2000 and 3000 Series to adapt to specific attributes of a given application.
A small amount of disk capacity will be used to save the write cache when a power failure occurs.
Each disk drive is housed in a hot pluggable disk module. Each module consists of a disk drive, a drive carrier, and a regulator PCB. In redundant RAID configurations, when a disk failure occurs, any module can be removed from a logical group without halting operation of the array. When drive replacement is done, data is automatically rebuilt on the new disk.

In redundant RAID configurations global sparing is another area where the DAS 1000, 2000 and 3000 Series offers significant benefit. Global sparing allows the user to designate one or more spares which will satisfy the requirements of any redundant logical group within the subsystem. By initiating a rebuild on the global spare, the disk array essentially heals itself; thereby re-establishing disk level redundancy, minimizing the impact of degraded mode operation, and minimizing exposure to double failures within a single group.
Manufacturers specify disk capacities in GB. One gigabyte (GB) is 1,000,000,000 bytes (ten to the ninth). Under A.I.X., volume sizes are given in MB (two to the twentieth) with the convention: one MB is 1024 x 1024 bytes. A 5-percent difference in size appears between both measurements of the same space. For example a 4.2 GB disk (4.2 x 10**9 bytes) will be viewed as a 4,091 MB volume at A.I.X. level.

2.6.4. The DAS 3000 Series Cabinet

It is a 14-inch high rackmounted chassis and is available in deskside or rackmounted configurations. It includes space for 5 to 30 replace-under-power (hot plug) disk drives, two Storage Control Processors,

one mid-plane, three DC power supplies, and one cooling assembly to support the array's operation and replace-under-power features. DAS3200/DAS3500 cabinets manage room for a Battery Backup Unit for write cache security.
Hot plug technology results in dynamic expansion ability. Users can expand capacity or add any other component while the system remains on line and operating.
There is no difference between the cabinet models.
The DAS3500 subsystems is connected to the host either via a copper connection (limited to 30 meters) or via an optic fiber connection using an Media Interface Adapter (MIA) depending on the distance between the Host and the DAS3500.
The distance is up to 10Km by using Link Extender box and suited optic fiber connection (9µ).

(Note: The DAS3500 will be discontinued as of 30 June 1999.
The DAS3200 will be discontinued as of 30 September 1999.)

2.6.5. The DAS 2000 Series Cabinet

It is a 14-inch high rackmounted chassis and is available in deskside or rackmounted configurations. It includes space for 5 to 20 replace-under-power (hot plug) disk drives, two Storage Control Processors, one mid-plane, three DC power supplies, and one cooling assembly to support the array's operation and replace-under-power features. DAS2900 cabinets manage room for a Battery Backup Unit for write cache security.
Hot plug technology results in dynamic expansion ability. Users can expand capacity or add any other component while the system remains on line and operating.
There is no difference between the cabinet models.

2.6.6. The DAS 1000 Series Cabinet

In the DAS 1000 Series cabinet 3 to 10 hot-plug disk modules and two Power Modules can be housed. All other features of the 2000 Series cabinet are supported.

2.6.7. The Power Subsystem

It includes power supplies (VSCs) (three for the DAS 2000 Series and 3000 Series or up to two for DAS 1000 Series), AC input and AC circuit breaker. The subsystem supports an n+1 DC power supply configuration to allow for automatic failover in the event of a single supply failure. Each DC power supply is contained in a replace-under-power module and can be replaced without disrupting subsystem operation. Power fault design ensures data integrity even in the event of power loss during a write operation.
The third Power Module is automatically configured with every DAS 2000 and 3000 Series.

2.6.8. The Cooling Subsystem

Like the power subsystem, the DAS 1000, 2000 and 3000 Series incorporates an n+1 cooling design. Two fan pack modules are contained in a single cooling subsystem (one for DAS 1000 Series), and each fan pack module consists of 3 fans and a fan monitoring PCB. One fan in the system can fail without impacting operation of the disk array. The entire cooling subsystem can be detached from the array cabinet and replaced while the system continues to operate.

2.6.9. The SCSI Host Connection

The main component of the connection to the ESCALA host is the standard dedicated SCSI-2 SE/DE adapter excepted for the DAS3500 (Fibre Channel). It is a 20MB/s fast/wide differential MCA/PCI-to-SCSI-2 Adapter. The connection uses also a SCSI-2 bus cable and an asynchronous RS232 cable for the DAS1300, DAS2900 and DAS3200.
The DAS3500 uses a Fibre Channel connection to connect the SP to the Host.

2.6.10. Disk Drives Specifications

Nominal Disk Capacity (GB)	4.2	8.8	17.8
Actual Disk Capacity (10*6 B)	4372	8800	17800
Interface	SCSI-2	SCSI-2	SCSI-2
Form Factor	3.5"	3.5"	3.5"
Seek Time (Average R/W) (ms)	8.4 /9.9	8.5 /10.5	8.5 /10.5
Spindle speed (RPM)	7202.7	7202.7	7202.7
Latency (ms)	4.17	4.17	4.17
Transfer Rate			
-buffer to/from media (MB/sec)	9.59 to 12.58	10 to 15	10 to 15
-buffer to/from host (MB/sec)	up to 20		
Buffer Size (kB)	512	1024	1024

Disk drives are common to DAS 1000, 2000 and 3000 Series.

(4.2GB disks will be discontinued as of 30 November 1999.)

2.6.11. Mirrored Caching option.

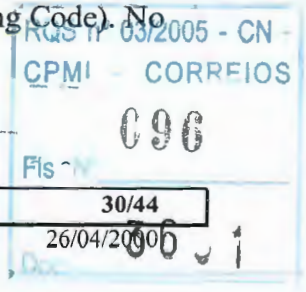
On DAS1300, DAS2900 and DAS3200/DAS3500 models, with dual SP, a cache memory is available. Mainly dedicated to write access caching, it can be also configured as a read cache or as a read and write cache.
The write cache drops the response time for every write access and thus alleviates the write penalty tied to RAID5. A small amount of read cache (2 to 4 MB) will benefit sequential access.

The 1000, 2000 and 3000 Series write cache is fully protected against power failures by a Battery kup Unit (BBU), against memory components by an ECC (Error Correcting Code) and against SP lures by mirroring. The mirrored copy of data and associated address is saved on the second SP.

DAS1300 can have 30, or 62 MB of cache memory. A 2 MB memory space is reserved by the SP for internal use. DAS2900 and DAS3200/DAS3500 can have 28 or 60 MB of cache memory. A 4 MB memory space is reserved by the SP for internal use. The actual memory capacity is twice the user size due to mirroring protection.

2.6.12. Single board Caching option.

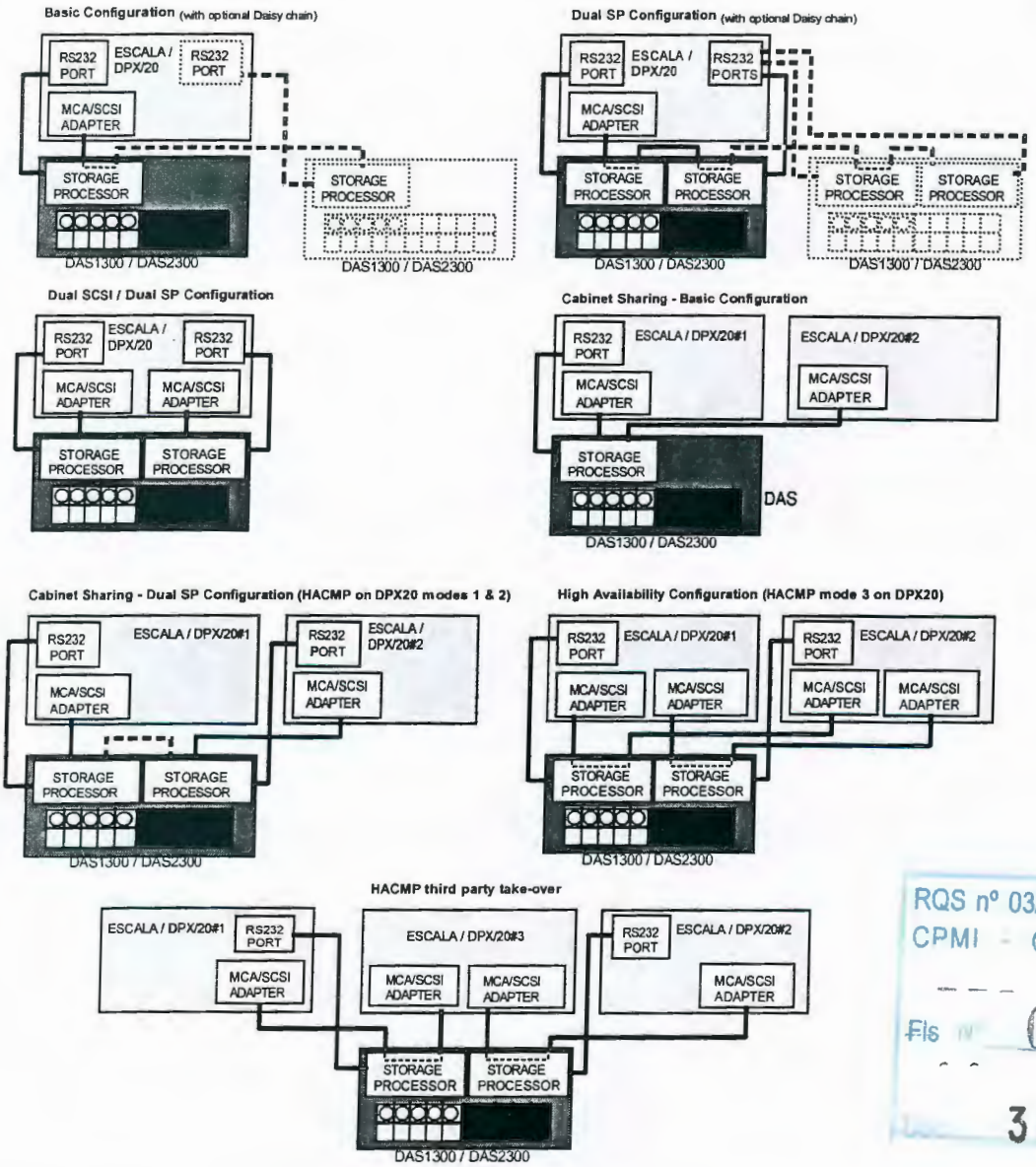
On DAS1300, DAS2900 and DAS3200/DAS3500 models, with only **one SP**, a cache memory option is now available.
This option offers a competitive price for basic configurations
The 1000, 2000 and 3000 Series single board cache is protected against power failures by a Battery Backup Unit (BBU), and against memory component failure by an ECC (Error correcting Code). No mirrored copy of data is provided.



DAS1300 can have 30 MB of cache memory. A 2 MB memory space is reserved by the SP for internal use. DAS2900 and DAS3200/DAS3500 can have 28 MB of cache memory. A 4 MB memory space is reserved by the SP for internal use.

2.6.13. Prerequisites & Configurability

DAS 1000, 2000 and 3000 Series are available as a standard offering on ESCALA platforms. The following configurations are possible for DAS1300, DAS2900 and DAS3200/DAS3500:



Performance in these configurations is dictated by a number of factors, including host CPU utilization, SCSI bus traffic, individual disk usage, write cache option.

The basic configuration includes a single ESCALA host interfaced to the DAS through a standard MCA/PCI-to-Differential/SCSI-2 host adapter or Fibre Channel adapter for the DAS3500. In this configuration, a single Storage-Control Processor (SP) is used to access up to 10 (DAS1300), 20

(DAS2900) or 30 (DAS3200/DAS3500) drives in the array chassis. A second array can be daisy chained to the first (up to 264GB: 30x8.8GB for 3000 Series). The cache memory is available as an option.

The dual Storage Control Processor (SP) configuration offers a higher performance and availability alternative to the basic configuration through the addition of second SP. The mirrored cache memory is available as an option. The SPs can be configured to any of the disks within the subsystem, *however, shared access to a single drive is not supported.* A second DAS 1000, 2000 or 3000 Series array can be daisy chained to the first. In the dual SP configuration, system level redundancy is provided at the drive, power supply and cooling levels. Redundancy at the Storage Control Processor level is also provided: *failover requires operator interaction with the host system.*

The dual SCSI adapter or Fibre Channel adapter/dual SP configuration extends the capabilities of the dual SP configuration by extending a separate SCSI or Fibre bus to the second SP. As with the previous configurations, the optional cache is available and a second array can be daisy chain to the t system. Failover of the storage processors, or SCSI-2 adapters, or Fibre Channel adapters can be tiated *through operator interaction with the host system.*

The cabinet sharing configurations: in this configuration, the SCSI-2/Fibre Channel-to-SP connections are on separate SCSI/Fibre buses, thereby allowing both host systems to share the DAS array as a highly integrated, high availability storage solution.

Limitations to the DAS 1000, 2000 and 3000 Series Cabinet Sharing Configuration:

- Dynamically shared access by two systems to a single drive requires host software (HANFS or HACMP).
- HANFS and HACMP configurations are supported on redundant configurations.

2.6.14. Configuration rules and hints for DAS1300, DAS2900 and DAS3200/DAS3500

- Basic cabinet: one SP is included in the basic cabinet, with 3 power modules for DAS2900 and DAS3200/DAS3500, only 1 for DAS1300.

- Number of disk drives allowed:

DAS3200/DAS3500:	5 to 30
DAS2900:	5 to 20
DAS1300 without cache:	3 to 10
DAS1300 with cache:	5 to 10
All models with cache and hot-spare disk	6 to 10, 20 or 30

A location exclusion exists between the hot-spare disks and the 5-disk group dedicated to cache saving.

- RAID group binding rules:

RAID0:	3 to 16 drives per group (3 to 10 for DAS1300)
RAID1:	always 2 drives per group
RAID1/0:	4 to 20 drives per group (4 to 10 for DAS1300)
RAID3:	always 5 drives per group
RAID5:	3 to 16 drives per group (3 to 10 for DAS1300)

In a DAS1300, or in a DAS 2000 Series with more than 5 drives per group, a very small risk of single point of failure exits at internal SCSI bus level.
When configured in RAID1 RAID3 or RAID5 an amount of capacity of one disk is used for redundant data storage.

- Number of power modules:
  for DAS1300:
  the second power supply is an option, power redundancy is only assumed with it. Add the second power supply with 2SPs or with the cache option. NOEMIE will set the option as default. You may remove it to get a lower price, but availability will become poor.
  for DAS2900 and DAS3200/DAS3500:
  the third power supply will be delivered with every subsystems.

- Number of Storage Processors (SP):
  The second SP is recommended for a higher availability (associated or not with the second SCSI connection/Fibre Channel connection) and over 10 drives for performance.
  It is mandatory for high availability, and to get the mirrored cache option.
  For DAS2900 the mono SP configuration is able to manage up to 15 disks without internal I/O saturation (short random I/O's).

- Mirrored cache:
  The mirrored cache option needs the dual SP configuration, 5 disk drives or more, and the Battery Backup Unit. The memory modules are provided by pairs. Memory size is 32, or 64 MB per SP. A 2-MB space will be reserved for internal use on DAS1300. DAS2900 and DAS3200/DAS3500 need a 4-MB reserved space, 8 and 16 MB memory sizes will not be delivered.

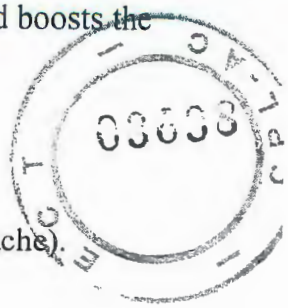
- Single board cache:
  The single board cache option is available in mono SP configuration, 5 disk drives or more, and the Battery Backup Unit. The memory size is limited to 32 MB for every model. A 2-MB space will be reserved for internal use on DAS1300. DAS2900 and DAS3200/DAS3500 need a 4-MB reserved space.

2.6.15. Microcode

The DAS 1000, 2000 and 3000 Series Storage System Manager (DASMGR) software, is an integrated set of utilities that allow users to configure the array, monitor the status of the major storage system components, and download updates of the arrays internal microcode. For Escala, DASMGR is delivered with AIX™ 4.2.
The Storage processors are controlled by on board internal software. This microcode is included in the base configuration of the subsystem. Enhanced functionalities are distributed through updates of this software. It is customer installable through the DASMGR utility.
In addition we can take advantage of a new graphic array management tool simplifying day-to-day operational tasks. Called ArrayGUIde, this tool is basically available and requires a graphical color display on the host or somewhere on a LAN connected to the host.

2.6.16. Performance

Performance takes advantage of the capability of mixing RAID architectures to fit application needs. The appropriate RAID level must be chosen according to the file size and the type of access. The write cache drops the write response time for all RAID levels, sweeps out the RAID 5 penalty and boosts the read after write access.



The raw performance of DAS1300 reaches in RAID 5 for one 5-disk LUN:

- 350 I/Os per second (100 % of READ, random access of 512 bytes, without cache)
- 120 I/Os per second (100% of WRITE, random access of 512 bytes, with an 8MB cache).
- a 13ms response time for 20 I/O per second (read without cache)
- a 7.3 ms response time for 20 I/O per second (write with a 8MB mirrored cache)
- a 5 ms response time for 20 I/O per second (write with a 8MB single cache)

The raw performance of DAS2900 is much higher for large configurations (more than 12 drives).

- 1200 I/O's per second (100 % of READ, random access of 4 Kbytes, cache hit = 0, access time = 32 ms, 20-disk 4-LUN RAID5, Dual SP Dual SCSI configuration).
- 4 ms less than DAS1300 in access time for 4 Kbytes I/O's in the same conditions.
- 500 I/O's per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Dual SP Dual SCSI configuration).
- 340 I/O's per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Mono SP Mono SCSI configuration).
- a 7 ms response time for 20 I/O per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Mono SP Mono SCSI configuration). These values are worst cases, measured within a full size working space, the access time includes a higher seek time than the one usual applications get.

2.7. EMC² Symmetrix 3000 Family Subsystems

The Symmetrix 3000 family is the industry's premier open storage solution from Bull partner EMC².

Major Features:

- Up to 32 physical SCSI interface connections
- Up to 16 physical Fibre Channel interface connections
- 4 to 256 physical 3.5-inch disk devices
- Remote diagnostics and AutoCall feature via an integrated service processor
- Non-disruptive component repair
- Non-disruptive microcode upgrades
- Dual-initiator disk director

Data Protection Features:
- Mirroring option (RAID 1)
- Dynamic Sparing option

Software features:
- Information Protection:
  - Symmetrix Remote Data Facility (SRDF™)
  - EMC TimeFinder™
- Information Sharing:
  - Symmetrix Enterprise Storage Platform (ESP)
  - EMC InfoMover™
- Information Management:
  - Symmetrix Manager - Base Component
  - Symmetrix Manager - SRDF / TimeFinder Component
  - Symmetrix Manager - SDDR Component
  - EMC PowerPath™

Classification:
- The Symmetrix Models 3000 are classified as Electronic Data Processing Equipment intended to be installed in a data processing center environment (class 2).

2.7.1. Description

Symmetrix enables to consolidate storage from multiple heterogeneous UNIX, Windows NT and AS/400 hosts. Optional Symmetrix Enterprise Storage Platform (ESP) software also allows mainframe information to be resident and accessible on the same Symmetrix 3000 system.

Symmetrix 3000 Enterprise Storage systems protect the largest relational databases and most demanding applications with the highest degree of data protection. The enterprise is fully protected against planned or unplanned disruption to information availability and accessibility. Protection choices include disk Mirroring (RAID 1), Symmetrix Remote Data Facility (SRDF™) remote mirroring software, hardware redundancy, and non-disruptive microcode and component replacement:

- EMC's disk Mirroring provides the highest data availability for mission-critical applications. By creating two copies of data on separate disk drives, Mirroring ensures both the highest availability and highest system performance.

- SRDF software maintains mirrored copies of data on physically separated Symmetrix systems to ensure continuous business operations in the event of planned or unplanned system or data center outages and disasters.

- EMC TimeFinder™ allows businesses to create independently addressable business continuance volumes (BCVs) for mainframe and open systems enterprise information. The BCVs are copies of active production volumes that can be used to run simultaneous tasks in parallel with one another. This gives customers the ability to do concurrent operations, such as data warehouse loads and refreshes or point-in-time backups, without affecting production systems.

- Symmetrix systems support non-disruptive microcode update loading. The business or agency remains online and unaffected even as it gains the advantages offered by enhanced capabilities.

- Symmetrix systems feature a full-system battery that guarantees no lost writes and orderly transitions or shutdowns during power outages. Extensive proactive and predictive intelligent maintenance features, such as cache and disk scrubbing and an integrated Remote Maintenance Processor (RMP), add to Symmetrix's information protection and continuous information availability features.

The Symmetrix 3000 family provides the highest performance systems to enhance online transaction processing and other response-time intensive applications:

- Up to 16GB of non-volatile cache (8GB on Symmetrix 3630 systems) helps ensure that all of the applications run at top speed.

- In addition to its large, intelligent cache, Symmetrix's parallel processing capabilities achieve levels of performance that result in dramatic reductions in both online response times and batch processing windows.

The major components in the Symmetrix 3000 are the directors (channel directors and disk directors), cache, and disk devices, as discussed below:

Ultra-SCSI Director:

The Ultra SCSI director is a single card that has four differential wide interfaces for connection to host systems and one high-speed path to cache. It can attach to hosts supporting Ultra-SCSI connectivity and Fast-Wide differential SCSI connectivity. The Ultra SCSI director contains two advanced microprocessors that process commands and data from the host and manage access to cache. They support data transfer rates up to 40 MB/sec with a host over each channel interface simultaneously. On a Ultra-SCSI channel director, data transfers from the host to cache occur as four concurrent operations. Each Ultra SCSI director can support up to 960 logical volumes (with a maximum of 2,048 logical volumes per Symmetrix 3830 and Symmetrix 3930 and 1,024 logical volumes for the 3630 Symmetrix)

Fibre Channel Director:

The Fibre Channel director is a single card that has two FC ANSI compliant 1 Gigabit Fibre Channel interfaces for connection to open systems hosts and one high-speed path to cache. It supports a data transfer rate of up to 100 MB/sec. The Fibre Channel director contains two advanced microprocessors that process commands and data from the host and manage access to cache. The Fibre Channel SCSI protocol mapping and upper level protocol layers are both implemented within the director. Each Fibre Channel director can support up to 256 logical volumes per Symmetrix system.

Serial Channel Director:

The serial channel director processes frames from the mainframe host and manages access to cache. The serial channel director supports data transfer rates up to 17 MB/sec with the host. With the IBM ESCON Multiple Image Facility (EMIF) Symmetrix can contain up to 1,024 different images. EMC offers four-port serial channel directors, which can support up to 1,024 logical volumes per board. Symmetrix serial channel directors support 2 Control Unit Address (CUADD) images, 512 logical devices per ESCON port and 32 separate logical paths (LPaths) addressable to one port. The 32 logical paths may be shared in any fashion between the 2 CU images. For example, all 32 logical paths can be configured on one CU image and none on the other. Or, 32 logical paths may be split between the ports (for example, 18 on CUADD 0 and 14 on CUADD 1)

SRDF Remote Link Director:

The Remote Link Director (RLD) is a 4-port serial channel director microcode configured as the link between Symmetrix units in a Symmetrix Remote Data Facility (SRDF) configuration. The Remote Link Director (RLD) interfaces to Symmetrix channels via a serial channel interface adapter. The Remote Link Director supports data transfer rates up to 17 MB/sec and supports up to 1,024 logical volumes per board. Symmetrix requires a minimum of two and supports up to four RLDs in each Symmetrix 3630 unit used in an SRDF configuration. When one of the processors of a serial channel director (two ports on each processor) is configured as an RLD, *only one of the ports* on that processor can be configured as a remote link, while the remaining port is not used. The second processor can be configured as a serial director, with *both ports* being used for serial channels. If two ports of the four-port RLD are needed as remote links to other Symmetrix units, only one port from each processor can be used.

Disk Director:

The disk director is a single card that provides an interface between cache and the disk devices. Each disk director supports one disk device on each of its four SCSI buses, but is capable of supporting up to eight devices per SCSI bus in the Symmetrix 3930 (six in the 3830, four in the 3630). Each disk director provides an alternate path to the disk devices of the other disk director. That is, should the primary path through a disk director to a disk device fail, the Symmetrix 3000 accesses that device through the other disk director.

Cache:

The Symmetrix 3630 model has two standard cache slots. Symmetrix 3830 and 3930 models have four standard cache slots. The Symmetrix 3630 models support a maximum of 8,192 MB of cache when 4 GB cache cards are installed in both slots. The Symmetrix 3830 and 3930 support a maximum of 16,384 MB of cache when 4 GB cache cards are installed in all four slots. Individual cache memory cards are available in 512 MB, 1 GB, 2 GB, and 4 GB sizes.

2.7.2. Symmetrix 3000 model specifications

Model	Connectivity directors								Cache directors		Disk devices	
	Ultra SCSI		Fibre Channel		Serial Channel		Remote Link					
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3630-18/36	2	4	2	4	2	4	2	2	2	2	8	32
3830-18/36	2	4	2	4	2	4	2	2	2	4	16	96
3830-18/36 (1)	2	6	2	6	2	6	2	4	2	2	16	96
3930-18/36	2	8	2	8	2	8	2	6	2	4	32	256

(1) with option to convert to Cache slots in Front End Director slots

3. Storage Area Network (SAN)

The term SAN designates a new type of storage architecture in which the storage systems are attached to a high speed network dedicated exclusively to storage. Connections between storage systems and servers or clients use interconnect technologies such as hubs and switches. SANs enable storage to be externalized from servers improving system performance. The application servers (usually UNIX or NT based) connected to this high-speed network exchange data using a SCSI-type I/O protocol.

3.1. Fibre Channel Optical Link Extender

3.1.1. Highlights

The FLX-2000 extends the distance of high-speed optical fibers well beyond the 500 m limit of multimode optical fibers. Finisar's Optical Link Extenders facilitate new applications such as remote storage and disaster recovery.

A pair of FLX-2000s extend a link by converting the short-haul copper or multi-mode optical signal to a long-haul, single-mode signal, and vice versa. Its internal Digital Signal Conditioner re-times the signal over the long-served over long distances with a bit error rate of 10^{-12} or better.

Simple to install, FLX-2000 link extenders include comprehensive system status monitoring and link diagnostics. The link monitoring and diagnostics provide quick fault detection and isolation. Integration with network management is provided via an RS232 serial port attached to a local terminal or modem to allow remote access.

3.1.2. SAN topologies & interoperability

Long distance links have been qualified only with one Optical link extender at both ends of the fiber. Interoperability with other devices on the long-haul optical fiber has not been qualified.

The Optical link extender has been qualified with links up to 10 km. Longer distances can be obtained in SFR (up to 120 km).

The short-haul connection has been qualified with DAS RAID subsystems, AIX PCI servers, and the Gadzoox Bitstrip fibre channel hub.

3.1.3. Packaging

The Optical Link Extender is a tabletop equipment, which can be stacked. Flat mounting on a wall is possible. Rack mounting kit is not available.

3.1.4. Technical specifications

Fibre channel specification

Protocol: Fibre Channel
Data rate: 1.062 Gbps

Electrical specification

Power requirement: +5 V (3 A), redundant inputs
Power supply: 110/220 V input, +5 V (4 A) output

Front-panel LED

Power
System
Short-haul
Long-haul

Short-haul connectivity

Short-haul copper cable: Shielded balance per FC-PH specification
Maximum short-haul copper distance: 25 m

Long-haul connectivity

Long-haul fiber connector: ST
Long-haul fiber cable: Single-mode zero dispersion at 1310 nm, 9/125 µm
Maximum long-haul distance: 10 km (optional up to 120 km)
Minimum Tx power: -3 dBm
Minimum Rx sensitivity: -26 dBm

Physical Dimensions

Dimensions: 8.2" x 7.5" x 1"(20,8 cm x 19,5 cm x 2,5 cm)
Weight: 2.5 lbs (1.3 kg)
Operating Temperature: 0 to 50°C

Other

Laser safety: Class 1 per FDA/CDRH, IEC 825-1
Agency Approvals: UL1950, CSA 22.2 950, EN 60950,IEC 950, CE Mark, VCCI

Electromagnetic Specifications

Emission: FCC Part 15 Class A, EN55022A, EN 55022, DOC CAS C108.8
Immunity: EN 50082-1

3.2. Gadzoox Biststrip™TW Fibre Channel Hub

3.2.1. Highlights

The Gadzoox Bitstrip™ TW Fibre Channel Arbitrated Loop (FC-AL) hub is specifically designed to be a cost effective entry point into high availability, gigabit storage networking. The Bitstrip TW incorporates several active features, such as Gadzoox' Reflex intelligent port bypass and per port data regeneration, which ensure reliable, trouble free, plug and play operation as well as a high degree of data integrity.

The Bitstrip TW is a 9-port FC-AL active hub that uses a DB-9 connector for each port allowing native connection to copper cabling. The Bitstrip TW also supports optics on all 9 ports through the use of external DB-9 to optics Media Interface Adapters (MIAs). MIAs are hot-pluggable and field upgradable, providing hub users with maximum flexibility in mixing copper and optical connections in their Fibre Channel systems. Power is automatically supplied on a per port basis to each connected MIA.

The Reflex feature, an intelligent port detection and bypass capability, dynamically reconfigures the arbitrated loop network to preserve communication between all operating devices. Using Reflex, the Bitstrip TW manages movement of nodes on and off the network, constantly monitoring nodes for failure, cable disconnection or network reconfiguration. Non-operating nodes are automatically bypassed, newly communicating nodes are automatically entered onto the loop. All loop reconfiguration is handled by the Bitstrip TW without disrupting communication on the remainder of the network. In the absence of the Bitstrip TW, the physical loop would need to be recabled on the addition or removal of a node, bringing the network down and disrupting communications.

The Bitstrip TW can be cascaded to other FC-AL hubs for the expansion of the loop. Port expansion is supported to the FC-AL limit of 126 nodes. Any port may be used for cascading.

The Bitstrip TW implements the most complete suite of intelligent data detection tests to ensure the highest availability of the Fibre Channel Arbitrated Loop. This test suite includes:

- Valid 8B/10B Data Detection
- Oscillation Detection
- Open Cable Detection

These three tests allow the Bitstrip TW to differentiate between valid Fibre Channel data and erroneous data, preventing corruption on the loop. Multiple detection circuits ensure that nodes will be bypassed only on real line failures, allowing transient events such as bit failures to be handled by the Fibre Channel frame level protocol. In the event that a node is bypassed, front panel LEDs provide convenient indications.

3.2.2. SAN topologies & interoperability

Despite the advanced features of the hub to retime and regenerate the signal allowing hub cascading, hubs interconnections must be avoided because of the risk of performance bottleneck. The hub shares the 100 MB/s bandwidth between the connected devices. Thus with 8 servers connected to a single hub, the average bandwidth per server is only 12,5 MB/s (100/8), i.e. much less than SCSI.

Interconnecting hubs does not increase the available bandwidth, but at the opposite share the 100 MB/s between more devices. The single case where hubs interconnection is tolerated (but should not exceed 3) is when there is no more than 9 devices (host bus adapters or storage subsystems) and the interconnection simplify the cabling. Typical examples are the disaster recovery configurations. Please refer to the SAN configuration guide for more information.

Another consequence of the bandwidth sharing concerns servers with multiple adapters: attempting to connect multiple adapters to a single hub is a design error. It will not increase the bandwidth available for the server, and furthermore, a failure of the hub (like a power outage) will impact all the connected adapters.

The interconnection of hubs and switches has not yet been qualified.

3.2.3. Packaging

The hub is a tabletop equipment.

It can also be mounted into a rack. It is designed as a precise half rack chassis so that two hubs installed with a single, 1U-height rack space. There is a double rack mount kit designed for mounting two hubs, side by side into a rack.

3.2.4. Technical Specifications

Bit Rate

1.0625 Gigabit/Second, 8B/10B encoded

Data Rate

100 MByte/Second each direction

Standards Support

Fibre Channel Arbitrated Loop

Physical Specifications

(H) 1.7 in./43mm, (W) 8.7in/221mm, (D) 5.7 in./145mm

Weight

Net - 3 lbs., Shipping - 3.3 lbs.

LED 'ndicators

1 Amber/port - LED on indicates port by-pass
1 Green - LED on indicates power on

Environmental Specifications

Operating temperature: +10 deg. C to +40 deg. C
Storage temperature: -30 deg. C to +60 deg. C
Operating humidity: 80% maximum relative humidity

Electrical Specifications

AC Voltage: 100-240 VAC
Power: 2A, 50-60 Hz

Electromagnetic Specifications

FCC Part 15 Class A, EN55022A

Agency Approvals

UL1950, CSA 950, EN60950 (IEC950), CE Mark, VCCI

3.3. MIA

3.3.1. Highligths

The MIA is a high performance integrated duplex data link for bi-directional communication over multimode optical fiber for Fibre Channel applications. It is compliant with the Media Interface Adapter (MIA) specification. The MIA is specifically designed to connect to electrical high speed data communications links that require extended distance performance. The previous limit of 30 m in copper connections can easily be extended to 500 m with multimode.

3.3.2. SAN topologies & interoperability

The MIA has been qualified with Gadzoox hubs and DAS subsystems.

Caution

This MIA, introduced in 9/99, replaces the product number MI DCOQ001-0000. It is not compatible with PCI copper DB9 fibre channel PCI adapters (LP 6000: DCCG166-0000, LP 7000^{e}: DCCG141-0000, LP 8000: DCCG147-0000). To support optical connections on AIX servers, a PCI adapter with the native optical interface must be used. If necessary, existing adapters must be replaced.

3.3.3. Packaging

The MIA is plugged directly on copper / DB9 connectors on hub's ports or on DAS host interface ports.

3.3.4. Technical specifications

Bit Rate

1.0625 Gigabit/Second, 8B/10B encoded

Data Rate

100 MByte/Second each direction

Standards Support

Fibre Channel

Physical Specifications

(H) 0.63 in./ 16 mm. (W) 1.4 in. / 36 mm, (D) 2.7 in. / 68.6 mm

Environmental Specifications

Operating temperature: +0 deg. C to +70 deg. C
Storage temperature: -40 deg. C to +85 deg. C

Optical interface

SC Duplex Optical Interface
50 µm multimode optical fibers
62.5 µm multimode optical fibers

Electrical Interface

DB-9
75 ohm Input / Output
Single +5V Power Supply

Safety

Class 1 Laser Safety Compliance IEC825-1
FDA radiation performance standards 21 CFR, chapter 1 subchapter J
UL 1950 Approved
FCC Part 15 class B

Chapter 4: Serial Storage Architecture Subsystems

1. Overview

(Note: The SSA offer has been discontinued as of 30 June 1999. SSA disks have been discontinued as of 31 December 1999. It is available through reconnection when upgrading from T604e/T620, or E604e/E620, to T430/T450 or E230/E250 respectively.)

1.1. Architecture

SSA is a powerful high performance serial interface. It has been specifically designed to connect disk drives, tape drives, CD-ROMs, optical drives, printers, scanners and other peripherals to workstations, servers, and storage subsystems. It is the only serial interface that was designed from the outset to meet the requirements of a wide range of I/O devices. SSA offers superior performance because its fundamental building block is a single port capable of carrying on two 20 MB/sec conversations at once -- one inbound and one outbound. A basic SSA connection is a dual-port node capable of carrying on four simultaneous conversations, for a total bandwidth of 80 MB/sec.

SSA's dual-port, full-duplex architecture allows peripherals to be connected in configurations with no single point of failure. Because multiple paths are inherent in the design, increased fault tolerance is far easier to implement. SSA provides "hot plugging" and automatic configuration when nodes are added or deleted. For configuration flexibility, SSA nodes can be up to 20 meters apart using low-cost shielded twisted pair. SSA will offer many advantages over future parallel interfaces due to the simple fact that cabling and connector costs can be reduced dramatically. SSA enhancements include speed, distance, simplicity and reliability. Many leading computer and peripheral companies have adopted SSA as their future serial architecture choice.

SSA has the flexibility to be implemented with multiple topologies including string, loop, and switch configurations. In a typical single loop example, 128 nodes (peripherals or hosts) can be supported. In a complex switched configuration with multiple loops, the theoretical maximum number of nodes would be just over two million.

While performance, availability, and reliability continue to improve, computing requirements are also becoming more complex. SSA's flexibility not only supports this increasing complexity, but actually permits new approaches not available with other interconnection technologies.

SSA is being developed by the American National Standards Institute (ANSI) X3T10.1. The standards being developed describe the protocol and electrical specifications of the interface.

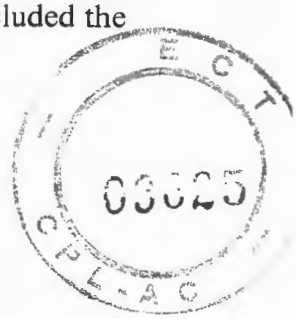
1.2. History

Like all computer interfaces the Serial Storage Architecture Interface started out as just another proprietary computer interface. The first SSA interface was developed by IBM and was called the 9333 I/O channel. This interface was designed for high performance storage applications and today there are thousands of units installed in the field. In 1991, this technology was made available to the computer industry as one of the serial storage options for SCSI-3.

SSA started out under control of SSA-UIG (Serial Storage Architecture - User Industry Group) which was made up of many leading computer companies. Since 1994, SSA standardization and documentation has been under control of X3T10.1. This ANSI committee is a daughter committee to

X3T10, which is the SCSI-3 committee. This has literally opened the architecture to any interested company and makes the interface an international serial option.

When the architecture was taken over by the X3T10.1 ANSI subcommittee many enhancements needed to be made which dramatically changed the interface. Some of these changes included the following:



- 20 MB/sec Serial Links
- Interoperability between different host systems
- The ability to operate under any Protocol, i.e. SCSI, IP, HIPPI, ATM, etc...
- Enhanced electrical specification
- Advanced error handling and warning system

1.3. Features and Advantages

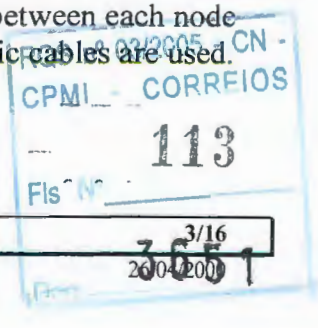
Easy Migration from SCSI
A serial alternative that allows current and future SCSI mapping. By allowing SCSI mapping, the integrator can re-use Device Drivers and target firmware. This makes migration to the SSA interface much easier because it retains much of the SCSI logical model. Estimates could be as low as a 15% code rewrite to upgrade the SCSI firmware on a disk drive from SCSI to SSA. If you don't like SCSI mapping, choose your own protocol. SSA has the capability to map any protocol across its physical link.

Addressing, Queuing, Commands, Status, and Sense Data
SSA maintains the **address** scheme as defined in the SCSI standard where as there are initiators, targets, and logical units. Therefore you don't need to learn new terms and functions. The SCSI **queuing** model is also retained by using a 2-byte Tag for each I/0 process with Simple, Ordered and Head of Queues. SSA can use the same 6, 10 and 12-byte **Commands** and return the same **Status** codes as defined by SCSI. This means that you can issue the same Read command and determine command completion as defined by current Device Driver implementations. If an error occurs (i.e. a Check Condition status code), the Request Sense command can be issued and the **Sense Data** returned as specified in the SCSI standard. This makes error handling for the host system software and target firmware identical to current SCSI implementations.

SSA adds a layer of software/firmware onto a product which is used to manage the link protocol, link/system configuration, frame buffers and handle link errors.

Advantages Over Existing SCSI Parallel Interface

- **Compact cables** and **connectors** for small form-factor devices:
  When SSA cabling and connectors are compared to the 50 or 68 wire parallel SCSI interface, the costs savings alone make SSA appealing. Internal connections are made with six conductor cable and connectors which consists of leaf style multiport headers on .050 inch spacing and 6 circuit insulation displacement connectors. External connectors are 9-way micro-mini 'D' connectors and shielded cables. SSA is also a point to point architecture with up to 20 meters between each node with low cost copper cables or up to 680 meters between each node if fiber optic cables are used.



- **Excellent performance:**
  Due to the fact that there are no bus phases like Arbitration, Selection, and Reselection, the protocol has low overhead typically around 6%. Functions like arbitrating only add overhead to a transfer. This makes SSA 94% efficient, which means that 94% of the data on the interface is customer data.
- **Greater connectivity options:**
  This is accomplished via strings, loops, and switches. No longer are you limited to a daisy chain of devices. SSA allows up to 129 nodes in a string, 128 nodes in a loop, and a virtually unlimited node count if switches are used. Compare this to only 8 or 16 devices for parallel SCSI.
- **Enhanced reliability:**
  This is achieved by having CRC on each transfer and a link layer recovery mechanism. CRC translates to a raw error rate of less than 1 in 10^{13} bytes. The link layer recovery mechanism that is designed into the interface means link errors are handled by each node and not by the system software. If errors are not recovered by the link layer a network administrator handles and coordinates error recovery.
- **Higher availability, fault-tolerance, and hot plugging:**
  The network can be configured into loops and switches, which translates to no single point of failure. Point to point links also facilitate fault isolation and permits hot plugging. Nodes are addressed by a Path address in each frame. This means no hardware switches need to be set. Higher availability is accomplished via alternate paths and spatial reuse (this is covered later).

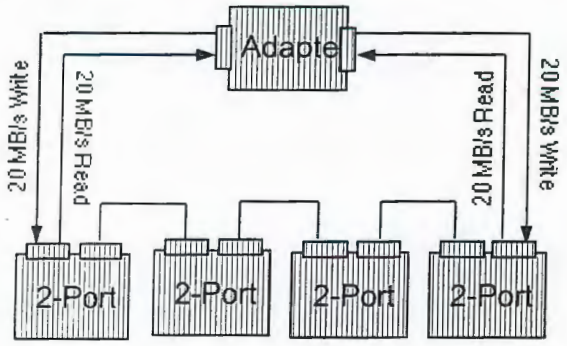
Cost-sensitive
SSA has been optimized for **cost-sensitive** applications such as disk drives. The hardware can be fully integrated in 3.3 V CMOS technology. This feature combined with the fact that cabling and connectors costs are reduced truly makes SSA a cost-sensitive interface.

Frame routing is done in hardware
This means that a node's firmware will not have to analyze a frame before the routing function takes place. SSA is also a forward and store interface, which means that frames are routed after the first couple of bytes have been analyzed.

Disk spindle synchronization integrated
Spindlesync is integrated into SSA protocol (No additional cables are needed). It is multiplexed onto the SSA link using a special character and is beneficial to disk array applications.

High data transfer rates are supported
Initial peak data rate is 20 MB/sec in each direction per port. This will be known as the link speed, the total traffic on either line. This will equate to a maximum port speed of 40 MB/sec total bandwidth in full-duplex mode. If another port is added to a node and a cyclic loop is used, each node could have a theoretical 80 MB/sec bandwidth (minus any overhead). Note: In order to achieve the theoretical 80 MB/sec data transfer speed, spatial reuse and full-duplex transfers must occur. These features may require advanced hardware and programming behind the SSA interface. The architecture is open-ended so that higher speeds (i.e. 40 MB/sec and 100 MB/sec per direction) will be supported. Multiple concurrent transfers with each node and optional out-of-order transfers, e.g. for RAID-5 controllers, are supported.

80 MB/sec bandwidth per dual-port node if running full-duplex.

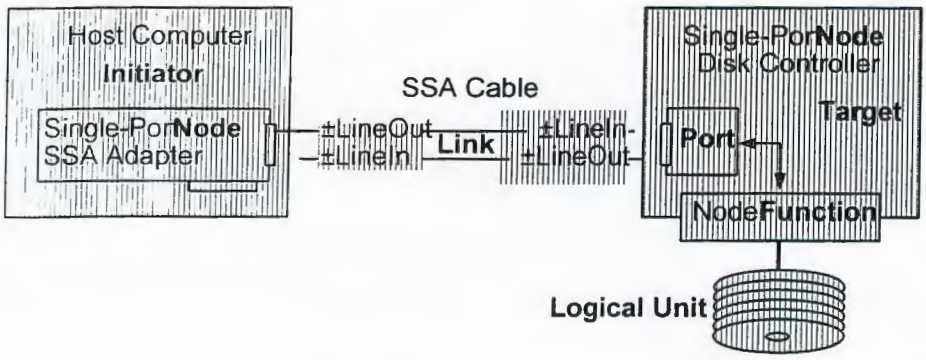


Standardization

Standardization of SSA document has been submitted to the Accredited Technical Committee X3T10.1 for review and approval as an American National Standard.

1.4. Basic SSA Definitions

The most basic network consists of a single-port host adapter connected to a single-port peripheral. The serial connection consists of six wires of which four are used to transmit frames of information. The four lines consist of a plus/minus LineOut and a plus/minus LineIn.



A **Link** (to unite. connect, or join) is a dedicated connection between two single-port nodes. An interesting note about a link is that when a link is idle, i.e. no frames are being transferred, synchronizing characters are sent between the single-ports. This keeps the link synchronized and allows the network to instantly detect a line fault (link failure).

A **Port** (a gateway) consists of the hardware and firmware to support one end of a link. Most of a port functions are contained within currently available silicon. These chips have SERDES Serializer/Deserializer. ABUS for "CFE Local Bus operation" or "Disk Manager Operations" and a BBUS for address, data and control signals that could be used for communication with an external processor. Special protocol registers, which are used to properly sequence the interface, and frame buffers are present for Inbound and Outbound frames. Some silicon implementations have the DMA controller and processor logic fully integrated.

A **Node** (a point of concentration, a central point) is a system, controller or device with one or more serial links. There are three types of nodes, single-port, dual-port, or switch port. Each node has a **function**, which is the specific responsibility, task, or use of the node, i.e. the reason for the node existence.

Initiator the mode of the node within a device that determines what task needs to be executed and which target will perform the desired task. It creates frames of information to be sent across the SSA link and confirms that the target performed the task assigned to it. In SSA there must be one initiator in the network that is designated as the Master.

Target, the mode of the node within a device that acknowledges the receipt of frames of information. Targets inform the initiator that it is ready to receive a frame of information and it may have up to one hundred twenty eight logical units (LUN) attached to it.

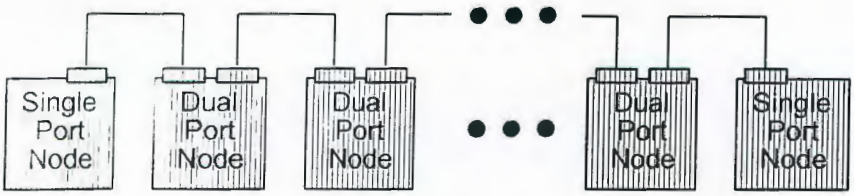
Logical units are a physical or virtual peripheral device addressable through a target (peripheral troller). They are the basic addressable unit on a target and can be a portion of a peripheral device e. a partition).

1.5. SSA Topologies

The different configurations of an SSA network can be seen below. The progression will be from the most basic configuration to the most advanced. There are three basic topologies that exist in SSA and these topologies can exist individually or can be combined to form a complex network.

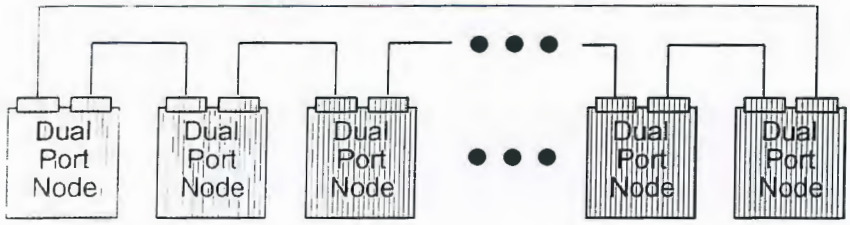
The string topology below is the simplest of topologies. This topology is not popular because it has single points of failure.

String Topology



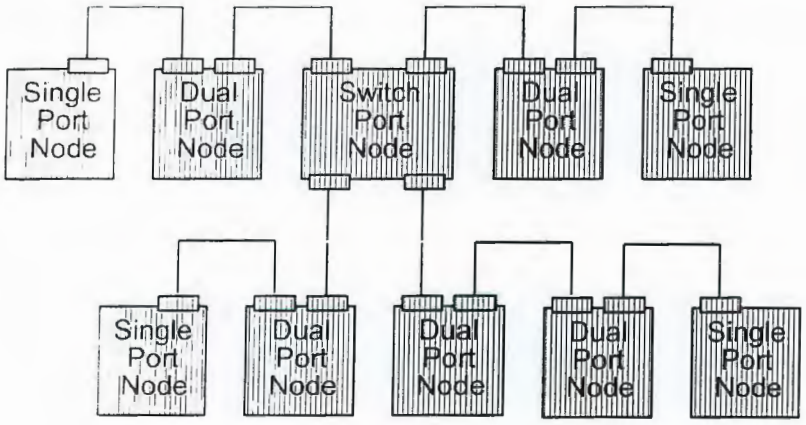
The loop topology below is the most popular of topologies because it has alternate paths to each node in the network and it eliminates a single point of failure.

Loop Topology



The switch topology below is the most complicated topology because it takes additional hardware to implement. Fortunately the currently available silicon has switch capability fully integrated and to add this functionally to a network is an exercise in hardware implementation. This configuration is the most fault tolerant and allows a virtually unlimited network configuration.

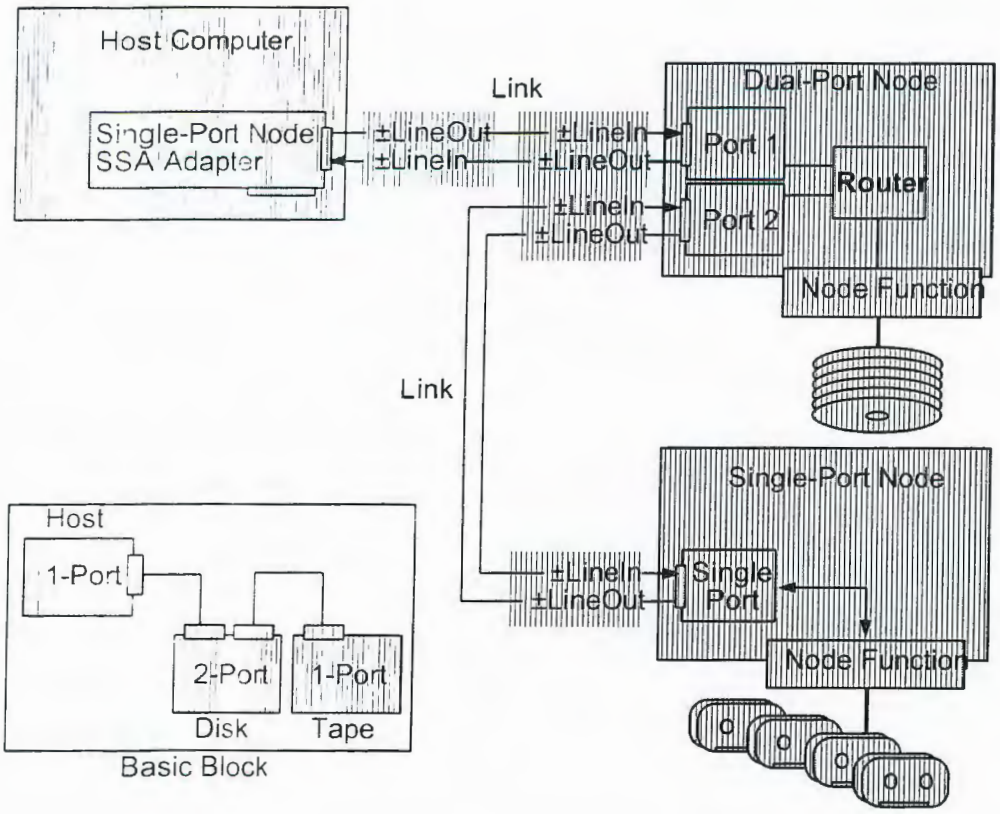
Switch Topology



1.5.1. String Characteristics

A string is a linear network of two or more nodes, as shown below.

The extreme nodes at either end of a string can be single-port nodes, dual-port nodes with one port not operational or a switch. The intermediate nodes (if any) are always dual-port nodes.
Each link operates independently and manages its own flow control and error recovery. An error in one link does not affect other links, except for the possible need to abort a frame that is already being forwarded. The maximum number of nodes in a string is 129, including the end nodes.



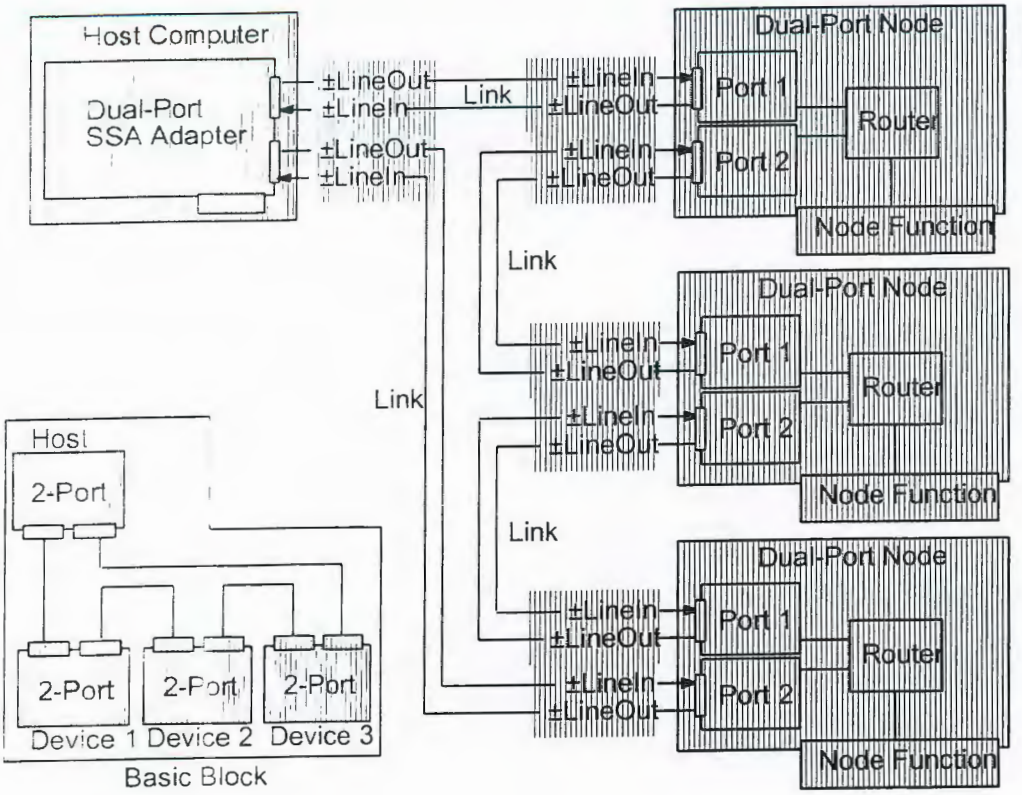
Router (the function of routing, i.e. to send by a certain route):
Depending on the address field of the inbound frame to the node, the router forwards the frame to the node function or to the outbound line of another port. When the node wants to originate a frame it instructs the router to transmit it on a specified port. Note that all **message** and **data** frames relating to a particular **command** use the same port.

1.5.2. Loop Characteristics

A loop is a cyclic network containing **only** dual-port nodes, as seen below.

A loop provides better availability than a string because any single-port node can fail without blocking communication between any pair of the remaining nodes. A node can also be inserted into the loop or removed from the loop dynamically without preventing communication between the other nodes. This will require reconfiguration of the network but the loop will remain functional. The maximum number of nodes is limited to 128. A loop may not contain a switch, as this would break up the continuity of the loop.

An important property of strings and loops is *spatial reuse*. Each link functions independently of the other links so that several transfers can occur concurrently at the full bandwidth provided that each uses different links. This allows much higher throughput than a token ring or bus. Translation: A port can be sending a frame of information out its *LineOut* while the port is receiving a frame of information into its *LineIn*. It also means that if the node has two ports this can simultaneously occur on each port.

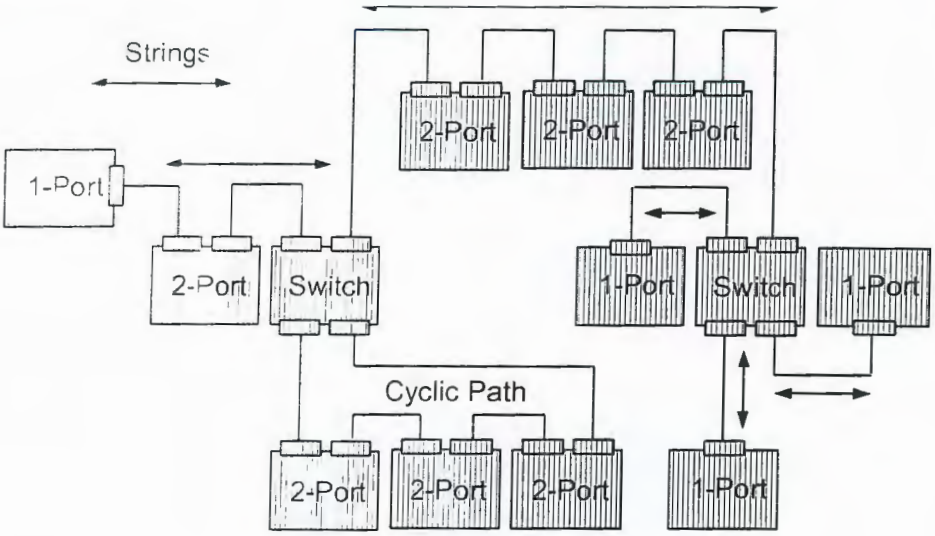


1.5.3. Switch Characteristics

Switches allow a number of strings to be connected to achieve an almost unlimited number of nodes.

Allows alternative paths to be provided to achieve fault-tolerance. The figure below shows a complex network including 2 switches, 5 strings and a cyclic path (if a cyclic path includes a switch it is not a loop).

The maximum number of ports that can be addressed in a switch is 96. There is no standard method on how port addresses are determined on a switch. This is usually a function of the hardware. There will always be an even number of ports (from 4 - 96) and an internal router in every switch.



1.5.4. Summary of Topologies

An SSA interface may consist of one or more of the following:

Strings: A linear network with up to 129 nodes.

Loops: A cyclic network with up to 128 dual-port nodes.

Switches: A frame switch with up to 96 ports. Switches can be inter-connected and combined with strings to allow an almost unlimited choice of topologies.

1.6. Parallel (SCSI-2 or SCSI-3) and Serial (SSA) Differences

Parallel - SCSI-2	Serial - SSA
Only two devices can communicate at one time.	Multiple devices can use link(s) providing there is enough buffer space and bandwidth.
Bus phases.	No phases but plenty of states and modes; no arbitration, selection or reselection phases.
Connects, disconnects and reconnects.	No equivalent concepts. Messages are sent and FLAG determines end of frame. Full multiplexing capabilities, multiple I/O processes can be started simultaneously before completion status received.
Commands.	Messages.
Messages.	Messages.
Status.	Another message.
Interlocked interface.	Frame multiplexed interface.
Bus signals consist of control and data lines.	Control and data share same line.
50 to 68 pin connectors and cables.	Six internal and nine external wires.
Untagged and tagged queuing.	Only tagged queuing, untagged queuing must be emulated.
Contingent Allegiance.	Auto Contingent Allegiance Condition.

Protocol Comparison

Below is a comparison between the bus phases of the parallel interface verses the frames of the serial interface. An example of a single Request Sense command is used.

Bus Phases	Frames	
Bus Free		
Arbitration Start		
Arb_win		
Selection Start		
Selection Complete		
Message Out		
Command Out Request_sense	SCMD	Request Sense
Data In	DATA	Sense Data Bytes
Status In	STAT	Good Status
Message In		
Bus Free		

SSA has simplified the protocol with no Arbitration, Selection, Message or Bus Free phases. These bus phases add substantial overhead to a transfer and the SSA architecture virtually eliminates this type of overhead. However, for each SCSI I/O process the same results must occur between the two interfaces in that, each I/O process could have three main components:

1. the command
2. the data (optional)
3. the status

2. SSA Subsystem

2.1. Overview

The Serial Storage Architecture Disk Subsystem model DeskSide is second-generation, leading-edge serial storage subsystem that implement industry-standard Serial Storage Architecture (SSA) to deliver outstanding performance, capacity, and availability in a low cost, scalable package.
Combined with the SSA adapter (Multi-Initiator/RAID Enhanced Loop (EL) Adapter), the DeskSide model can be configured for high performance, multihost attachments, or economical RAID 5 data protected storage on PCI bus of Escala E&T Series. On the Escala T430 the SSA offer is only available through reconnection, when upgrading from T604e/T620.
The power cooling units are also auto-docking and customer replaceable.

The SSA Disk Subsystem model (DeskSide) can be populated with up to 16 auto-docking, customer replaceable, SSA disk drive modules.
The disk drive modules are available in two different capacities: 4.5GB, and 9.1GB.
The 9.1GB SSA Disk Drive features require AIX™ 4.2.1.

Four 4.5GB disk drive modules are standard. However, select features allow these to be replaced by the 9.1GB modules at time of original order. Features are provided to add any combination of supported SSA disk drive modules, up to a maximum of 16, providing up to 145.6GB of disk storage capacity (using 9.1GB disk drives).

An SSA Fiber-Optic extender (CTKG069) is available on this model. This feature supplies a pair of optical converters that convert electrical SSA signals into optical signals for transmission via customer supplied optical fibers. This feature allows the maximum distance between SSA nodes to be increased from 25 meters to 2400 meters for use in campus type installations.
One SSA Fiber-Optic extender is required for each SSA loop segment.

This model offers:

Outstanding Capacity Footprint

- 4.5GB, and 9.1GB drives
- Four to 16 drives per Subsystem

Outstanding Subsystem and Adapter Performance

- Up to 8,000 ops sec/subsystem
- Up to 140MB sec/subsystem
- Up to 3,000 ops/sec/adapter
- Up to 35MB sec/adapter

Outstanding Availability and Reliability

SSA dual paths to every disk
Redundant power and cooling
Concurrent maintenance on power, cooling, and drives

Maximum

The Escala E&T SSA adapter can attach up to a maximum configuration of 48 drives per loop, two loops per adapter, totaling up to 96 SSA disk drive modules.

2.2. Positioning

The SSA Disk Subsystem Model DeskSide is second-generation serial storage subsystem that significantly exceed the performance and capacity available with directly attached SCSI disk drives. The SSA RAID adapter can deliver 35MB/sec sustained to the Escala E&T PCI bus and supports up to 3.000 ops/sec. It can also attach up to 96 SSA disk drive modules, 48 per loop.
The SSA RAID adapter can be configured with multiple RAID 5 arrays with global hot spares spread across up to 96 disk drive modules.

In the transaction processing environment, the SSA Disk Subsystem provides the ideal solution when used as mirrored storage in a "high availability" server systems for applications that require sustained high performance despite a single failure. If the cost of data protection is more important than high performance, then RAID 5 via the SSA RAID adapter should be considered.
The basic SSA Disk Subsystem is delivered with four 4.5GB disk drives (with an option to select 9.1GB).
The shared SSA Disk Subsystem in High Availability Solution will be soon available.

In engineering/scientific, data-mining, data-warehousing, and decision support applications, the ability to sustain high data rates makes the SSA Disk Subsystem an attractive solution.

2.3. SSA DeskSide model - Technical description

The Subsystem provides power and packaging for SSA disk drive modules. The DeskSide Model is a standalone unit.

The Subsystem provides slots for up to 16 SSA disk drive modules. These 16 disks are grouped together in fours. The DeskSide Model provides circuitry that will automatically connect these groups of disk drives together. The automatic connection is made based on the presence of signals on the external connector. If there are signals present at one connector of a pair of connectors then these connectors will not be connected automatically. If there is not a signal at both of the connectors in a pair then these connectors will be connected automatically.

The Subsystem can be populated with two different SSA disk drive modules. The different capacities are 4.5GB, and 9.1GB. The basic machine includes four 4.5GB disk drives as standard. These can be replaced by 9.1GB drives at time of original order.

The Subsystems includes three auto-docking power/cooling units. These provide redundant power to all sixteen disk drive module positions. These units may also be replaced by the customer.

The Subsystem has selectable cable features of up to 25 meters long for attaching to an SSA RAID Adapter in the attaching systems and for connecting to other subsystems.
An SSA Fiber Extender is also available for use with optical fibers up to 2.4KM.
An Escala E&T System can be connected several SSA Disk Subsystems depending on free slots.

The SSA Disk Subsystem is configured with three fan-and-power-supply assemblies. The fan-and-power-supply assemblies can run on either ac or dc power.
They provide all the power generation and distribution for the SSA Disk Subsystem.

The disk drive modules are connected to each other strings of four modules (two strings at the front of the SSA Subsystem and two strings at the back). These strings can be connected to each other, to strings in other SSA Subsystem, or to SSA adapters. The adapters can be in separate using systems or the same using system.

The SSA Disk Subsystem can be disconnected from its related SSA adapters while the using system is running. Also, most of the field-replaceable units (FRUs) of the SSA Disk Subsystem can be removed and replaced while the Subsystem and the using System are running.

2.4. SSA Adapter

The SSA Disk Subsystem can be attached to an SSA Multi-Initiator/RAID Enhanced Loop (EL) Adapter.
This Adapter is two-initiator, non-RAID capable, or one-initiator RAID capable, and both accept the SSA Fast-Write Cache Option Card that supports operation in either an one-initiator RAID or one-initiator non-RAID application. These Adapters interoperate together when configured in a two-initiator, multihost configuration.

The SSA Multi-Initiator/RAID EL Adapter has four ports, two SSA loops, and a supported configuration of 48 SSA disk drives per loop or 96 SSA disk drives per adapter. The adapter supports HACMP.

The RAID adapters utilize the new SSA adapter architecture -- SSA Enhanced Loop. The SSA EL architecture offers a choice for SSA HA Data Protection:

- Disk Mirroring -- Best Performance Multi-Initiator RAID -- Lowest Total System Cost
- SSA EL adapter architecture enables Escala Systems to share SSA Storage in a multihost SSA environment.
- SSA EL also will enable SSA for future performance enhancements, for example, SSA 40MB/s (160 MB/s per loop) on future adapters. All new SSA installations should only use SSA Enhanced Loop (EL) architecture.

2.4.1. SSA 4-port Multi-Initiator/RAID EL Adapter

The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA).

The SSA 4-Port Multi-Initiator/RAID EL Adapter supports RAID 5 in a single initiator configuration for each loop (two ports make up one loop) and provides two loops per adapter. RAID 5 function provides protection to the data in the unlikely event of a disk drive failure.
The SSA 4-Port Multi-Initiator/RAID EL Adapter also supports non-RAID SSA attachment to SSA disk drive subsystems in a single initiator per loop environment. A utility program is also provided for controlling the RAID configuration.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides low cost data protection and is ideally suited for video applications, data servers, and mission-critical storage needs.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Supports both RAID 5 and non-RAID configurations in single initiator, per each loop, environment
- RAID 5 Arrays from 2-data plus parity to 15-data plus parity can be configured
- Up to 32 2-data plus parity RAID 5 Array groups per adapter
- Up to 6 15-data plus parity RAID 5 Array groups per adapter
- Supports Hot Spare
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- PCI type long adapter card size

An optional 4MB Fast-Write Cache card is now available and improve write performance in RAID 5 or non-RAID (one-initiator configurations) operations.

The SSA Fast-Write Cache Option Card, FC is a 4 Mbytes fast-write optional feature that will plug into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years. During the unlikely event of an SSA Multi-Initiator/RAID EL Adapter failure, a new SSA Multi-Initiator/RAID EL Adapter can be installed and the SSA Fast-Write Cache Option Card can be removed from the failing adapter and installed in the new SSA Multi-Initiator/RAID EL Adapter ensuring data integrity.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache.
The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes, machine type/model and application parameters.

The SSA Fast-Write Cache Option Card plugged into either SSA Multi Initiator/RAID EL Adapter will operate in either Non-RAID or RAID 5 mode, in a one-initiator configuration.

Operational requirements

- One PCI slot must be available for the installation of the SSA 4-Port Multi-Initiator/RAID EL Adapter.

2.4.2. Limitations

PCI SSA Multi-Initiator/RAID EL Adapter:

- RAID arrays must have all array members in same SSA loop
- PCI bus interface only

SSA Fast-Write Cache Option Card:

- One-initiator SSA configuration (does not support two-initiator configurations) in either non-RAID or RAID 5 mode

2.5. SSA Disk Drive Modules and capacity

The SSA Subsystem is configured with 4 Disk Drive Modules (18 GB up to 36.4GB using 9.1GB disk drive). Up to 16 Disk Drive Modules (72 GB up to 145.6GB using 9.1GB disk drive) can be connected to the Subsystem.
All the Disk Drive Modules start their power sequence when the input voltage is inside the specified limits. Their motors are started under control of the SSA adapters in the using system. To prevent the need for excessive electrical current, the Disk Drive Module motors are not all started together (at least 10 seconds delayed).

2.6. SSA Loops and Links

The Disk Drive Modules of the SSA Subsystem are connected through two or more SSA links to an SSA adapter that is located in the using System. The Disk Drive Modules, SSA links, and SSA Adapter are configured in loops. Each loop provides a data path that starts at one connector of the SSA adapter and passes through a link (SSA cable) to the Disk Drive.

2.7. Disk Drive Module String

In the SSA Subsystem, the Disk Drive Modules are arranged in strings of four modules. Each string has its own two SSA connectors and can be connected through external SSA cables to a pair of connectors on the SSA adapter to make a SSA loop of four modules.
A string can also be connected to other strings to make a bigger loop.
The strings can be in the same SSA Subsystem or in different SSA Subsystems

Chapter 5: Graphics Subsystems

1. Graphics Adapters

1.1. Power GXT130P Graphics Accelerator (GTFG048-0000)

The POWER GXT130P is a versatile, low-priced 2D graphics accelerator for Escala servers. This accelerator delivers exceptional 2D graphics performance for AIX systems at a low price .
The POWER GXT130P is supported on the Escala S, E230, E250, T430 and T450.

Advantages

- Meets the performance and functional requirements of demanding 2D graphics for X Windows applications.
- Displays graphics and text for workstation applications that require very rich and complex visual information simultaneously.
- Provides an exceptional performance level of visual interaction for servers at an affordable price.

Hardware

- Utilizes a half-length PCI slot
- Concurrent colors: 256 out of 16.7 million
- RAM DAC frequency: 250MHz
- Maximum resolution: 1600 x1200 8-bit pixels
- Maximum refresh rate: 85Hz
- Memory bandwidth: 640MB/sec.
- Memory type: 8MB SDRAM
- Display Power Management Signaling (DPMS)

Features

- Supports 60 to 85Hz monitor refresh rates, including those that comply with ISO 9241 Part 3.
- Video acceleration features such as scaling and color space conversion.
- Supports screen resolutions of 640x480, 800x600, 1024x768, 1280x1024, 1600x1200 at 8-bits per pixel.
- Satisfies the ISO 9241 standard of visual quality, refreshing the screen at up to 85Hz for all resolutions.
- Provides a standard 15-pin DIN output connector for half-length PCI card slot.
- Supports:
  - Multisync monitors with at least a 64KHz horizontal scan capability.
  - DDC-2B-compliant multisync monitors with at least a 38KHz horizontal scan capability.

Software requirements

- AIX® 4.3.2 and above.
- Xlib is included with AIX 4.3.2 and above.

Machines/number of adapters

Escala	S	E230	E250	T430	T450
Nb adapters	4	1	2	1	1

1.2. Power GXT2000P Graphics Accelerator (GTFG049-0000)

Valid on only on Escala S, the POWER GXT2000P graphics accelerator brings a new level of productivity to day-to-day design and engineering. The POWER GXT2000P graphics accelerator is a single PCI adapter card that requires only a half-sized PCI slot. It provides display resolutions up to 1920 x 1200 (maximum) at up to 76 Hz. It has been designed specifically to support the functional requirements of the OpenGL and graphics application programming interfaces.

Features

- 1920 x 1200 maximum resolution up to 76Hz (Maximum refresh rate for 1600 x 1200 and smaller displays is 85Hz).
- 8-bit and 24-bit double-buffered color.
- 24-bit Z-buffer.
- 8-bit overlay buffer.
- 16MB texture memory at 1280 x 1024 screen resolution.
- 4-bit window ID buffer.
- 4-bit stencil buffer.
- Four 256-entry hardware color tables.
- Separate gamma correction table.
- Face culling support.
- OpenGL polygon offset support and mode support.
- Trilinear texture mapping.
- Video support.

Software requirements

- AIX® 4.3.2 and above.
- Xlib is included with AIX 4.3.2 and above.

Machines/number of adapters

Escala	S
Nb adapters	4

1.3. PCI High Resolution Graphics Adapter - 4MB WRAM (MI: GTFG039-0100)

(Discontinued: 30/11/1999.)

Valid on Escala E&T Series only, the PCI High Resolution Graphics adapter with 4MB WRAM is a Graphics Adapter designed to provide:

- High Performance
- Multiple screen
- Up to 16.7 million colors displayed in the same time.

This adapter is only available through reconnection on the Escala E230, E250, T430 and T450 when upgrading from the E604e/E620 or T604e/T620.

1.3.1. Features without Extension Memory

General Hardware Features:

Bus	32-bit PCI
Memory	4 MB WRAM
Maximum Non-Interlaced Resolution	**1600x1200**
Maximum Colors	Color depth 8 bits/pixel: 256 Color depth 16bits/pixel: 64K Color depth 24 bits/pixel: 16.7 million
Refresh rate	up to 200 Hz
Monitor connector	15-pin

Other Hardware Features:

Color Map	1
WRAM Features	Dual ported memory type 20 nanosecond page mode cycle time (50% faster than the fastest VRAM) 2 Color block write mode.
Hardware 2D acceleration	lines, rectangles, bit block transfert
Hardware 3D acceleration	Hardware True Color Gouraud shading 16-bit Z-buffer in off-screen WRAM Hardware double buffering in WRAM Color dithering in 8 and 16 bit per pixel modes Complex bit-block transfert with Z
Compatibility Features	Integrated 32-bit VGA core VESA compatible VESA DPMS compliant Saves power Green PC support VESA DDC-1, -2 compliant

Resolution	Pixel format and refresh rates (hardware)	Color depth and refresh rates (with AIX)
640x480	8, 16, 24, 32 (up to 200 Hz)	8, 16, 24 (60Hz)
800x600	8, 16, 24, 32 (up to 200 Hz)	
1024x768	8, 16, 24, 32 (up to 130 Hz)	8, 16, 24 (60, 70, 75 Hz)
1152x882	8, 16, 24, 32 (up to 110 Hz)	
1280x1024	8, 16, 24 (up to 100 Hz)	8, 16 (60, 71, 75 Hz)
1600x1200	8, 16 (up to 78 Hz)	8, 16 (60Hz)

1.3.2. Features with 8 MB WRAM Extension Memory of 4MB (MI: GTFG039-0100 + GTFG045-0100)

(Discontinued: 30/11/1999.)

Resolution	Pixel format and refresh rates (hardware)	Color depth and refresh rates (with AIX)
640x480	8, 16, 24, 32 (up to 200 Hz)	8, 16, 24 (60Hz)
800x600	8, 16, 24, 32 (up to 200 Hz)	
1024x768	8, 16, 24, 32 (up to 130 Hz)	8, 16, 24 (60, 70, 75 Hz)
1152x882	8, 16, 24, 32 (up to 110 Hz)	
1280x1024	8, 16, 24, 32 (up to 100 Hz)	8, 16, 24 (60, 71, 75 Hz)
1600x1200	8, 16, 24 (up to 78 Hz)	8, 16, 24 (60Hz)

1.4. GXT120P Graphics Adapter - (GTFG047-0000)

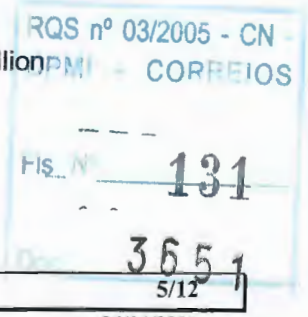
(Discontinued: 30/11/1999.)

Valid on Escala S Series only, The PCI GXT120P Graphics Adapter is the Entry Level Graphics Adapter for Escala Series S and meets the graphics needs of many commercial applications, and provides an entry point for workstation users. It is also a cost effective entry point for server environments that require a graphical user console.

The POWER GXT120P provides video acceleration features such as scaling and color space conversion. The GXT120P can support multisync monitors with at least a 64KHz horizontal scan capability or DDC-2B-compliant multisync monitors with at least a 38KHz horizontal scan capability.

General Hardware Features:

Bus	32-bit PCI
Memory	2MB EDO DRAM
Maximum Non-Interlaced Resolution	1280x1024
Maximum Colors	8 bits/pixel: 256 from a palette of 16.7 million
Refresh rate	60 to 85 Hz (ISO 9241 Part 3)
Monitor connector	15-pin



Other Hardware Features:

Color Map	1
Clipping	Rectangular and non rectangular
Other	Pattern Fill support

Resolution	Color depth and refresh rates (hardware)	Color depth and refresh rates (with AIX)
640x480	8 (60 to 85 Hz)	8 (60, 72, 75, 85 Hertz)
800x600	8 (60 to 85 Hz)	8 (56,60,70,75,76,85Hertz)
1024x768	8 (60 to 85 Hz)	8 (60,70,72,75,76,85Hertz)
1280x1024	8 (60 to 85 Hz)	8 (60, 75 Hertz)

1.5. GXT255P Graphics Adapter - (GTFG042-0000)

(Discontinued: 30/11/1999.)

The PCI GXT255P Graphics Adapter is a more powerful board for Escala Series S.

The GXT255P provides excellent 2D 8-bit, 16-bit, or 24-bit graphics performance for Escala Series S. It is designed for 2D applications including desktop publishing, X-window applications, 2D mechanical drafting, CASE, chemical and biological applications, and electrical CAD.

The GXT255P has 8-bit, 16-bit and 24-bit true color depth and allows simultaneous display of the entire palette of approximately 16.7 million colors.

These accelerators may also offer an exciting level of soft 3D performance. Its 8MB of VRAM (6MB frame buffer plus 2MB auxiliary buffer) provides outstanding support for high-end graphics applications.

General Hardware Features:

Bus	64-bit or 32-bit PCI
Memory	8MB VRAM
Maximum Non-Interlaced Resolution	1280x1024
Maximum Colors	Color depth 8 bits/pixel: 256 Color depth 16bits/pixel: 64K Color depth 24 bits/pixel: 16.7 million
Refresh rate	60 to 85 Hz (ISO 9241 Part 3)
Monitor connector	15-pin

Other Hardware Features:

Single Buffer	8,16 or 24-bit
Double Buffer	8-bit up to 1280x1024
Hardware acceleration	points, lines, triangles, rectangles, quadrilaterals, bit block transfert
Hardware Window	4 Window ID bits
Color Map	3
Clipping	Rectangular and non rectangular
Other	Pattern Fill support
	Dithering support

Resolution	Color depth and refresh rates (hardware)	Color depth and refresh rates (with AIX)
1024x768	8, 16, 24 (60 to 85 Hz)	8, 16, 24 (60,70,75,76,85 Hz)
1280x1024	8, 16, 24 (60 to 85 Hz)	8, 16, 24 (60, 75,77,85 Hz)

2. Graphics Monitors

2.1. 15-inch Color Monitor

The 15" Color Display is intended for graphics applications. It provides sharp, bright and realistic colors with minimum distortion. The anti-reflective CRT surface treatment eliminates screen reflections while optimizing image quality.

The 15" Display is a high resolution multisync graphics raster scan color Display.

Main characteristics are:

Picture tube	Type and size	15", Diagonal, Flat
	Dot Pitch:	0.28 mm
	Face treatment	Non Glare, Anti-Static
Input	Signal	R.G.B. Analog
	Connector	15Pin, D-Type
Synchronization Range	Horizontal	30KHz to 70KHz (Automatic)
	Vertical	50Hz to 150Hz (Automatic)
Video Bandwidth		85MHz (-3dB)
Display	Area (H x V)	260 x 195 mm
	Color	Unlimited colors, depends on graphics board
	Resolution	Up to 1280x1024 at 60 Mhz
Compatibility	VGA, S-VGA, XGA, VESA	
Power Source	100-240VAC (Universal Power) 1.8A 80W (Max.)	
Dimensions	365(W)x370(H)x384(D)mm	
Weight	12.9 Kg	
Environment	Operating	+5°C to +35°C, Humidity 35% to 80%
	Storage	-30°C to +60°C, Humidity 30% to 85%

The 15" Display meets the following electromagnetic emissions and safety standards:

Emissions:

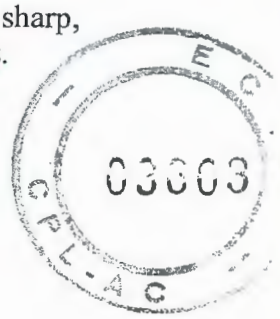
- Nordic MPR-II Basic
- FCC Part 15, Subpart J, Class B
- CE
- CSA C108.8, Class B
- CISPR 22, Class B EN (55022)
- EPA ENERGY STAR

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 220
- NEMKO, DEMKO, FIMKO, SEMKO
- IEC 380/950 Safety (TUV) EN (60950)
- ISO 9241 parts 3 recommendations for VDT ergonomics
- DHHS

2.2. 17-inch Color Monitor

The 17-inch Color Display is intended for high resolution graphics applications. It provides sharp, bright, realistic color for users of graphics applications that require high-resolution Displays.



The 17-inch display is a high resolution multisync graphics raster scan color display.

Main characteristics are:

Picture Tube	Type and size	17" flat square CRT
	Dot pitch	0.26 mm Trio dot pitch
	Face treatment	Antistatic, antiglare and silica coating
Input	Signal	Analog 0.7 Vp-p75ohm Positive
	Sync.	Separate Sync - TTL Level
		Horizontal Sync - Positive/Negative
		Composite Sync - TTL Level - Positive/Negative
		Composite Sync on Green - Sync 0.3 Vp-p Negative
	Connector	15 pin, D-type
Video Bandwidth		120 Mhz
Compatibility		VGA, S-VGA, VESA, XGA
Display	Color	Unlimited colors, depends on graphics board
Synchronization range	Horizontal	24 Khz to 82 Khz
	Vertical	50 hz to 120 hz
	Resolution	up to 1600x1200 at 60 Hz
Area	Horizontal	300mm (Active area a storng function of timing input
	Vertical	225mm (Active area a storng function of timing input
Misconvergence		less than 0.4mm
Power Source		100-240V 60/50hz
Rated current		2.0 - 1.0A
Dimensions		408(w)x425(h)x435(d) mm
Weight		21 Kgs
Environment	Operating	0°C to +35°C, Humidity 30% to 90% (0 to 10,000feet)
	Storage	-21°C to +60°C, Humidity 10% to 90% (0 to 45,000feet)

The 17" Display meets the following electromagnetic emissions and safety standards:

Emissions:
- FCC Class B
- CISPR Class B, CE

X-ray:
- DHHS, PTB

Safety:
- UL, CSA, CE
- MPR II, ISO-9241-3, DDC1/2B

The 17" Display is labeled CE. (EN50082-1, EN55022, EN60950)

2.3. 17-inch Multiscan Color Monitor

The 17-inch Multiscan Color Display is intended for high resolution graphics applications. It provides sharp, bright, realistic color for users of graphics applications that require high-resolution Displays.

The 17-inch Multiscan Color Display is a high resolution multiscan graphics raster scan color display.

Main characteristics are:

Picture Tube	17" inch CRT Super Fine Pitch* Trinitron*		
	90 degree deflection, 0.25 mm Trio Dot Pitch		
	Medium short persistence phosphor		
Input Signal	Video	Analog 0. Vp-p75ohm Positive	
	Sync	Separate Sync	TTL Level
		Horizontal Sync	Positive/Negative
		Composite Sync	TTL Level
			Positive/Negative
		Composite Sync on Green	Sync 0.3 Vp-p Negative
		Equalization/Serration Pulses	Acceptable
Display Colors	Analog input:	Unlimited colors, depends on graphics board	
Synchronization Range	Horizontal	30KHz to 85KHz	
	Vertical	48Hz to 150Hz	
Maximum Resolution	Horizontal	1280 dots	
	Vertical	1024 dots	
Video Bandwidth	on DSUB	75MHz	
	on BNC	135MHz	
Factory Size Preset	Horizontal 328mm (Active area a storng function of timing input)		
	Vertical 242mm (Active area a storng function of timing input)		
Rated Voltage	100-240V 60/50Hz		
Rated Current	1.7A (100-120V) - 1.2A (220-240V) - 140 watts (maximum)		
Dimensions	403.6(W)x426.3(H)x450(D)mm		
Weight	20Kg		
Environment	Operating	0°C to +35°C, Humidity 30% to 90%	
		0 to 10,000 feet	
	Storage	-21°C to +60°C, Humidity 10% to 90%	
		0 to 45,000 feet	

The 17" Multiscan Color Display meets the following electromagnetic emissions, X-ray, safety and ergonomic standards:

Emissions and X-ray:

- TCO 95, MPR-II, FC Class B, IC Class B, VCCI-2, CE mark (EN55022-B, EN60555-2, EN50082-1)
- DHHS, DNHW, PTB

Safety:

- UL1950, CSA C22.2 N° 950, CE mark (EN60950), SEMKO, NEMKO, DEMKO, EI

Ergonomics:

- TCO 95, TÜV/Rheinland Ergonomics, ISO-9241-3

2.4. 19-inch Multiscan Color Monitor

The 19" Multiscan Color Display is intended for high resolution graphics applications. It provides sharp, bright, realistic color for users of graphics applications that require high-resolution Displays.

The 19" Multiscan Color Display is a high resolution multisync graphics raster scan color display.

Main characteristics are:

Picture Tube	19" inch CRT Super Fine Pitch* Trinitron* (48cm)		
	System MALS (Multi Astigmatism Lens System)		
	System EFEAL (Extended Field Elliptical Aperture Lens)		
Input Signal	Video	Analog 0. Vp-p75ohm Positive	
	Sync	Separate Sync	TTL Level
		Horizontal Sync	Positive/Negative
		Composite Sync	TTL Level
			Positive/Negative
		Composite Sync on Green	Sync 0.3 Vp-p Negative
		Equalization/Serration Pulses	Acceptable
Display Colors	Analog input:	Unlimited colors, depends on graphics board	
Synchronization Range	Horizontal	30KHz to 94KHz	
	Vertical	48Hz to 160Hz	
Maximum Resolution	Horizontal	1600 dots	
	Vertical	1200 dots	
Video Bandwidth	on DSUB	75MHz	
	on BNC	135MHz	
Factory Size Preset	Horizontal 365mm (Active area a stomg function of timing input)		
	Vertical 274mm (Active area a stomg function of timing input)		
Rated Voltage	100-240V 60/50Hz		
Rated Current	1.7A (100-120V) - 1.2A (220-240V) - 130 watts (maximum)		
Dimensions	467(W) x 444(H) x 456(D) mm		
Weight	25Kg		
Environment	Operating	0°C to +35°C, Humidity 30% to 90%	
		0 to 10,000 feet	
	Storage	-21°C to +60°C, Humidity 10% to 90%	
		0 to 45,000 feet	

The 19" Multiscan Color Display meets the following electromagnetic emissions, X-ray, safety and ergonomics standards:

Emissions and X-ray:
- TCO 95, MPR-II, FC Class B, IC Class B, VCCI-2, CE mark (EN55022-B, EN60555-2, EN50082-1)
- DHHS, DNHW, PTB

Safety:
- UL1950, CSA C22.2 N° 950, CE mark (EN60950), SEMKO, NEMKO, DEMKO, FIMKO, NOM

Ergonomics:
- TCO 95, TÜV/Rheinland Ergonomics, ISO-9241-3

3. Keyboards

The keyboard features double-rate typematic default speed for the cursor keys. All keyboards are 102 keys, except the US model, which is 101 keys.

Keyboards available are:

- French
- US
- UK
- Italian
- German
- Spanish
- Danish
- Finnish/Swedish
- Norwegian
- Portuguese
- Belgian

ESCALA Attachment

The keyboard connects to the ESCALA keyboard port using a 2.75-m (9-ft) detachable cable with a 6-pin MINI-DIN connector.

4. Mouse

An optomechanical 3-Button Mouse (320 dpi) allows users to point to and select items on a display. The cover on the mouse snaps off for routine cleaning of the roller ball.

ESCALA Attachment

The mouse connects to the system unit mouse port using a 2.75-m (9ft) detachable cable with a 6-pin MINI-DIN connector. The mouse controller is built into the system unit.

Chapter 6: Disks and Media

This chapter describes the disks, associated controllers, and media (floppy disks, tapes, CD–ROMs,...) available on the ESCALA S, E and T Series.

1. Disk Drives

1.1. Disk Drives Comparison Table

	2.1 GB	4.2 GB	4.5 GB	9.1 GB	9.1 GB	9.1 GB	9.1 GB	18.2 GB	18.2 GB	18.2 GB
Form Factor	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½
Size	1"	1"	1"	1"	1"	1"	1"6	1"	1"	1"
Average Seek Time (ms)	8.5	7.1	7.5	5.2	7	6.9	8.2	5.2	7	6.9
Average Latency (ms)	4.17	4.17	4.17	2.99	4.17	4.17	4.17	2.99	4.17	4.17
Rotational Speed (RPM)	7200	7200	7200	10000	7200	7200	7200	10000	7200	7200
Data Rate: Media (MB/sec - max)	17.5	23	16	36	32	28	15.5	36	32	28
Interface	Ultra SCSI	Ultra SCSI	Fast Wide SCSI	Ultra 2 SCSI	Ultra SCSI	Ultra SCSI	Ultra SCSI	Ultra 2 SCSI	Ultra SCSI	Ultra SCSI
Data Transfer Rate (MB/s)	40	40	20	80	40	40	40	80	40	40
Type	SE	SE	SE	LVD/SE	SE	SE	SE	LVD/SE	SE	SE
Internal(I)/External(E)	I	I	I	I	I	I	I	I	I	I
Internal CRU	Y	Y	N	Y	N	Y	Y	Y	Y	Y
S - Basic Cabinet	-	-	Y	-	Y	-	-	-	Y	-
S - Expansion Cabinet	-	Y	-	-	-	Y	-	-	-	-
E&T - Basic Cabinet	EOC (1)	EOC (1)	-	E230, E250, T430, T450	-	Y(1)	EOC(1)	E230, E250, T430, T450	-	Y(1)
E&T - Expansion Cabinet	EOC (1)	EOC (1)	-	E230, E250, T430, T450	-	Y(1)	EOC(1)	E230, E250, T430, T450	-	Y(1)

(1) Available on the T430/T450 and E230/E250 through reconnection only, when upgrading from the T604e/T620 or E604e/E620 respectively.

1.1.1. 2.1 GB Ultra SCSI Disks (for Escala E&T Series)

(Discontinued)
Available on the T430/T450 and E230/E250 through reconnection only, when upgrading from the T604e/T620 or E604e/E620 respectively.

Internal (SE High Speed)
Internal CRU (SCA Connector)

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 8.5
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 17.5 (max)

1.2. 4.2 GB Ultra SCSI Disks (for Escala E&T Series)

(Discontinued on Escala T Series as of 30 October 1999)
Available on the T430/T450 and E230/E250 through reconnection only, when upgrading from the T604e/T620 or E604e/E620 respectively.

Internal (SE High Speed)
Internal CRU (SCA Connector)

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 7.1
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 23 (max)

1.3. 4.5 GB Fast Wide SCSI Disk (for Escala S Series)

Internal (SE High Speed)

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 7.5
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 16 (max)

1.4. 9.1 GB LVD/SE Disks (for Escala T430, T450, E230 and E250)

Internal (Ultra2 SCSI - LVD/SE)
Internal CRU(SCA Connector)

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 5.2
Average Latency (ms)	: 2.99
Rotational speed (RPM)	: 10,000
Data Rate Media (MB/s)	: 36 (max)

1.5. 9.1 GB Fast Wide SCSI Disks (for Escala S Series)

Internal (SE High Speed)

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 7
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 32 (max)

1.6. 9.1 GB Ultra SCSI Disks (for Escala E&T Series)

Available on the T430/T450 and E230/E250 through reconnection only, when upgrading from the T604e/T620 or E604e/E620 respectively.

Internal (SE High Speed)
Internal CRU (SCA Connector)

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 6.9
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 28 (max)

1.7. 9.1 GB Ultra SCSI Disks (for Escala E&T Series)

(Discontinued)
Available on the T430/T450 and E230/E250 through reconnection only, when upgrading from the T604e/T620 or E604e/E620 respectively.

Internal (SE High Speed)
Internal CRU (SCA Connector)

Form factor	: 3"1/2
Size	: 1"6
Average seek time (ms)	: 8.2
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 15.5 (max)

1.8. 18.2 GB LVD/SE Disks (for Escala T430, T450, E230 and E250)

Internal (Ultra2 SCSI - LVD/SE)
Internal CRU(SCA Connector)

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 5.2
Average Latency (ms)	: 2.99
Rotational speed (RPM)	: 10,000
Data Rate Media (MB/s)	: 36 (max)

1.9. 18.2 GB Ultra SCSI Disks (for Escala S Series)

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 7
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 32 (max)

1.10. 18.2 GB Ultra SCSI Disks (for Escala E&T Series)

Available on the T430/T450 and E230/E250 through reconnection only, when upgrading from the T604e/T620 or E604e/E620 respectively.
Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	: 3"1/2
Size	: 1"
Average seek time (ms)	: 6.9
Average Latency (ms)	: 4.17
Rotational speed (RPM)	: 7200
Data Rate Media (MB/s)	: 28 (max)

2. Disk Drive Adapters

2.1. PCI SCSI-3 LVD/Wide Adapter (MSCG041-0000)

The PCI SCSI-3 LVD/Wide Adapter is a single ported Ultra2 (40 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 80 megabytes per second. The PCI SCSI-3 LVD /Wide Adapter provides high performance attachment to both internal and external SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 LVD /Wide Adapter has one external VHDCI connector (68p) and one high-density internal connector (68p). The Adapter is capable of addressing up to 15 LVD/SE devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The adapter supports either 8-bit or 16-bit devices.

Characteristics:

- Ultra2 and wide (16-bit wide) SCSI PCI Adapter
- One external 68p VHDCI connector
- One internal 68p HD connector
- Controller conforms to SCSI-SPI2
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 80 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible (version 2.0 and 2.1)
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)
- Automatic switching to LVD or SE mode.

Operational requirements

- Supported on the Escala T430, T450, E230 and E250 only.
- One free PCI slot.
- AIX version 4.3.2, or later.

2.2. PCI SCSI-3 Ultra/Wide SE Adapter (MSCG022-0000)

The PCI SCSI-3 Ultra/Wide SE Adapter is a single ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 megabytes per second.
The PCI SCSI-3 Ultra/Wide SE Adapter provides high performance attachment to both internal and external Single Ended SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra/Wide SE Adapter has one external connector (68p) and two internal connectors (1 Narrow 50p and 1 Wide 68p). The Adapter is capable of addressing up to 15 Single Ended devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The adapter supports either 8-bit or 16-bit devices.

Characteristics:

- Ultra and wide (16-bit wide) SCSI PCI Adapter
- One external 68p connector
- Two internal (50p & 68p) connectors
- Controller conforms to ANSI Doc X3T9.2/86-109 rev 10h
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)

Operational requirements

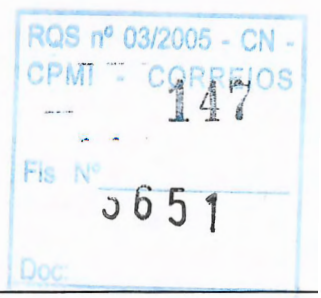
- Supported on the Escala E & T only.
- One free PCI slot.
- AIX v4.2.1, or later.

2.3. PCI SCSI-2 Fast/Wide SE Adapter - DPT (MSCG027-0000)

The PCI SCSI-2 Fast/Wide SE Adapter is a single ported fast (10 MHz) and wide (16-bit wide) SCSI SCSI Adapter that can provide synchronous SCSI bus data rates of up to 20 megabytes per second. The PCI SCSI-2 Fast/Wide SE Adapter provides high performance attachment to external Single Ended SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-2 Fast/Wide SE Adapter has one external Single Ended port. The external port is capable of addressing up to seven Single Ended devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The external port of this adapter supports either 8-bit or 16-bit devices via a 16-bit connector. The external Single Ended SCSI bus is capable of supporting cable lengths of 4 meters.

This Adapter is used with the Escala S expansion disks cabinet.



Characteristics:

- Local ROM interface
- Fast and wide SCSI Interface
- 32-bit intelligent bus master, DMA PCI bus interface
- Program local FLASH memory for updates to BIOS or SCRIPTS programs
- 32-bit word data burst with variable burst lengths
- ANSI X3.131-1994 (SCSI-2) specification support
- 20 Mbytes/sec on 16-bit, fast SCSI
- 10 Mbytes/sec on 16-bit normal SCSI or 8-bit fast SCSI
- Minimizes SCSI I/O start latency
- Performs complex bus sequences without interrupt
- 64 byte DMA FIFO on the PCI side
- Big/Little Endian support through pin selection
- Build option for either single-ended and differential SCSI
- 68 pin shielded SCSI connector

Operational requirements

- Supported on the Escala S only.
- One free PCI slot.
- AIX v4.2, or later.

2.4. PCI SCSI-3 Ultra/Wide RAID SE Adapter - DPT (CKTG068-0000 and CKTG075-0000)

The PCI SCSI-3 Ultra/Wide SE Adapter is a Dual ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 megabytes per second on each port.
The PCI SCSI-3 Ultra/Wide SE Adapter provides high performance attachment to internal Single Ended SCSI disks. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra/Wide SE Adapter has two internal Single Ended ports. One of these ports is also available on the external connector. Each port is capable of addressing up to 15 Single Ended devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The external port of this adapter supports 8-bit or 16-bit devices via a 16-bit connector.

The PCI SCSI-3 Ultra/Wide SE Adapter supports RAID functionality (RAID 0, RAID 1 and RAID 5 mode) and is designed with 16 MB cache upgradable to 64 MB.
The PCI-SCSI-3 Ultra/Wide SE Adapter provides SAF-TE and "Storage Works" capabilities (fault detection and management)

This Adapter is used with the internal disks.

Key features:

- Bus-mastering, with on-board processor for reduced SCSI and host CPU overhead
- Supports simultaneous operation of Wide and Narrow devices
- Scatter/Gather transfer support
- SCSI-1, SCSI-2, SCSI-3, Fast/Wide (W) or Fast-20/Wide (UW) SCSI support with active termination
- Overlapped I/O and tagged command queuing

Characteristics:

- Ultra and wide (16-bit wide) PCI SCSI RAID Adapter
- two ports (1 internal/external and 1 internal)
- Controller conforms to SCSI-SPI2
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible (version 2.0 and 2.1)
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)
- SAF-TE and "Storage Works" capabilities
- RAID functionality
- Hot spare disk and hot-plugging disks
- Array configuration graphic support
- No jumper - Automatic configuration by Software

Operational requirements

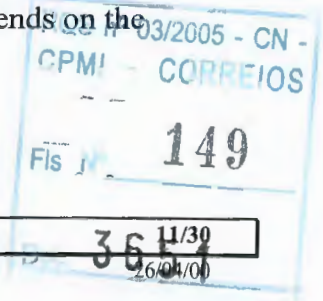
- Supported on the Escala E & T only.
- One free PCI slot.
- AIX® v4.2.1 or later.

Restriction: PCI SCSI-3 Ultra-Wide RAID Adapter - DPT can't be used for Native HA.

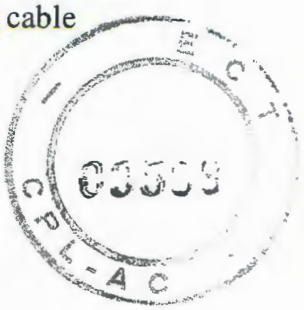
2.5. PCI SCSI-3 Ultra/Wide DE Adapter (MSCG023-0000)

The PCI SCSI-3 Ultra/Wide DE Adapter is a single ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 megabytes per second.

The PCI SCSI-3 Ultra/Wide DE Adapter provides high performance attachment to external Differential SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.



The PCI SCSI-3 Ultra/Wide DE Adapter has one external Differential port. The external port is capable of addressing up to fifteen Differential devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The external port of this adapter supports either 8-bit or 16-bit devices via a 16-bit connector. The external Differential SCSI bus is capable of supporting cable lengths of 25 meters (82 feet).



Characteristics:

- Ultra wide (16-bit wide) PCI Adapter
- One external Differential 16-bit bus
- Controller conforms to SCSI-SPI2
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible (version 2.0 and 2.1)
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)

Operational requirements

- One free PCI slot.
- AIX v4.2.1, or later.

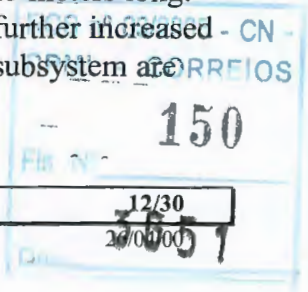
2.6. PCI SSA 4-port Multi-Initiator/RAID EL Adapter (MSCG039-0000)

(Note: The SSA offer has been discontinued as of 30 June 1999.)

The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA).
The SSA 4-Port Multi-Initiator/RAID EL Adapter enables attachment of SSA technology disks and subsystems.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are



automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA 4-Port Multi-Initiator/RAID EL Adapter allows connection of up to two hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Conform to SSA, Level 1
- 8-byte bus master
- Address and data parity support
- Streaming data transfer at 40MB/sec or 80MB/sec
- Two-way, high-availability configurations using HACMP Version 4.1 in modes 1, 2, and 3 on AIX 4.1.4
- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- Micro Channel Type 5 form factor card

An optional **4MB Fast-Write Cache** card is now available and improve write performance in RAID 5 or non-RAID (one-initiator configurations) operations.

The SSA Fast-Write Cache Option Card, FC is a 4 Mbytes fast-write optional feature that will plug into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years. During the unlikely event of an SSA Multi-Initiator/RAID EL Adapter failure, a new SSA Multi-Initiator/RAID EL Adapter can be installed and the SSA Fast-Write Cache Option Card can be removed from the failing adapter and installed in the new SSA Multi-Initiator/RAID EL Adapter insuring data integrity.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache.
The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes, machine type/model and application parameters.

The SSA Fast-Write Cache Option Card plugged into either SSA Multi Initiator/RAID EL Adapter will operate in either Non-RAID or RAID 5 mode, in a one-initiator configuration.

Operational requirements

- Supported on the Escala E & T only.
- One free PCI slot.
- Available on the T430 and E230 through reconnection only, when upgrading from the T604e/T620 or E604e/E620 respectively.

2.7. PCI Fibre Channel Adapter (DCCG141-0000)

Discontinued: 30/11/1999.

The Fibre Channel PCI Host Bus Adapter utilizes a state of the art dual ported on-board memory architecture to provide high-performance I/O solutions for applications like client/server, database I/O, multimedia, imaging and clustering which require sustained high throughput coupled with low latency characteristics.

Architecture

The Fibre Channel PCI Host Adapter is designed using custom ASIC technology from Emulex. This integrated design, including both chip level technology and Emulex developed firmware, reduces host requirements, while simplifying the driver interface.

- Emulex developed ASIC technology up to 33 MHz PCI bus master DMA
- 512 Kbytes FLASH memory
- 512 Kbytes - 512 Kbytes context RAM
- 512 Kbytes - 512 Kbytes buffer RAM

Host Support

The PCI Fibre Channel Host Adapter provides simultaneous and concurrent multiple protocols (IP and SCSI) support..

Specifications

- Supports Fibre Channel rate of 1 Gbits/sec
- Support point-to-point and arbitrated loop Fibre Channel topologies
- Supports both network and storage protocols simultaneously (IP and FCP)
- Direct interface to copper cables through standard 80-pin GLM
- Built-in protocol engine with an integrated RISC processor

Benefits

- Industry's best I/O performance
- Single interface for network and storage applications
- Eliminate distributed application bottlenecks

Standards

- ANSI Fibre Channel FC-PH Revision 4.3
- ANSI Fibre Channel FC-AL Revision 4.5
- FCSI 301 Rev 1.0 Gigabaud Link Module
- PCI Local Bus Revision 2.0/2.1
- Fibre Channel Class 3

Hardware Interface

80-pin GLM (Gigabit Link Modules) connector for both fiber optic and copper interface

Copper GLMs

Data Rate	1062.5 Mbits/s
Cable Type	Dual Twinax or Quad Axial
Connector Type	DB9
Distance	30 meters

Distance Supported

Up to 30m with copper cables
Up to 175m with 62.5/125µm multimode fiber
Up to 500m with 50/125µm multimode fiber
Up to 10km with optical link extenders

MIAs, HUBs and Link Extenders

- Hubs to provide up to nine copper ports (DB9 Female) with re-generated signals. The Hubs can be chained. (External Hub or "Rack-mounted" Hub are available)
- MIAs to convert copper (DB9 Male) to multimode fiber (DSC) and to provide distant connections. The MIA is directly connected to the copper interface (DBB9 Female) of the equipment.
- Link Extenders to offer a distant connection up to 10km from a copper interface (DB9) to a monomode fiber (9/125µm - optical ST)

Agency Approvals

- Class 1 Laser Product per DHHS 21 CFR (J) and EN60825
- UL Recognized to UL1950
- CUR Recognized to CSA22.2, No. 950
- TUV Certified to EN60950
- FCC Rules, Part 15, Class A
- DOC Rules, Class A
- EMC Directive 89/336/EEC (CE Mark)
  - EN55022, DISPR22/85, Class A
  - EN50082-1

Operating System requirement

- AIX® 4.3 or later.

Machine requirements

ESCALA	S xxxx	E xxxx	T xxxx
Max Supported	no	4	4

2.8. PCI 64 bits Fibre Channel Adapters (DCCG147-0000, DCCG148-0000)

The PCI 64 bits Fibre Channel Host Bus Adapters deliver exceptional performance through the use of Emulex's new Dragonfly ASIC, a 266 MIPs on-board processor, and state of the art dual ported buffer memory. These adapters include sophisticated capabilities such as full-duplex data transfers, full fabric support, parity protection and large data buffers.

The LP8000 delivers point-to-point, arbitrated loop and switch fabric connections as well as both Class 2 and 3 frame formats. Support for both copper and fiber optic cabling is provided through embedded interfaces.

Host Support

The PCI Fibre Channel Host Adapter provides simultaneous and concurrent multiple protocols (IP and SCSI) support.

ecifications

- Simultaneous full duplex fibre channel 1.0625 Gb/s transfers
- 64-bit PCI data and addressing
- On-board high speed 266 MIPs RISC processor
- Large on-board buffers
- Application Programming Interface (API)
- All fibre channel topologies: point-to-point, arbitrated loop and switch topologies
- Full fabric support using F Port and FL Port connections (FL port in a future product release)
- Full support for both FC service Class 2 and 3
- Supports both network and storage protocols simultaneously (IP and FCP)
- 2 physical interfaces : embedded copper or embedded optical fiber.

Architecture

- mulex developed ASIC technology up to 33 MHz PCI bus master DMA
- 512 KBytes FLASH memory
- 1 MByte code RAM
- 256 KBytes buffer RAM.

Benefits

- Industry's best I/O performance
- Single interface for network and storage applications
- Designed to support mission critical enterprise SAN applications.

Standards

- ANSI Fibre Channel FC-PH
- ANSI Fibre Channel FC-AL
- ANSI Fibre Channel FC-PLDA
- ANSI Fibre Channel FC-FLA
- PCI Local Bus Revision 2.2
- Fibre Channel Class 2, 3

Copper

Data Rate:	1.0625 Gb/s
Cable Type:	Dual Twinax
Connector Type:	DB9
Distance:	98' (30 meters)

Optical

Data Rates:	1.0625 Gb/s
Optics:	short wave laser 50/125 µm multimode fiber
Connector Type:	dual SC

Physical Dimensions

Short PCI form factor 6.88 inch X 4.20 inch.

Power Requirements

Volts:	+5 VDC
Power:	10 watts

Environmental Conditions

Operating Temperature:	32° to 113° F (0° to 45° C)
Storage Temperature:	14° to 131° F(-10° to 55° C)
Relative Humidity:	5% to 95% non-condensing

Agency Approvals

- Class 1 Laser Product per DHHS 21CFR (J) and EN60825
- UL Recognized to UL 1950
- CUR Recognized to CSA22.2, No. 950
- TUV Certified to EN60950
- FCC Rules, Part 15, Class B*
- ICES-003, Class B*
- EMC Directive 89/336/EEC (CE Mark)
  - EN55022, Class B*
  - EN50082-1
- Australian EMC Framework (C-Tick Mark)
  - AS/NZS 3548, Class B*
- VCCI, Class B*

*Note: Embedded copper Fibre Channel adapter is Class A.

Operating System requirement

AIX 4.3.2 or later.

Machines/number of adapters

Escala	Sxxx	Exxx	Txxx
Nb adapters	No	4	4

3. Basic Disk/Media Cabinet

The Internal Disks & Media are housed in the Basic Disk/Media Cabinet.

3.1. Basic Disk/Media Cabinet Features (for Escala E & T Series)

The Basic Disk/Media Cabinet is made of 5 Areas for plugging Disks or Media.

- The first Area is dedicated for the CD-ROM emplacement and can house additional media.
- The second Area can house either Media or a Disks Cage.
- The three other Areas can house a Disks Cage.

A Disks Cage can house either 3 Disks (1" high) or 2 Disks (1.6" high)
Two Media can be plugged in the second Area.

he Basic Disk/Media Cabinet integrates 2 SCSI busses:

- Bus N°2: One SCSI-2 Fast Wide or SCSI-2 Ultra Wide (E230, E250, T430 and T450) for the Media
  (Area N°1 & N°2)
- Bus N°0: One Ultra SCSI or Ultra2 SCSI (E230, E250, T430 and T450) for the Disks (Area N°4 & N°5)

The System Disk is always in the Area N°5 (Bus N°0). The RAID access is available on the System Disk.
The Disks plugged in the Area N°3 and N°2 use an additional PCI Adapter which is either a "Symbios SE" adapter for Ultra SCSI Disks on standard access, or a "DPT" adapter for Ultra SCSI Disks on RAID access.

The Standard Configuration is an Ultra SCSI on the Area N°4 and N°5 (Bus N°0) with the following options:

- Bus N°0 and Bus N°1 on RAID Access with the "DPT" adapter (the 2 "DPT" adapter channels used)
- Bus N°0 on standard access with the internal Ultra SCSI and Bus N°1 on RAID access with the "DPT" adapter (only 1 "DPT" adapter channel used)
- Bus N°0 on RAID access (System disk) and Bus N°1 on standard access with Ultra SCSI (the 2 "DPT" adapter channels are used).

In the case of using one Bus on RAID access, the 2 "DPT" adapter channels will be used to get better performances.
In the case of using one Bus on standard Ultra SCSI, the "mirroring" functionality will use an additional "Symbios SE" adapter.

3.2. Basic Disk/Media Cabinet Disk Capacity

The Basic Disk/Media Cabinet maximum disk capacity is reached with 4 Areas dedicated for Disks Cages (Area N°1 is dedicated for Media).

The maximum Disks Cage capacity is 54.6GB (3x18.2GB)
The maximum Disk/Media Cabinet disk capacity is 218.4GB (4x54.6GB)

3.3. Expansion Disk/Media Cabinet Features

The Expansion Disk/Media Cabinet is made of 5 Areas for plugging Disks or Media.

- The first Area is dedicated for Media emplacements.
- The four other Areas can house a Disks Cage.

Disks Cage can house either 3 Disks (1" high) or 2 Disks (1.6" high)

The Disks housed in the cages are Hot swappable.

An optional Redundant Power Supply is available on the Expansion Disk/Media Cabinet.

3.4. Expansion Disk/Media Cabinet Disk Capacity

The Expansion Disk/Media Cabinet maximum disk capacity is reached with 4 Areas dedicated for Disks Cages (Area N°1 is dedicated for Media).

The maximum Disks Cage capacity is 54.6GB (3x18.2GB)
The maximum Disk/Media Cabinet disk capacity is 218.4GB (4x54.6GB)

3.5. Basic Disk/Media Cabinet Features (for Escala S Series)

The 8 Disk/Media bays Cabinet is an external Cabinet connected through a SCSI-2 Fast/Wide SE DPT Adapter to the Escala S Series. This Cabinet allows for the use of up to seven 3"5 Disks, or up to seven 3"5 Disks and one Media, or up to six 3"5 Disks and two Media.

It includes a double fan and a self-ventilated power supply.
It handles one SCSI channel.

The maximum disk capacity is 63.7 GB (7*9.1 GB).
2 Disk/Media cabinet are allowed and supported per Escala S Series.

Software requirement

AIX® 4.2. and later

4. Media

4.1. Media Usage Summary Table

S: Standard **O:** Internal Option **E:** External Option

	Current Offer	Save/ Restore	Media Interchange
3"1/2 Floppy	1.44MB	Y	Y
1/4" QIC Tape	2.5/5 GB	Y	Y
1/4" QIC Tape	16/32 GB	Y	Y
1/4" QIC Tape	25/50 GB	Y	Y
8mm VDAT Tape	7/14 GB	Y	Y
8mm VDAT Tape	20/40 GB	Y	Y
4mm DAT Tape	4/16 GB	Y	Y
4mm DAT Tape	12/24 GB	Y	Y
DLT 4000 Tape	20/40 GB	Y	Y
DLT 7000 Tape	35/70 GB	Y	Y
1/2" STK Tape	STK	Y	Y
CD-ROM	600 MB 12 speed	N	N
CD-ROM	600 MB 14-32 speed	N	N

4.2. Diskette Drives

4.2.1. 3.5-Inch 1.44MB Diskette Drive

A 1.44 MB 3-1/2 inch diskette drive is standard on all ESCALA system units.
It supports also the 720 KB format.

Attachment
The drive attaches to the system using an internal cable to the diskette controller in the system unit.

4.3. Tape Drives

4.3.1. QIC 2.5/5 GB 1/4-Inch Cartridge Tape Drive (MTUG021)

(Discontinued.)
Available on the T430 through reconnection only, when upgrading from T604e/T620.

The QIC 2.5/5 GB 1/4-Inch Tape Drive is available on ESCALA S Series only.

The 1/4-inch Cartridge Tape Drive operates in a streaming mode and provides data interchange and save/restore capabilities.

The drive supports the following standards:

. QIC-24 (read only, without ECC)
. QIC-120 (read and write, without ECC)
. QIC-150 (read and write, without ECC)
. QIC-525 (read and write, with ECC)*
. QIC-1000 (read and write, with ECC) *
. QIC-2GB (read and write, with ECC) *

* : 18 MB per minute sustained data rate

Need of a special cleaning cartridge - Bull Express Reference: 6249 - for 50 cleaning ('Wet process')

1.3.2. QIC 16/32 GB MLR1 1/4-Inch Cartridge Tape Drive (MTUG032)

(Discontinued: 30 October 1999)

The QIC 16/32 GB MLR1 (Multi Channel Linear Recording 1) 1/4 inch Cartridge Tape Drive operates in a streaming mode and provides data interchange and save/restore capabilities with preformatted data cartridges.
The cartridge loading in QIC 16/32 GB MLR1 Tape Drive is motorized.

The drive supports the following standards:

Format	Maximum Capacity	Operation	Bull Express Reference	Imation Reference
QIC 5010	16/32 GB	R/W - ECC	43473	16.0 GB
QIC 5010	13/26 GB	R/W - ECC	47023	13.0 GB
QIC-2 GB	2.5/5 GB	R/W - ECC	3236	MAGNUS 2.5
QIC 1000	1.2 GB	R/W - ECC	3217	MAGNUS 1.2
QIC 525	525 MB	R/W - ECC	3215	DC 6525
QIC 150	150 MB	R/W	3209	DC 6150

The QIC 24 format is no more available

* SCSI Bus transfer rate: 18 MB/s
User average Data Transfer rate, streaming mode: 1.5 MB/s native and 3 MB/s compressed (assuming an average Data Compression ratio of 2:1).
Warning: Capacity and Transfer rate using the HW Data Compression embedded into the drive depends on the pattern of the transferred data.
Need of a special "Dry Process" cleaning cartridge - Bull Express Reference: 05678 - for 50 cleaning

4.3.3. QIC 25/50 GB MLR3 1/4-Inch Cartridge Tape Drive (MTUG036)

The QIC 25/50 GB 1/4-Inch Tape Drive is available on **ESCALA E, T and S120 Series.**

The QIC 25/50 GB MLR3 (Multi Channel Linear Recording 3) 1/4 inch Cartridge Tape Drive operates in a streaming mode and provides data interchange and save/restore capabilities with preformatted data cartridges.
The cartridge loading in QIC 25/50 GB MLR3 Tape Drive is motorized.

The drive supports the following standards

Format	Maximum Capacity	Operation	Bull Express Reference	Imation Reference
MLR3-25GB	25/50 GB	R/W ECC	43498	MLR3 25 GB
QIC 5010	16/32 GB	R/W - ECC	43473	16.0 GB
QIC-4 GB	4/8 GB	R only - ECC	43474	MAGNUS 4.0
QIC-2 GB	2.5/5 GB	R only - ECC	3236	MAGNUS 2.5
QIC 1000	1.2 GB	Not Supported		
QIC 525	525 MB	Not Supported		
QIC 150	150 MB	Not Supported		
QIC 24	60 MB	Not Supported		

User average Data Transfer rate, streaming mode with MLR3 25 GB cartridges: 2.0 MB/s native and 4 MB/s compressed (assuming an average Data Compression ratio of 2:1).
Warning: Capacity and Transfer rate using the HW Data Compression embedded into the drive depends on the pattern of the transferred data.
Need of a special "Dry Process" cleaning cartridge - Bull Express Reference: 05678 - for 50 cleaning.

4.3.4. 7/14 GB 8 mm Tape Drive (or VDAT 7/14 GB) "Eliant" (MTUG029)

The 7 GB 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 1 MB per second.

The 7 GB 8 mm tape drive features data compression hardware using an adaptation of IBM's IDRC algorithm which provides an effective capacity of up to 14 GB of data per cartridge, and an increased effective data rate of 2 MB per second, assuming an average data compression 2:1, depending on the type of data transferred.

Caution :	The 8200 format is "**Read only**". When using this format the cartridge **MUST** be write protected.

4.3.5. External 20/40 GB 16-bit 8 mm Tape Drive (or VDAT 20/40 GB - MTSG015)

The External 20 GB 16-bit 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 3 MB per second.

The External 20 GB 16-bit 8mm Tape Drive features a Liquid Crystal Display (LCD) to provide operating and error messages.

The External 20 GB 16-bit 8 mm tape drive features Data Compression hardware using an adaptation of IBM's IDRC algorithm which provides an effective capacity of up to 40 GB of data per cartridge, and an increased effective data rate of 6 MB per second assuming an average Data Compression 2:1, depending on the type of data transferred.

The External 20 GB 16-bit 8mm tape drive reads the 8mm tape cartridges in capacities of 2.3GB, 5GB, 7GB and 20GB in native mode or 10GB, 14GB and 40GB in compressed mode.
The External 20GB 16-bit 8mm tape drive writes the 8mm tape cartridges in capacities of 20GB in native mode and 40GB in compressed mode when using Advanced Metal Evaporated (AME) media.

Characteristics:

- Capacity: 20GB native mode, 40GB (typical) compression mode
- Form Factor: 5.25-inch half-high
- Media: 8mm Advanced Metal Evaporated media on Write/Read 20GB format, 8mm Metal Particle (MP) media on Read 2.3GB, 5GB, 7GB format
- Technology: Helical scan, rotating head, Liquid Crystal Display (LCD) for messages
- Operation: Streaming
- Data Transfer Rate: 3MB/s native mode, 6MB/s (typical) compression mode
- Interface: SCSI-2 (single-ended) asynchronous/synchronous
- Physical Specifications: 250mm (Width), 275mm (Depth), 55mm (Height), 5Kg (Weight)

EMC Conformance Classification:

- USA: FCC Class B
- Japan: VCCI-2
- Europe: CISPR 22 Class B

Product Safety/Country Testing/Certification:

- USA: UL
- Canada: CNL (CSA or cUL)
- Germany/Europe: CE Mark (Safety, TUV, EN60 950)

Warning:	The 8mm Metal Particle media (2.3GB, 5GB and 7GB) is "Read only".

Limitations:

If this tape drive is used for reading Metal Particle media (2.3GB, 5GB or 7GB), the drive must be cleaned with a cleaning cartridge prior to using an Advanced Metal Evaporated media (20GB).
Cleaning Tape: Ref 315250 (Bull Express) for 18 cleanings.

4.3.6. 4/16 GB 4 mm DAT Tape Drive (MTUG022)

The 4mm Tape Drive is available on **ESCALA S Series only**.

This Tape Drive features IPL capability and up to 16GB of storage capacity with compression in a 3.5" full high enclosure that attaches via the SCSI interface.

The main characteristics of the 4mm Tape Drive are:

- Non-data grade media rejection (will not write on audio grade media)
- DDS1 and DDS2-data compression format
- SCSI2 command support with SCSI-2 SE interface
- Synchronous and asynchronous SCSI data transfers, Streaming operation
- 30 second average file search speed
- 4GB capacity per cartridge, 16GB with data compression (typical)
- Data transfer rate: 510kB/s native, 1020kB/s compressed
- 5MB/s SCSI transfer rate.

4.3.7. 12/24 GB DAT 4 mm Tape Drive (MTUG028)

The 4mm Tape Drive features IPL capability and up to 24GB of storage capacity with compression in a 3.5" full high enclosure that attaches via the SCSI interface.

The main characteristics of the 4mm Tape Drive are:

- Non-data grade media rejection (will not write on audio grade media)
- DDS, DDS2 and DDS3-data compression format
- SCSI2 command support with SCSI-2 SE interface
- Synchronous and asynchronous SCSI data transfers, Streaming operation
- Average file search speed:
  - 40 second (125m tape)
- 12GB capacity per cartridge, 24GB with data compression (typical)
- Data transfer rate:
  - Max. Sustained Native: 1 MB/s
- Data Buffer 2 MB
- Rewind Speed 1m/s.

	Cartridge Types			
	DDS-1 (60m)	DDS-1 (90m)	DDS-2 (120m)	DDS-3 (125m)
Characteristics	Read and write in DDS-1	Read and write in DDS-1	Read and write in DDS-2	Read and write in DDS-3
Data capacity *	1.3GB/2.6GB	2GB/4GB	4GB/8GB	12GB/24GB
Bull Express Reference cartridge	3226	3227	3228	3230

* in Not Compressed/Compressed mode

4.3.8. DLT 4000 Tape Drive (MTSG014)

The DLT 4000 Tape Drive is a high-performance, high capacity, streaming 1/2" cartridge tape product designed for use on midrange and high-end systems.

The main characteristics of the DLT 4000 Tape Drive are:

- External Table Top - 5"1/4 form factor - 1/2" tape drive
- 20GB capacity per cartridge, 40GB typical with 2:1 data compression ratio
- Differential interface (up to 25m connection)
- Tape cartridge available
  - CompacTape IV (up to 20GB native formatted data)
  - CompacTape III (2.6, 6.0 and 10GB native formatted data depending on selecting)
- SCSI-2 differential interface - wide connection
- Data transfer rate : 1.5MBytes/second native, 3.0MB/s in compression mode (with 2:1 ratio)
- Dual channel read/write
- Maximum block size of 16MBytes
- Read/write data cache of 2MBytes
- Tape mark directory to maximize throughput and to minimize data access tie
- Timing characteristics :
  - Tape speed : 110 inches/sec on read/write - 150 inches/sec on search
  - Average rewind time : 45 sec
  - Average access time : 45 sec
  - Load to BOT : 48 sec for tape already used
  - Unload from BOT : 17 sec

Warning:	The CompacTape III (2.6GB, 6GB and 10GB) can be only "on read". The CompacTape IV (20GB) can be only "on read" or "on write". The CompacTape (40GB) cannot be "on read ".

4.3.9. DLT 7000 Tape Drive (MTSG017)

The DLT 7000 Tape Drive is a high-performance, high capacity, streaming 1/2" cartridge tape product designed for use on midrange and high-end systems.

The main characteristics of the DLT 7000 Tape Drive are:

- External Table Top - 5"1/4 form factor - 1/2" tape drive
- 35GB capacity per cartridge, 70GB typical with 2:1 data compression ratio
- Differential interface (up to 25m connection)
- Tape cartridge available
  - CompacTape IV (20GB and 35GB native formatted data)
  - CompacTape III (2.6, 6.0 and 10GB native formatted data depending on selecting)
- SCSI-2 differential interface - wide connection
- Data transfer rate: 5.0MBytes/second native, 10MB/s in compression mode (with 2:1 ratio)
- Quad channel read/write
- Maximum block size of 16MBytes
- Read/write data cache of 8MBytes
- Tape mark directory to maximize throughput and to minimize data access tie
- Timing characteristics:
  - Tape speed: 160 inches/sec on read/write - 175 inches/sec on search and on rewind
  - Average rewind time: 60 sec
  - Average access time: 60 sec
  - Load to BOT : 37 sec for tape already used
  - Unload from BOT : 17 sec

Warning:	The CompacTape III (2.6GB, 6GB and 10GB) and the CompacTape IV (20GB) can be only "on read". The CompacTape IV (40GB) can be "on read" or "on write".

4.3.10. STK9914 1/2" 9 TrackTape Drive (MTSG009)

(Discontinued.)

The STK9914 is an autoloading, autothreading, reel to reel tape device. Its main features are:

- ANSI Standard 9-track tape interchange,
- selectable tape density: 6250bpi (GCR mode), 1600bpi and 3200bpi (PE mode) and 800bpi (NRZ mode),
- transfer rate: 781kB/s,
- tape speed: 42/125ips,
- reel size: 6 to 10.5" (IBM Hub)
- tape length: up to 3600'
- MTBF (specified): 25000H.

Attachment

- Max. one tape drive per system
- Connection to a SCSI1 controller
- Connection to a SCSI2 controller

4.4. CD/ROM Drives

4.4.1. 12 Speed Tray-Loading CD-ROM Drive (for Escala E & T Series)

(Discontinued.)

The Twelve Speed Tray-Loading CD-ROM is a 600MB SCSI-2 CD-ROM drive that provides 12x speed performance with the convenience of loading a CD without a caddy.

Main Characteristics are:

- Form factor: 5"¼ in Half High
- Height: 42 mm
- External Interface: SCSI-2 8-bit Single Ended
- Interface Speed: 10 Mb/sec max.
- Access Time: 125 ms average
- Data Rate: 1800 Kb/sec average

Operational requirements

- AIX® v4.2, or later.

4.4.2. 14-32 Speed Tray-Loading CD-ROM Drive (for Escala E & T Series)

The 14-32 Speed Tray-Loading CD-ROM is a 600MB SCSI-2 CD-ROM drive that provides from 14 up to 32x speed performance with the convenience of loading a CD without a caddy.

The speed is on Constant Angular Velocity. The speed is depending on the location of the "read head".

Main Characteristics are:

- Form factor: 5"¼ in Half High
- Height: 42 mm
- External Interface: SCSI-2 8-bit Single Ended
- Interface Speed: 10 Mb/sec max.
- Access Time: 90 ms average
- Data Rate: from 2300 Kb/sec to 5400 Kb/s average

4.4.3. Twenty Speed Tray-Loading CD-ROM Drive (for Escala S Series)

The 20X (Max) SCSI-2 Internal CD-ROM Drive is a tray loading CD-ROM drive providing up to 3000KB/sec maximum media data transfer rate. It is a 5.25 inch half-high form factor, single ended, 8 bit, multi-session capable, CD-ROM drive which provides state of the art performance and supports existing 600MB CD-ROM discs.

Main Characteristics are:

- Form factor: 5"¼ in Half High
- Height: 42 mm
- External Interface: SCSI-2 8-bit Single Ended
- Avg. Random Access Time: 95ms (typical)
- Access Time: 125 ms average
- Data Rate: 3000 KB/sec (Max)

Operational requirements

- AIX® v4.2, or later.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Chapter 7: Memory Expansion Cards

1. ESCALA S Series

1.1. Escala S100 Model

The ESCALA S Series system memory is organized in memory banks, and the motherboard contains six 168-pin standard DIMM (Dual In-line Memory Modules) slots.

The "ECC" DIMMs module corrects single-bit errors that may occur in any byte of DIMM data. It is recommended for systems that run critical applications but do not have native ECC. This family of DIMMs provides the memory reliability required by these applications with no performance penalty.

The maximum memory bank is 128 MB.
The maximum memory configuration is 768 MB.

A memory bank can be made up of DIMMs having capacity of 32/64/128 MB.

The ESCALA S100 supports the following memory DIMMs:

- DIMM Standard 72 bit 168 pin with EDAC
- VCC 3.3V
- Time of Access 60 ns
- Functionality Extended Data Output (EDO)
- Height 1.250 Mil. max
- Package Type TSOP
- Application ECC

Specifically:

- The 32MB memory bank is memory with EDO Mode and 4M x 72 DRAM DIMM with ECC using 4Mx4, 2K/4K Refresh.
- The 64MB memory bank is memory with EDO Mode and 8M x 72 DRAM DIMM with ECC using 8Mx4, 4K/8K Refresh.
- The 128MB memory bank is memory with EDO Mode and 16M x 72 DRAM with ECC using 16Mx4, 4K/8K Refresh.

1.2. Escala S120 Model

The ESCALA S120 supports 64 MB, 128 MB or 256 MB memory modules (ECC, SDRAM, 10ns) in a Dual In-line Memory Module (DIMM) package.

Memory must comply with the following specifications:

- Type: registered SDRAM (Synchronous DRAM)
- Time of Access 10 ns
- Functionality Extended Data Output (EDO)
- DIMM Standard 168 pin
- VCC 3.3V
- Height 1.250 Mil. max
- Application ECC

2. AUTONUMLGLESCALA E Series

2.1. ESCALA E604e/E620

The ESCALA E604e/E620 system memory is organized in memory banks made up of two memory DIMMs.

The two memory connectors on the planar board can house:

- Either one memory bank
- Or two memory risers hosting up to eight memory banks.

Each memory riser hosts eight memory DIMM connectors.

A memory bank hosted on memory risers is made up of 1 DIMM for each memory riser (total of 2 memory DIMMs).

The maximum memory bank is 256 MB.
The maximum memory configuration is 2 GB.

The ESCALA E Series supports the following memory DIMMs:

- DIMM Standard 72 bit 168 pin with EDAC (16Mbits and 64Mbits technology)
- VCC 3.3V
- Time of Access 60 ns
- Functionality Extended Data Output (EDO)
- Height 1.25 inch max
- Package Type TSOPII
- Application ECC
- Memory Data Bus peak throughput : 2.8 GB/s

A memory bank can be made up of DIMMs having capacity of 32/64/128 MB.

Table of the memory bank characteristics

Technology	DIMM Size (Mbits)	Refresh	DIMM Size	Memory Bank Capacity
16 Mbits	4Mx72	4K	32 MB	64 MB
64 Mbits	8Mx72	4K	64 MB	128 MB
64 Mbits	16Mx72	8K	128 MB	256 MB

2.2. ESCALA E230 and E250

The ESCALA E230 and E250 system memory is organized in memory banks made up of four memory DIMMs. Memory banks are hosted on four memory risers connected to the planar board.

Two memory risers are available:

- a memory riser with 1 memory DIMM connector
- a memory riser with 8 memory DIMM connectors.

A memory bank hosted on memory risers is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs)

The maximum memory bank is 512 GB.
The maximum memory configuration is 4 GB.

The ESCALA E230 and E250 support the following memory DIMMs:

- SDRAM DIMM, 72 bit, 168 pin
- VCC 3.3V
- Access Time 10 ns (100MHz, CAS latency 2 mode)
- Height 1.65 inch
- Application ECC
- LVTTL electrical interface
- Memory Data Bus peak throughput: 5.6 GB/s
- PC100 Intel specifications compliant.

A memory bank can be made up of DIMMs having capacity of 64 or 128 MB.

Table of the memory bank capacity

Technology	DIMM Size	Memory Bank Capacity
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB

3. ESCALA T Series

3.1. ESCALA T604e/T620

The ESCALA T604e/T620 system memory is organized in memory banks made up of four memory DIMMs.

The four memory connectors on the planar board can house:

- Either one memory bank
- Or four memory risers hosting up to six memory banks.

Each memory riser hosts six memory DIMM connectors.

A memory bank hosted on memory risers is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs)

The maximum memory bank is 512 MB.
The maximum memory configuration is 3 GB.

The ESCALA T604e/T620 supports the following memory DIMMs:

- DIMM Standard 72 bit 168 pin with EDAC
- VCC 3.3V
- Time of Access 60 ns
- Functionality Extended Data Output (EDO)
- Height 1.25 inch max
- Package Type TSOPII
- Application ECC
- Memory Data Bus peak throughput: 2.8 GB/s

A memory bank can be made up of DIMMs having capacity of 32/64/128 MB.

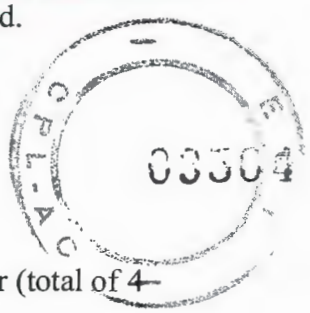
Table of the memory bank capacity

Technology	DIMM Size	Memory Bank Capacity
16 Mbits	32 MB	128 MB
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB

EMBED

3.2. ESCALA T430 and T450

The ESCALA T430 and T450 system memory is organized in memory banks made up of four memory DIMMs. Memory banks are hosted on four memory risers connected to the planar board.



Two memory risers are available:

- a memory riser with 1 memory DIMM connector
- a memory riser with 8 memory DIMM connectors.

A memory bank hosted on memory risers is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs)

The maximum memory bank is 1 GB.
The maximum memory configuration is 8 GB.

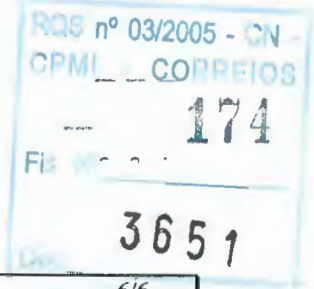
The ESCALA T430 and T450 support the following memory DIMMs:

- SDRAM DIMM, 72 bit, 168 pin
- VCC 3.3V
- Access Time 10 ns (100MHz, CAS latency 2 mode)
- Height 1.65 inch
- Application ECC
- LVTTL electrical interface
- Memory Data Bus peak throughput: 5.6 GB/s
- PC100 Intel specifications compliant.

A memory bank can be made up of DIMMs having capacity of 64/128/256 MB.

Table of the memory bank capacity

Technology	DIMM Size	Memory Bank Capacity
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB
128 Mbits	256 MB	1 GB



Chapter 8: Communications Controllers

1. Modems

1.1. ISA Modem Adapter

The ISA modem adapter provides support for a modem line to an ESCALA S100, E, or T. It is used for RSF (Remote Services Facilities) usage to allow communications with a Customer Service Center for maintenance purpose: it allows asynchronous communications in a reliable way via a connection to the PSTN (Public Switched Telephone Network).

This adapter features:

- automatic adaptation to the line conditions and capacities of the remote modem
- support for data transmission rate up to 33.6 kbps
- full or half duplex mode on the switched telephone network
- automatic or manual dialing
- automatic or manual answer

Hardware:

- 1 RJ11 connector
- ISA bus
- Form factor: short length card

Cables:

The base board provides a RJ11 connector and a RJ11 cable is delivered with it according to the country.
For the United States, there is a specific and additional connector to connect directly the Phone on the board.

Attachment:

The controller fits into a single ISA slot.

Operating System Requirement:

- AIX 4.2.1, or later.

1.2. External Modem

An external modem is available for the Escala S120.

The modem is intended to be dedicated to RSF (Remote Services Facilities) operation. RSF is a Bull software that performs system error monitoring and handles communications for remote maintenance operations. The modem, together with RSF, provides a link, via a phone line, between the system at the customer site and a Bull Customer Service.

The external modem has the following features:

- automatic adaptation to the line condition and capacities of the remote modem for the following standards: V34, AT&T V32terbo, V32bis, V32, Bell 212A and 103/113, V22, V22bis, V29, V42, V42bis.
- support for data transmission rate up to 33.6 kbps
- full or half duplex mode on the switched telephone network
- automatic or manual dialing, automatic or manual answer

The modem is available for the following countries: France, UK, Germany, Italy, Belgium, Netherlands, US.

Hardware:

- Modem box with a RS232 DB25 connector, a power connector and two RJ11 connectors for the phone line and the phone set.
- Modular power supply with jack (cable length 1.8m), specific voltage input and plug depending on the country choice.

Cables and adapters:

- RS232 cable, DB25M/DB9F, 1.7 meter
- RJ11/RJ11 cable, specific wall socket adapter depending on the country choice.

Operating System Requirement:

- AIX 4.2.1 or later.

2. PCI Asynchronous Multiport Controllers

2.1. 8-Port Async Controller EIA-232

The 8-port Async Controller provides support for attaching a maximum of eight EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an ESCALA S, E and T Series system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with EIA-232D requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- Form factor : short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect)

Cables:

The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

AIX® 4.2. or later.

Machine Requirements

ESCALA	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported	4	2 or 7	8	9

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the Escala model.

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

2.2. 8-Port Async Controller RS-422A

The 8-port Async Controller provides support for attaching a maximum of eight RS-422A asynchronous serial devices (such as modems, terminals, and printers) to an ESCALA S, E and T Series system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with RS_422A requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- Form factor: short length card

Cables:

The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

AIX® 4.2. or later.

Machine Requirements

ESCALA	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported	4	2 or 7	8	9

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the Escala model.

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

2.3. 64 Port Async Controller EIA-232/RS-422A

The 64 port Async Controller provides support for attaching a maximum of 64 EIA-232 or RS-422A asynchronous serial devices (such as modems, terminals, and printers) to an ESCALA S, E and T Series system unit.
The Controller is delivered with a 3 meters EBI (External Bus Interface) cable and has an EBI out connector, that allows up to four 16 ports connector boxes to be daisy chained. The maximum distance between the adapter and a connector box is 6 meters. EIA-232 and RS-422A connector boxes can be mixed on the same daisy link. The first 2 connector boxes are power supplied by the 64 port adapter; the third requires an external power supply for the two last ones.
This configuration provides support for up to 64 EIA-232 or RS-422A devices per PCI slot

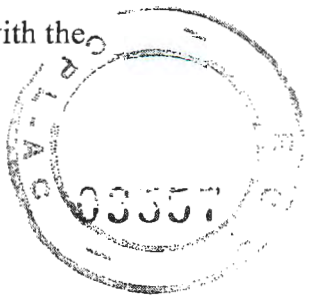
Hardware:

- Up to 64 asynchronous ports
- PCI bus
- 20 MHz IDT3051 RISC processor
- 1 Mbyte of dual port DRAM
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps[1]
- Form factor: short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect) on all EIA-232 lines

[1] For the moment, the Software limits the troughput to 38.4 Kbps

Cables:

The base board provides an EBI connector and a 3-meter EBI cable comes standard with the controller.



Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

AIX® 4.2.1, or later.

Machine Requirements

ESCALA	Sxxxx	E xxxx	T xxxx
Max Supported	2	4	4

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the Escala model.

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

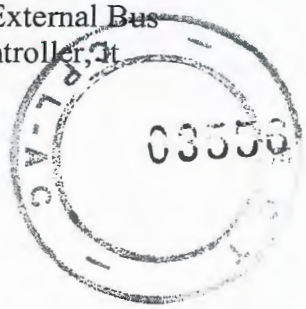
- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

2.4. 16 Port Connector Box EIA-232 for 64 ports Async Controller

The 16 port Connector Box is a subsystem with four 16C554-compatible UARTS that support sixteen RJ45 EIA-232 serial ports. It is connected to the 64 Port Async Controller with an EBI (External Bus Interface) cable. When used as third connector box linked to the same 64 Port Async Controller, it requires an additional power supply to power the third and the fourth ones.



The connector box features the following:

- 16 async ports, each with a data interchange rate of up to 115,2 kbps
- EIA-232D compatibility
- full set of modem control signals (including Ring Indicator and Carrier Detect)
- surge suppression circuitry

0,4-meter EBI cable comes together with the connector box. This cable can be used to link another connector box that can be either another EIA-232 or an RS-422A connector box.

Conformance to standard

This connector box meets the following electromagnetic emissions and safety standards:

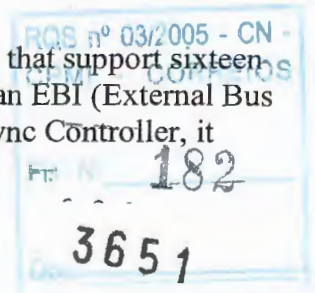
Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

2.5. 16 Port Connector Box RS-422A for 64 ports Async Controller



The 16 port Connector Box is a subsystem with four 16C554-compatible UARTS that support sixteen DB25 RS-422A serial ports. It is connected to the 64 Port Async Controller with an EBI (External Bus Interface) cable. When used as third connector box linked to the same 64 Port Async Controller, it requires an additional power supply to power the third and the fourth ones.
The connector box features the following:

- 16 async ports, each with a data interchange rate of up to 115,2 kbps
- RS-422A compatibility
- surge suppression circuitry

A 0,4-meter EBI cable comes together with the connector box. This cable can be used to link another connector box that can be either another EIA-232 or an RS-422A connector box.

Conformance to standard

This connector box meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

2.6. Auxiliary power supply for 16 port connector box for 64 port Async controller

An auxiliary international power supply is required on the 3rd connector box, if more than 2 connector boxes (EIA-232 or RS-422A) are connected to a 64-port Async controller.
The power supply is delivered with an additional plug adapter necessary for the 16-port EIA-232 concentrator. It uses a 5 pin DIN plug connector on a 6-foot cable.

2.7. 128-Port Async Controller EIA-232

The 128-port Async Controller provides support for attaching a maximum of 128 EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an Escala E and T Series system unit.

The Controller features two V11 synchronous channels that can link up to four Cluster Boxes (RANs) each via a "daisy chain". Each of those lines must be terminated by a terminator plug (delivered with the adapter).
This configuration provides support for up to 128 EIA-232 devices per PCI slot.

The ability to use synchronous attachments to any Remote Async Node provides even greater flexibility in system configuration, allowing customers to use synchronous modems for long-distance connectivity.
It is possible to use either V11/RS422 or V24/RS232 synchronous modems.
However, it is not possible to interpose more than one pair of such synchronous modems within this "daisy chain" of RANs.

Hardware:

- PCI bus
- 20 MHz IDT3041 RISC processor
- 1 Megabytes of tri-port DRAM
- Maximum EIA-232 distance supported is 62 meters (200 feet).
- Full modem support on all the lines, including Ring Indicator and Data Carrier Detect.
- dual high speed V11 channels: up to 3,7 Mbps per channel
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- surge suppression circuitry
- Form factor: short length card

bles:

DB15-DB15 cables are required for the connection of the cluster boxes. Three lengths are available: 0,20-meter, 4,6-meter (direct connection or modem connection), 15-meter.

Attachment:

The controller fits into a single PCI adapter slot.

Operating System Requirement:

AIX 4.2 or later.

chine Requirements

ESCALA	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported	2	2 or 7	8	9

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the Escala model.

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8f
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

2.8. 16 Port Cluster Box (RAN) for 128 port-adapter

The Cluster Box, also called Remote Async Node, is an intelligent interface device for use with the 128 Ports Async Controller.
It is connected to the 128 Ports Async Controller through a synchronous link.

The Cluster Box features the following:

- 16 async ports (RJ45 connectors), each with a data interchange rate of up to 115,2 Kbps
- support for cable lengths of up to 61m (200 ft) (provided the cable does not exceed a load capacitance of 2500pf).
- EIA-232D compatibility
- full set of modem control signals
- external power supply
- Machine-readable Vital Product Data (VPD)
- Character processing capability

The cluster box requires the external power supply, delivered with the power cord. It also requires a terminator plug, when used as the last element of a daisy-chain. This terminator plug is included in the delivery.

This cluster box meets the following electromagnetic emissions and safety standards:

Emissions:

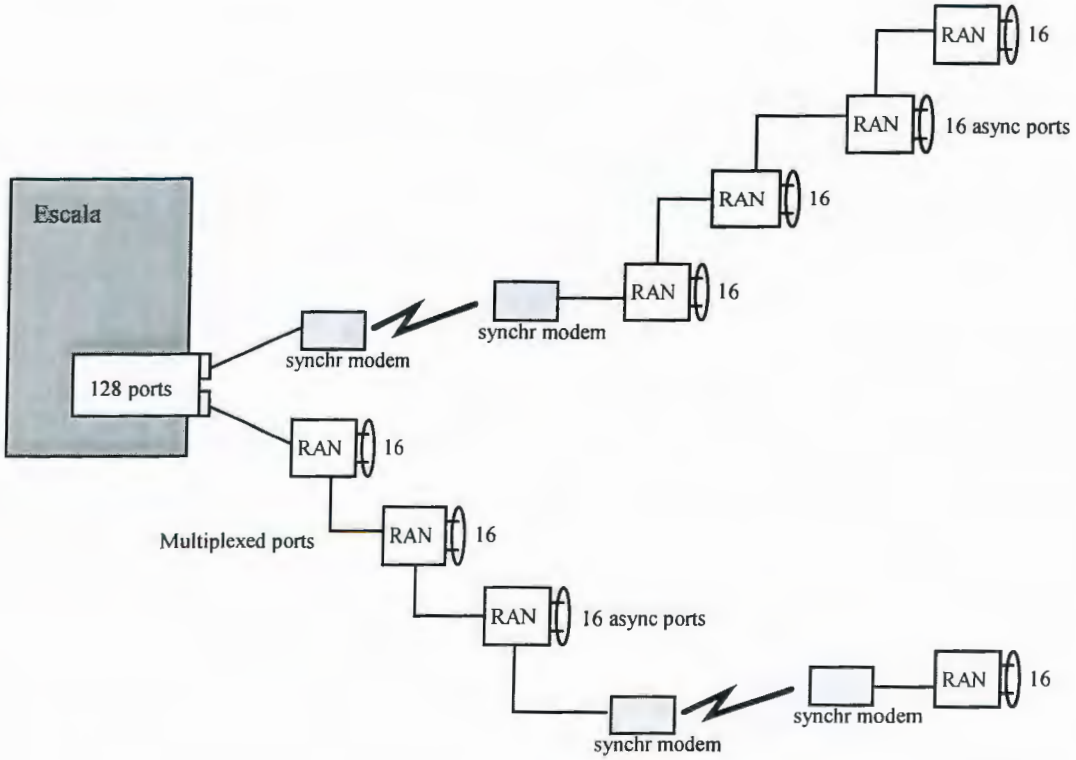
- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

2.9. Multiport Controllers Usage Summary Table

	Printers, Terminals	Async Modems	Sync Modems
8 Port EIA-232 Controller	X	X	
8 Port RS-422A Controller	X		
64 Port EIA-232/RS-422A Controller			X (to Cluster Box)
16 Port Connector Box EIA-232 for 64 Port EIA-232/RS-422A Controller	X	X	
16 Port Connector Box RS-422A for 64 Port EIA-232/RS-422A Controller	X		
128 Port EIA-232 Controller			X (to Cluster Box)
16 Port Cluster Box (RAN) for 128 Port EIA-232 Controller	X	X	X (to other Cluster Box or to 128 port adapter)



3. WAN Controllers

3.1. 4Ports Multi-protocol Serial I/O Adapter

The **4Ports Multi-protocol Serial I/O Adapter** is a high end SDLC and X.25 adapter which provides a very powerful SDLC and X.25 offer at a moderate pricing.

The **4Ports Multi-protocol Serial I/O Adapter** consists of a card that supports 4 ports with either V.24 or V.35 or V.11/X.21 physical interface. Each port can run either SDLC or X.25 and its physical interface type is software selectable

The **4Ports Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, SNA/20** (Valid on Escala E & T only), **HVX, XTI, XX25** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits per port according to stacks capabilities.

- **SNA/20** applications run and have access to SDLC networks through this adapter. (Valid on Escala E & T only)

The adapter can support up to 2500 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware:

- PCI long card, 1 slot used
- NET2 conformance
- 2 Mbps per port (4 x 2Mbps Max)
- Maximum line speed :
  - V24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 2 Mbps
- 4 x HDLC communication controllers (4 x ZILOG IUSC) available on the card:
  Each controller is customized with one of the following interfaces: V.24, V.35 and V.11/X.21. This adapter allows to have either 4 times the same interface or different types of interfaces on the same board. The **4Ports Multi-protocol Serial I/O Adapter** provides an efficient way to have independent ports and allows a high availability of the board in case of troubles. Furthermore, flexibility is insured in case of evolution of one of the interfaces.

Cables:

The board provides a 100 points female connector. A 2m cable attaches the 100 points connector to a distribution box. The distribution box has four 25 points connectors that could be connected to appropriate cables providing different types of interfaces. The cables are listed hereafter:

- V.24 cable: up to 28.8 Kbps (10m)
- V.35 cable: up to 64 Kbps (10m)
- V.11/X.21 cables: up to 2 Mbps (10m)

Attachment:

The controller fit into a single long PCI adapter slot

PSX25 Software:

PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to PSX25 Software description for more details.

Operating System Requirement

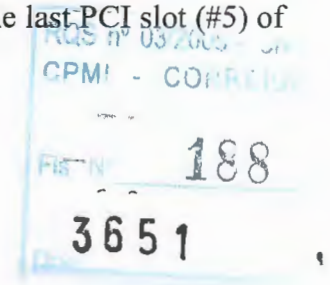
- AIX® 4.2.1, or later: TCP/IP, OSI, XTI, XX25, SNA/20 and HVX stacks

Machine Requirements

ESCALA	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported	3	2 or 7	6	6

Limitation:

- the total number of 4ports and 1 port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the Escala model.
- the 4ports Multi-protocol Serial I/O Adapter cannot be plugged in the first and the last PCI slot of Escala T Series models.
- The 4ports Multi-protocol Serial I/O Adapter cannot be plugged in the last PCI slot (#5) of Escala S Series models.



3.2. 1Port Multi-protocol Serial I/O Adapter

The **1Port Multi-protocol Serial I/O Adapter** is an entry level SDLC and X.25 adapter which provides a powerful X.25 and SDLC offer at a very competitive pricing.

The **1Port Multi-protocol Serial I/O Adapter** consists of a card that supports either one V.24 or V.35 or V.11/X.21 physical interface. This physical interface type is software selectable.

The **1Port Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, SNA/20** (Valid on Escala E & T only), **HVX, XTI, XX25** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits according to stacks capabilities.

- **SNA/20** applications run and have access to SDLC networks through this adapter. (Valid on Escala E & T only)

The adapter can support up to 200 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware:

- PCI short card, 1 slot used
- NET2 conformance
- Maximum line speed :
  - V24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 128 Kbps
- 1 HDLC communication controllers (ZILOG IUSC) available on the card:
  It is customized with one of the following interfaces: V.24, V.35 and V.11/X.21.

Cables:

The board provides a 25 points female connector that could be connected to appropriate cables providing different types of interfaces. The cables are same as for 4Ports Multi-protocol Serial I/O Adapter and are listed hereafter:

- V.24 cable: up to 28.8 Kbps (10m)
- V.35 cable: up to 64 Kbps (10m)
- V.11/X.21 cables: up to 2 Mbps (10m)

Attachment:

The controller fit into a single short PCI adapter slot

PSX25 Software:

PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to PSX25 Software description for more details.

Operating System Requirement

- AIX 4.2.1, or later: TCP/IP, OSI, XTI, XX25, SNA/20 and HVX stacks

Machine Requirements

ESCALA	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported	4	2 or 7	8	9

Limitation:

- the total number of 4ports and 1port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the Escala model.

3.3. PSX25 Software

PSX25 software is dedicated to the support of the 4ports and 1port Multi-protocol Serial I/O Adapters.

The X.25.2 and X.25.3 software, compliant with X.25-92 and ISO 8822, is running on the host.

The **PSX25** software running under AIX® is made of the following components:

- interfaces for the :
  - AIX® TCP/IP stack and enabling to run any TCP/IP application over X.25
  - OSI X.25 stack and the OSI (MAX3) X.25 API
  - XTI and XX25 APIs
  - SNA/20 stack and enabling to run SNA/20 applications in QLLC/X.25 mode.
  - HVX stack and enabling to run HVX applications over X.25 networks.
- Configuration tools integrated with SMIT providing an easy configuration of the adapters.
- A large set of utilities to administrate and monitor the adapters.

PSX25 software supports simultaneous accesses of the various communication stacks to the same or different physical links. It is provided with a base and extension MIs:

- access to a single X.25 line
- access from 2 to 4 X.24 lines
- access from 5 to 8 X.25 lines
- access from 9 to 32 X.25 lines

PSX25 product includes a local SNMP agent with a Management Information that contains statistics, operational and configuration tables. This includes:

- A subset of the Management Information Base defined by the Internet Standards RFC 1381 and RFC 1382. This is made to interoperate with market existing manager.
- A specific Management Information Base which goals the completeness of information and gives a full advantage of **PSX25** stack management.
- A browser providing system operators with an easy-to-use interface to monitor and configure PSX25 lines through the SNMP agent. It is based on the AIX® standard SMIT interface

Limitations:

- The IBM X.25 API provided by IBM's X.25 Software cannot be used through the PSX25 product. The Bull X.25 APIs (MAX3 or XTI) has to be used.
- does not support SNA Server

4. PCI LAN Controllers

4.1. Ethernet 10/100 Mbps (Fast Ethernet) PCI Controller

The Ethernet 10/100 Mbps PCI Controller is a Fast Ethernet network adapter that allows an ESCALA S, E and T Series system to connect to 10 Mbps or 100 Mbps Ethernet network. It works with PCI (Peripheral Component Interconnect) buses and connects to any 10Base-T or 100Base-TX compliant Ethernet hub to deliver 10 times the bandwidth delivered by Ethernet.

The adapter automatically selects between 10 and 100 Mbps operation.

For 100 Mbps operation, the adapter supports operation on two pairs category 5 unshielded twisted-pair (UTP).
For 10 Mbps operation, the adapter supports Category 3,4, or 5 UTP cable.

P/IP, SNA/20 (Escala E and T only), HVX, XTI, and **OSI** applications are run through this dapter.

Connectivity rules:

The maximum length of a twisted pair segment- distance from a repeater to a host system-is 100 meters.
The diameter of collision domain -distance between two end-stations- is 205 meters.

Features

- 10 Base-T (twisted-pair) support
- 100 Base-TX support
- Support Full-Duplex operation at 100 Mbps
- Support for Category 3 or 4 UTP cable for 10 Mbps, category 5 UTP cable for 10 Mbps and 100 Mbps
- Activity (transmit/receive) and Link Integrity LED indicators mounted on bracket.
- Does not support full duplex operation at 10 Mbps.
- IEEE 802.3
- CSMA/CD
- TCP/IP, SNMP complient
- Automatically selects between 10 Mbps and 100 Mbps operation.

Hardware:

- Interface with the 32-bits PCI local bus
- 32-bit data path with bus-master design

Cables:
Refer to the Cabling Guide for more details.

Attachment:
The controller fits into a single PCI slot.

Operating System Requirement

AIX 4.2 or later.

Machine Requirements

ESCALA	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported	4	2 or 7	8	9

4.2. Gigabit Ethernet SX PCI Adapter

The Gigabit Ethernet-SX PCI based adapter is available on Escala S120, E and T systems. This technology allows to provide the scalability and performance required to meet the increasing demands on today's communications.

Technical Overview:

The adapter provides one full-duplex 1000Base-SX connection. It is a short form factor PCI card with a SC-fiber connector to connect with short-wave (850 nm) 62.5 or 50 micron multi-mode fiber (MMF) to a Gigabit Ethernet network. The adapter requires a 32 or 64 bit PCI bus slot running at 33 or 66 MHz and supports both 3.3 V and 5 V signaling. The adapter conforms to PCI (Peripheral Component Interconnect) Local Bus Revision 2.0 and 2.1, IEEE 802.3z Gigabit Ethernet, and IEEE 802.3x flow control standards.

Connectivity Rules:

The following table gives the range of cable lengths from the adapter to another Gigabit Ethernet equipment:

Fiber type:	*Modal bandwidth MHz-km:*	*Minimum length meters:*	*Maximum length meters:*
MMF 62.5 um	160	2	220
MMF 62.5 um	200	2	275
MMF 50 um	400	2	500
MMF 50 um	500	2	500

Features:

-. Provides a 1 Gbps (1000BaseSX) full-duplex Ethernet LAN connection.
- Activity (transmit/receive) and Link Integrity LED indicators mounted on bracket.
- 1 MB on-card FIFO for transmit and receive

Hardware:

- 64 bit single PCI slot, 64-bit data path with bus-master design

Operating System requirement:

- AIX Versions 4.3.2 or later.
- AIX 4.3.2 or later is required for Jumbo Frame support.

Machine requirements:

- Up to 2 adapters are allowed in an Escala S120, E or T server.

4.3. Token Ring 16/4 PCI Controller

The Token Ring PCI adapter is designed to allow an Escala E and T Series system to connect to a 4 Mbps or 16 Mbps Token Ring local area networks. This adapter automatically selects the Correct Token-Ring speed (4 or 16 Mbps)

The adapter has:

- one connector RJ45 to attach to UTP cabling.
- one connector DB9 to attach to STP (IBM type 1) cabling.

TCP/IP, SNA/20, HVX, XTI, and **OSI** applications are run through this adapter.

Features

- 4 Mbps or 16 Mbps
- compatible with IEEE 802.5 specifications
- Support Full-Duplex

Hardware:

- Interface with the 32-bits PCI local bus
- 32-bit data path with bus-master design
- PCI Short - Form factor adapter

Cables:

Refer to the Cabling Guide for more details.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

AIX 4.2.1, or later.

Machine Requirements

ESCALA	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported	4	2 or 7	8	9

4.4. ATM 155 Mbps Controller

The Asynchronous Transfer Mode (ATM) Controller is a high-performance PCI controller that allows an Escala E and T Series system to connect to an ATM network.

The controller is designed to provide a bandwidth of 155 Mbps on the ATM network and allows operation in a Classical IP or LAN Emulation (LANE) network environment.

TCP/IP with AIX® 4.2.1 (or higher version) applications run through this adapter.

Features:

- RFC 1577 Classical IP support
- LAN Emulation V1.0 support
- Compliant with ATM ForumUNI Specification V3.0 and V3.1 for switched virtual circuits
- Virtual connection setup and tear down
- PVC and SVC concurrent support
- Maximum of 110 VC's
- ATM Adaptation Layer (AAL-5) support
- Bandwidth allocation and management
- SNMP sub-agent

Hardware:

- Compliant with ATM Forum standards
- Self configuration
- 32-bit PCI bus master
- Type short adapter card size

Cables:

Requires a 65 micron multi-mode fiber cable with SC connector

Attachment:

The controller fits into a single PCI slot

Operating System Requirement:

- AIX® 4.2.1 or later.

Machine Requirements:

ESCALA	Sxxxx	E xxxx	T xxxx
Max Supported	2	4	4

ATM will be available on the T430 from September 1999.

.5. Fibre Distributed Data Interface (FDDI) Controllers

The Fibre Distributed Data Interface FDDI is designed to allow a Escala E and T Series system to connect to:

- Multi-mode fibre Single-Attach Station (SAS) or Dual-Attach Station (DAS)
- UTP (Unshielded Twisted Pair) Single Attach Station (SAS)

A FDDI LAN can be up to 100 km (62 miles) and can include up to 500 system units. There can be up to:

- 2 km (1.24 miles) between system units or concentrators when using multi-mode fibre,
- 100 meters between system units or concentrators when using UTP.

Remote IPL is not supported via FDDI devices.

.P/IP, SNA/20, HVX, XTI, and **OSI** applications are run through these adapters.

Hardware:

- Data rate of up to 100Mbps
- PCI features:
  - Bus master
  - Memory and I/O slave
  - 32-bit address and data width
  - Support of "Dual Homing"
  - Machine-readable Vital Product Data (VPD)
  - PCI short-form factor adapter (SAS or DAS)

- Physical Medium Dependent (PMD)
  - Fibre ANSI X3T9.5 compliant
    Up to 2 Km between nodes
    SC connector
  - UTP ANSI X3T12 TP-PMD compliant
    Up to 100m between nodes
    1 RJ45 connector
- Station Management SMT 7.3
- SNMP Management

Cables:

- Fiber MIC 62.5µm Multi-mode
- UTP UTP cross over category 5 cable

Attachment:

The FDDI controller (SAS or DAS) fits into a single PCI adapter slot.

Operating System Environment

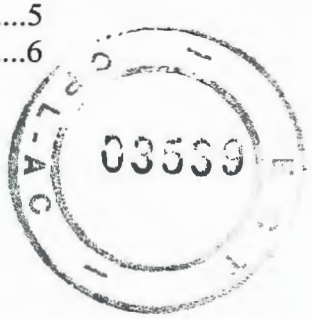
AIX® 4.2.1 or later.

Machine Requirements

Escala	S100/S120	E604e/E620	T604e/T620	E230/E250/T430/T450
Max Supported (UTP SAS)	2	2 or 7	8	9
Max Supported (Fiber SAS)	2	2 or 7	8	9
Max Supported (Fiber DAS)	2	2 or 7	8	9

Chapter 9: Reference Information

The following sections present information that will help you plan for the Escala S, E and T system units, and devices.



1. Physical Considerations

The following is a summary of the information you can use to compare systems and external removable media, and plan office space for the ESCALA S, E and T Series.

System Unit or Device	Height	Width	Depth	Minimum Weight	Maximum Weight
Model Sxxx	165 mm (6.5 in)	420 mm (16.5 in)	460 mm (18.1 in)	14.5 kg (29 lb)	18.2 kg (40 lb)
Model Exxx	630 mm (24.8 in)	353 mm (13.9 in)	500 mm (19.7 in)	-	55 kg (121.4 lbs)
Model Txxx	630 mm (24.8 in)	353 mm (13.9 in)	500 mm (19.7 in)	-	55 kg (121.4 lbs)

System Unit or Device	Height	Width	Depth	Minimum Weight	Maximum Weight
Disk Expansion Cabinet (Escala E & T)	630 mm (24.8 in)	353 mm (13.9 in)	508 mm (20 in)	-	45 kg (100 lbs)
Disk Expansion Cabinet (Escala S)	502 mm (19.7 in)	254 mm (10 in)	298 mm (11.7 in)	-	11.8 kg (26 lbs)
StorageTek External 9 tracks	240 mm (9.45 in)	480 mm (18.97 in)	670 mm (26.38 in)	43 kg	43 kg
DLT4000	146 mm (5.7 in)	235 mm (9.2 in)	332 mm (13 in)	6.6 kg (114.9 lbs)	7.1 kg (15 lbs)
DAS1300 Deskside	629 mm (24.75 in)	267 mm (10.5 in)	762 mm (30 in)		70 kg (156 lbs)
DAS2900 Deskside	629 mm (24.75 in)	356 mm (14 in)	762 mm (30 in)		84 kg (186 lbs)
DAS3200/3500 Deskside	629 mm (24.75 in)	467 mm (18.4 in)	762 mm (30 in)		119 kg (261 lbs)
DAS5700 Deskside	680 mm (26.8 in)	522 mm (20.6 in)	747 mm (29.4 in)		165 kg (364 lbs)
DAS5300 Deskside 10 slots	680 mm (26.8 in)	248 mm (9.8 in)	747 mm (29.4 in)		60 kg (132 lbs)
DAS5300 Deskside 30 slots	680 mm (26.8 in)	522 mm (20.6 in)	747 mm (29.4 in)		144 kg (316 lbs)
DAE5000 Deskside 10 slots	680 mm (26.8 in)	248 mm (9.8 in)	747 mm (29.4 in)		60 kg (132 lbs)
DAE5000 Deskside 30 slots	680 mm (26.8 in)	522 mm (20.6 in)	747 mm (29.4 in)		144 kg (316 lbs)
8mm Cartridge Tape Library	400 mm (15.8 in)	21.6 mm (8.5 in)	48.5 mm (19.1 in)		18 kg (40.8 lbs)

2. Electrical Requirements & Considerations

System Unit or Device	Power Source Loading (Typical in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (Typical in BTU/hr)	Power Requirement (Typical in Watts)	Power Factor	Max. Altitude
Model Sxxx	0.3	100 to 125 or 200 to 240	50 or 60	796	250	-	2135 m (7000 ft)
Model Exxx	0.95	100 to 127 or 200 to 240 (autoranging)	50 or 60	3050	870	0.99	2500 m (8202 ft)
Model Txxx	0.95	100 to 127 or 200 to 240 (autoranging)	50 or 60	3050	870	0.99	2500 m (8202 ft)

System Unit or Device	Power Source Loading (Typical in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (Typical in BTU/hr)	Power Requirement (Typical in Watts)	Power Factor	Max. Altitude
Disk Expansion Cabinet (Escala E & T)	0.95	100 to 127 or 200 to 240 (autoranging)	50 or 60	3300	950	0.99	2500 m (8,202 ft)
Disk Expansion Cabinet (Escala S)	-	115 to 230 (Switch selectable)	47 or 63	-	-	-	3050 m (10,000ft)
StorageTek External 9 tracks	0.22	120 to 240	48 to 62	-	200	-	-
DLT4000 Tape drive	-	100 to 240 (autoranging)	47 to 63	-	50	-	9150 m (30000 ft)
DAS1300	0.6	90 to 264 (autoranging)	47 to 63 (autoranging)	1963	575	0.99	7625 m (25,000 ft)
DAS2900	0.9	90 to 264 (autoranging)	47 to 63 (autoranging)	3000	860	0.99	7625 m (25,000 ft)
DAS3200/3500	1	90 to 264 (autoranging)	47 to 63 (autoranging)	3300	950	0.99	7625 m (25,000 ft)
DAS5700 Deskside	1.2	90 to 264 (autoranging)	47 to 63 (autoranging)	3730	1092	0.95	3038 m (10,000 ft)
DAS5300 Deskside 10 slots	0.4	90 to 264 (autoranging)	47 to 63 (autoranging)	1340	392	0.98	3038 m (10,000 ft)
DAS5300 Deskside 30 slots	1.2	90 to 264 (autoranging)	47 to 63 (autoranging)	3720	1180	0.98	3038 m (10,000 ft)
DAE5000 Deskside 10 slots	0.4	90 to 264 (autoranging)	47 to 63 (autoranging)	1340	392	0.98	3038 m (10,000 ft)
DAE5000 Deskside 30 slots	1.2	90 to 264 (autoranging)	47 to 63 (autoranging)	3720	1180	0.98	3038 m (10,000 ft)
8mm Cartridge Tape Library	-	90 to 264 (autoranging)	50 or 60	-	60	-	-

Note: The figures for power source loading, thermal output, and power requirements represent maximums.

3. Temperature, Relative Humidity, and Maximum Wet Bulb Requirements

System Unit or Device	Temperature		Relative Humidity (non-condensing)		Max Wet Bulb	
	Operating	Non-Operating	Operating	Non-Operating	Operating	Non-Operating
Model Sxxx	16°C to 32°C	-	8% to 80%	-	-	-
Model Exxx	10°C to 38°C	5°C to 50°C (41°F to 122°F)	20 to 80%	5 to 95%	24°C	28°C
Model Txxx	10°C to 38°C	5°C to 50°C (41°F to 122°F)	20 to 80%	5 to 95%	24°C	28°C

System Unit or Device	Temperature		Relative Humidity (non-condensing)		Max Wet Bulb	
	Operating	Non-Operating	Operating	Non-Operating	Operating	Non-Operating
Disk Expansion Cabinet (Escala E & T)	10°C to 38°C	-40°C to 60°C	20 to 80%	5 to 95%	24°C	28°C
Disk Expansion Cabinet (Escala S)	10°C to 50°C	-55°C to 85°C	20 to 80%	5 to 95%	-	-
StorageTek External 9 tracks	-	-	90%	95%	28°C	28°C
DLT4000 Tape Drive	10°C to 40°C	10°C to 40°C	20 to 80%	10 to 90%	-	-
DAST300/2900/3200/3500	10°C to 38°C	-40°C to 65°C	20 to 80%	10 to 90%	23°C (73°F)	27°C (80°F)
DAS5700/5300 (10 and 30 slots) Deskside DAE5000 (10 and 30 slots) Deskside	10°C to 40°C	-40°C to 65°C	20 to 80%	10 to 90%	23°C (73°F)	27°C (80°F)
8mm Cartridge Tape Library	5°C to 35°C	-40°C to 60°C	20 to 80%	-	-	-

Note: If any tape drive is installed, the minimum relative humidity of a system unit is 20%. If a CD-ROM Drive is installed, the minimum relative humidity of a system unit is 10%.

4. Noise Emissions Values

System Unit or Device	LWAd		LpAm		<LpA>m			
	Operating (bels)	Idle (bels)	Operating (dBA)	Idle (dBA)	Operating (dBA)	Idle (dBA)	Impulsive Noises	Prominent Discrete Tones
Model Sxxx	5.3	5.0	43	38	38	36	No	No
Model E604e/E620	5.4	5.2	-	-	53	50	No	No
Model E230/E250	5.6	5.4	-	-	-	-	No	No
Model T604e/T620	5.4	5.2	-	-	53	50	No	No
Model T430/T450	5.6	5.4	-	-	-	-	No	No

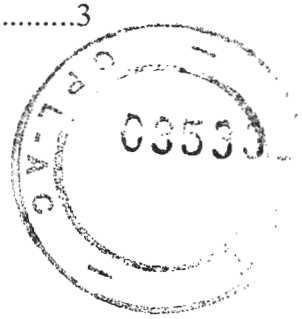
System Unit or Device	LWAd		LpAm		<LpA>m			
	Operating (bels)	Idle (bels)	Operating (dBA)	Idle (dBA)	Operating (dBA)	Idle (dBA)	Impulsive Noises	Prominent Discrete Tones
Disk Expansion Cabinet (Escala E & T)	x.x	x.x	-	-	xx	xx	No	No
Disk Expansion Cabinet (Escala S)	x.x	x.x	40	NA	xx	xx	No	No
DLT4000 Tape Drive	4.9	4.9	-	-	-	-	No	No
DAS1300	-	-	-	-	-	-	No	No
DAS2900	6.8	6.6	-	-	55	50	No	No
DAS3200/3500	-	-	-	-	-	-	No	No

Notes about Noise Emission Values:

1. LWAd is the declared sound power emission level for a production series of machines
2. LpAm is the mean value of the sound pressure emission levels at the operator position (if any) for a production series of machines
3. <LpA> is the mean value of the space-averaged sound pressure emission levels at the one-meter positions for a production series of machines
4. All measurements are made in accordance with ISO DIS 779, and reported in conformance with ISO DIS 7574/4

Chapter 10: Conformance to Standards

This Chapter provides information about Escala S, E and T Series conformance to standards.



1. ESCALA S Series

Status of ESCALA conformance to standards

Identification	Conformance	Certification	Comments
Electrical and Environmental Requirements			
Power			
IEC 950 class I	Y	Y	Product ranking
Safety Standards			
UL 1950	Y	Y	Underwriters Laboratories
CSA C22.2	Y	Y	Canada
EN 60950	Y	Y	European Norm
IEC 950	Y	Y	International Electrotechnical Commission
Directive 73/23/EEC	Y	Y	CE Marking
EMC/EMI			Disturbances produced by devices
FCC Part 15 class B	Y	Y	US
CSA C108.8 Class B	Y	Y	Canada
VCCI Class I	Y		Japan
EN 55022 (1988) Class B	Y	Y	Europe
CISPR 22 Class B	Y	Y	World Wide
Directive 89/336/EEC	Y	Y	CE Marking
Susceptibility to External Electromagnetic Disturbance			
IEC 801-2 severity level 3	Y	Y	Electrostatic discharges
IEC 801-3 severity level 2	Y	Y	Electric field
IEC 801-4 severity level 2	Y	Y	Conducted disturbances (fast transiant)
IEC 801-5 severity level 2	Y	Y	Voltage/current surges
EN 50082-1 (1992)	Y	Y	European Norm
Directive 89/336/EEC	Y	Y	CE Marking
Environment Temperature			
Operating limits: Max gradient 10C/hour	16 - 32°C		
Relative Humidity			
Operating limits: 8 to 80% non condensing			
Acoustic Noise			
ISO 7779			Reference
C012C Class 2	Y		
Mechanical Constraints			
IEC 68-2			Reference
C013C class I	Y		Bull standard
Packing and Packaging			
ISO 780, 2234, 2248, 3676, 4180-2, 4189-2	Y		
C138C	Y		Bull standard: Packaging configuration and labels
European Directives			
72/23/CEE	Y	Y	
89/336/CEE	Y	Y	

2. ESCALA E & T Series

Identification	Conformance	Certification	Comments
Electrical and Environmental Requirements			
Power			
EN 60950	Y	Y	Product ranking
IEC 555-2	Y	Y	
Safety Standards			
UL 1950	Y	Y	Underwriters Laboratories
CSA C22.2 No. 950-M89	Y	Y	
EN 60950 (1992 + A1 1993)	Y	Y	European Norm
IEC 950 Edition 1	Y	Y	International Electrotechnical Commission
Directive 73/23/EEC	Y	Y	CE Marking
EMC/EMI			Disturbances produced by devices
FCC CFR47 Class A	Y	Y	US
CSA C108.8 Class A	Y	Y	
VCCI Class 1	Y		Japan
EN 55022 (1988) Class A	Y	Y	Norway, Europe
CISPR 22 Class A	Y	Y	
Directive 89/336/EEC	Y	Y	CE Marking
Susceptibility to External Electromagnetic Disturbance			
EN 61000 -4 -2	Y	Y	Electrostatic discharges
EN 61000 -4 -3	Y	Y	Radiated, radio frequency, electromagnetic field
EN 61000 -4 -4	Y	Y	Electrical fast transient/burst
EN 61000 -4 -5	Y	Y	Surge immunity test
EN 61000 -4 -6	Y	Y	Conducted disturbances induced by radio frequency fields
EN 61000 -4 -11	Y	Y	Voltage dips, short interruptions and voltage variations
EN 61000 -3 -2	Y	Y	Limits for harmonic current emissions
EN 61000 -3 -3	Y	Y	Limitation of voltage fluctuation and flicker
Directive 89/336/EEC	Y	Y	CE Marking
Environment Temperature			
Operating limits: Max gradient 10C/hour	10 - 38°C		
Non-operating limits: Max gradient 25C/hour	5 - 50°C		
Relative Humidity			
Operating limits: Max gradient 10%/hour, Moisture content 0.019 Kg_water/Kg_dry_air			20 to 80% Wet: bulb + 24°C
Non-operating limits: Max gradient 30%/hour, Moisture content 0.024 Kg_water/Kg_dry_air			5 to 95% Wet: bulb + 28°C
Acoustic Noise			
ISO 7779			Reference
C012C Class 2	Y		
Mechanical Constraints			
IEC 68-2			Reference
C013C class 1	Y		Bull standard
Packing and Packaging			
ISO 780, 2234, 2248, 3676, 4180-2, 4189-2	Y		
C138C	Y		Bull standard: Packaging configuration and labels
European Directives			
72/23/CEE	Y	Y	
89/336/CEE	Y	Y	

EXPRESS5800 TM1100

The TRUSTWORTHY, Powerful, Entry Level Server

- Extremely cost effective solution for team and workgroup applications
- Efficient mono-Pentium III with speeds of up to 600Mhz for superb power in any implementation
- Scaleable up to 768 MB SDRAM memory and choice between 40.8GB EIDE or 72.8GB Ultra2 SCSI hard disk drives.
- Added data security with RAID and ECC memory
- Optional Windows NT Server preload for from-the-box operation
- Available in new, innovative 4U rack or tower based model

THE NEW FACE OF ENTRY LEVEL COMPUTING

- Small businesses and enterprise workgroups always demand the expandability and performance expected of larger, more powerful servers, all in an easy to use and affordable package. From these requirements we are proud to present the EXPRESS5800 "TeamMate" TM1100 server. Based on the latest Pentium III processor and 440Bx chipset, it delivers the optimised performance and expandability required by team and small workgroup file/print applications.

IMPROVED SCALABILITY

- Providing users with server features not normally found at this price, the TM1100 offers a single Pentium III processor, either EIDE or SCSI disks, which can be ordered preloaded with Microsoft NT Server. The TM1100 is ideal for file/print sharing, and small business and workgroup applications.

EASY TO OWN ADVANCED TECHNOLOGY

- The TM1100 implements an array of advanced features making it a cost-effective solution. Designed for ease of use and ownership, the TM1100 features error-correcting memory (ECC) on the processor cache and optionally on main memory.

UNRIVALED PERFORMANCE

- The TM1100 gives you the choice between efficient integrated EIDE or optional high performance Ultra2 SCSI controllers bundled with a RAID option gives outstanding throughput, data integrity and overall system flexibility. Furthermore, the TM1100 features a 10/100 Ethernet as standard and multiple hard drive bays, expansion slots and memory sockets provide straightforward scope for expandability and upgrade.

EASIER SET-UP AND MANAGEABILITY

- To help with the set up and manageability of your system, The Express5800 TM1100 comes with KickStart Set up and Recovery Software and ESMPRO Management Suite Agent as standard. Express5800 TM1100 can cater for easy mass deployments, installation and configuration, with or without the optional NT Server preload.

KEY FEATURES

- ✓ Single Intel Pentium III processor architecture with choice from 500MHz to 600MHz speeds for small business and enterprise workgroup computing
- ✓ Integrated 512KB L2 cache with ECC boosts processor performance even more
- ✓ 100MHz Front Side Bus for improved system throughput and performance
- ✓ 7 expansion slots (3 PCI, 2 ISA, 1 Combo and 1 AGP) provide profuse expandability
- ✓ Up to 768MB SDRAM memory for high reliability operation
- ✓ Integrated EIDE controllers provide continual high throughput
- ✓ Up to 40.8GB (2 x 20.4GB at 1") EIDE or 72.8GB (4 x 18.2GB at 1") SCSI disk capacity for maximum data storage
- ✓ In-chassis PCI RAID option for increased performance and reliability
- ✓ Alternative SCSI hard drive support throughput-heavy applications
- ✓ Tool-free access to chassis simplifies upgrading and changing cards and peripherals
- ✓ NT Server preload option speeds up mass deployments while also protecting your network
- ✓ Includes Kickstart software for easy set-up, configuration and recovery of your server
- ✓ Includes ESMPRO Management Suite agent for simple integration into a managed network of Express5800's
- ✓ Available in space saving 4U rack.
- ✓ Assemble to Order (ATO) – Configure your server as you want it to arrive facilitating mass deployments
- ✓ Three Year Limited Warranty including one year on-site maintenance provides added investment protection

Express5800 TM1100

FORM FACTOR	
Tower-Rack convertible	4U rack
PROCESSOR	
Number of processors	1
Type	Pentium III from 500 to 600MHz
Socket / slot type	Slot 1
Integrated L1 cache	32KB
L2 cache std / max / type	512KB ECC L2
ARCHITECTURE & MOTHERBOARD	
Chipset	Intel 440BX
Processor front side bus (FSB) speed	100 MHz
MEMORY	
Memory min / max / type	32 MB / 768MB / 100MHz SDRAM std Or 9-bit ECC SDRAM option option
Memory slots	3 DIMM
STORAGE	
Optional Hard disk drives	10.2/ 15GB EIDE 5400rpm 12.9/ 20.4GB EIDE 7200rpm 9.1/18.2GB U2 W SCSI 7200rpm
Hard disk drive and media controllers	Dual EIDE onboard Optional Ultra2 Wide SCSI board
RAID controller	Option
Max internal storage capacity	40.8GB EIDE (2 x 20.4GB) 72.8GB SCSI (4 x 18.2GB)
CD ROM drive	40X IDE
Floppy disk drive	1.44MB
Disk expansion unit	Optional
BAYS	
3.25" Media bays (total / free)	2 / 1
5.25" Media bays (total / free)	2 / 1
3.5" non Hot swap HDD bays	4 x 1" or 3x1.6"
SLOTS	
Bus slots (ISA / PCI / Combo / AGP)	2 ISA / 3PCI / 1 Combo / 1 AGP
Bus slots free (ISA / PCI / Combo / AGP)	2 ISA / 2 PCI / 1 or 0 Combo / 0 AGP

VIDEO	
Video controller	AGP SVGA (in AGP)
Video memory std / max / type	4MB/ 4MB VRAM
NETWORK	
Network interface controller	10/100 Ethernet (in PCI)
SECURITY	
2 level passwords	Yes
Front door / Intrusion protection	-
I/O PORTS	
USB Port	2
Mouse / Keyboard port	2
Parallel port	1
Mouse / keyboard port	2
SVGA video port	1
External SCSI connector	Optional
System Management board	-
Ethernet port	RJ45
POWER SUPPLY	
Power supply specs	235W
Power supply numbers	1
PHYSICAL SPECIFICATIONS	
Size (HxWxD)	420 x 205 x 410 mm
Weight	16 kg
Operating constraints	10 to 35° C, 45 to 70% RH
OS AND SOFTWARE	
Operating system	MS-DOS
Management software	ESMPRO Agent
Installation & configuration software	KickStart Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000* OS/2 Warp Server, Red Hat Linux 6.1
WARRANTY	
Standard warranty	3 years: 1st year on-site maintenance, 2nd & 3rd year spare part service
Warranty extension	Optional
REGULATORY & SAFETY	
Year 2000 safety ready	Yes
Regulatory compliance	UL, CSA, CE

* Check availability

PRODUCT INFORMATION GUIDE

Item 07 – Servidor Tipo INT7
Manual Técnico2

EXPRESS5800 TM1100

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PRODUCT OVERVIEW

Express5800
TM1100

The TRUSTWORTHY, Powerful Entry Level Server

The Express5800 TM1100 is a system dedicated to bringing true server functionality to the small/medium business team, enterprise workgroups and remote office environments, who look for the traditional brand values of quality and affordability synonymous with the Express5800 server line.

The Express5800 TM1100 is a mono-processor design supporting one Pentium III from 500 **up to 600MHz** with 512KB of L2 ECC integrated cache. It supports up to 768MB of main/system memory in either regular 8-bit or optional **9-bit parity/ECC 100MHz SDRAM** (standard on configured SCSI models). Added to this, the affordable SecuRAID110 **Ultra2 LVD SCSI RAID option** is available to ensure maximum data integrity and throughput.

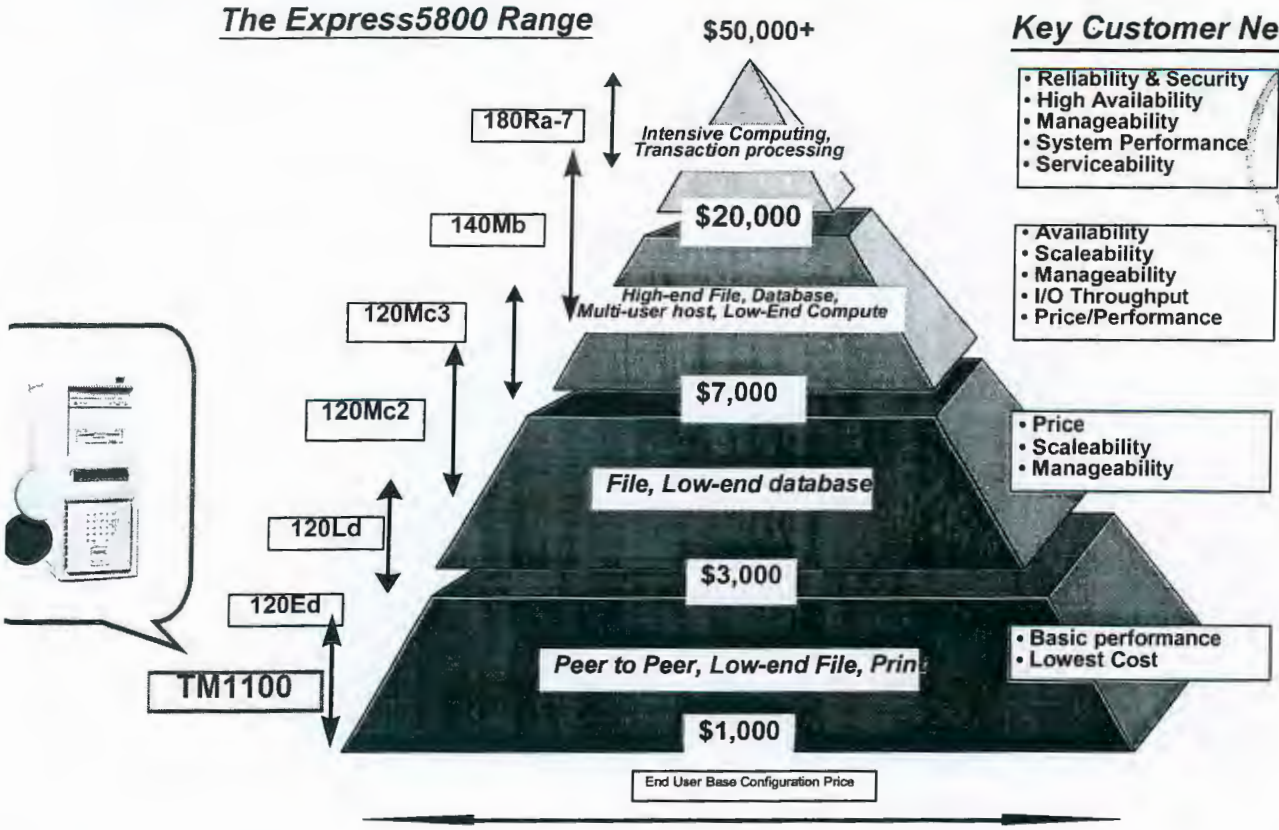
The system can be easily configured to meet the customer's price/performance requirements and permits smooth adaptation to the continuing evolution of customers' needs primarily through its **choice between cost-effective EIDE or optional efficient SCSI** (via SCSI kit including add-on PCI board + cable) HDD architectures. The TM1100 provides well balanced I/O and disk subsystems able to sustain a varied workload in a high-traffic networking environment.

The Express5800 TM1100 comes complete with **ESMPRO Management Suite agent** for simple integration into a managed network of Express5800 servers, and **Kickstart** software for easy set-up and configuration of your system. With our assemble-to-order (ATO) capability, Express5800 TM1100 systems can be built to your specifications and be ready for immediate installation, right up to the optional preloading of Microsoft Windows **NT Server 4.0** or Microsoft BackOffice which will give you a comprehensive protection to your network.

The Express5800 TM1100 is ideal for dedicated uses such as: file and print server, entry application or database server, electronic mail / fax server and communication server.

Backed by a limited three-year warranty (including one-year on-site maintenance) with worldwide service and support, the Express5800 TM1100 is **the TRUSTWORTHY, Powerful, Entry Level Server.**

TARGET AUDIENCES



POINTS WORTH NOTING

- **Extremely cost effective solution for team and workgroup applications**
- **Efficient mono-Pentium III with speeds of up to 600MHz for superb power in any implementation**
- **Scaleable up to 768MB SDRAM memory and choice the between 40.8GB EIDE or 72.8GB Ultra2 SCSI hard disk drives**
- **Added data security with RAID and ECC memory**
- **Optional Windows NT server preload for from-the-box operation**
- **Available in new, innovative 4U rack or tower based model**

Optional RAID controller

As performance and data availability are critical even on entry servers, the Express5800 TM1100 offers the affordable SecuRAID110 RAID option for higher data integrity and throughput. The SecuRAID110 RAID controller supports a 33MHz i960RP RISC processor and up to 16MB cache. It provides many fault detection and fault tolerance features such as automatic detection and transparent rebuild of failed drives, hot swap drive support, on-line RAID capacity expansion, hot spare drive support or RAID configuration stored in both disk and in non-volatile RAM, SMART capable drive support and SAF-TE enclosure management.

10/100Mbps Ethernet

All Express5800 TM1100 come standard with the cost-conscious auto-sensing EtherExpress PRO/100+ Server Adapter from Intel designed to optimize server performance and provide immediate network-readiness. By installing multiple PRO/100+ server adapters, several high-availability (load balancing, fault tolerance) and top performance (server bandwidth scaleable up to 800Mbps) features are provided for the most demanding networking environments.

AGP graphics add-in card

The TM1100 is equipped with a ATI 3D Charger AGP add-in card offering 4MB VRAM memory.. It offers high-performance graphics capability to display high-quality images with a wide selection of colors. Supported resolutions include:

Resolution	*Number of colours*
640 x 480	16,700,000
800 x 600	16,700,000
1024 x 768	16,700,000
1280 x 1024	16,700,000

7 total I/O expansion slots

The server's expansion capabilities meet the needs of file and application servers for high-performance I/O by providing three 32-bit PCI slots, two ISA slots, one shared PCI/ISA slot and a AGP slot. All the I/O expansion slots are Plug and Play ready and PCI connectors are parity enabled.

PCI/ISA Plug and Play

The Express5800 TM1100 supports PCI/ISA Plug and Play in the BIOS. By using Plug and Play compliant operating systems and options, users can easily upgrade and autoconfigure their system

Standard suite of I/O ports

The Express5800 TM1100 allows for connection of standard peripherals with 2 serial, 1 ECP/EPP parallel, 1 video, 1 mouse, 1 keyboard, and 2 USB ports (not supported in current NOS versions).

Moreover, the TM1100 offers tool-free access to chassis simplifying upgrading/changing cards and peripherals.

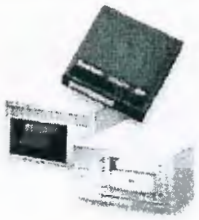
Ventilation

For efficient cooling, the Express5800 TM1100 features two (non-redundant) fans.

Optional DDS-2/DDS-3 and DDS-4 DAT Tape backup drives

The Express5800/120Mc2 can accommodate a complete range of cost-effective and high-performance DAT options for efficient back-up:

- DAT: DDS2 (4/8GB), DDS3 (12/24GB) and DDS4 (20/40GB)



Microsoft NT Server and SBS preload options

Preloaded Microsoft NT Server 4.0 or Microsoft Backup SBS allows companies with little or no dedicated IT/MIS staff to have the server up and running with the most up-to-date network operating system.

Windows NT
scalability availability manageability

System management software: ESMPRO Agent

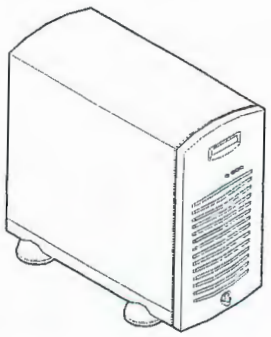
ESMPRO Agent allows simple integration of the TM1100 into an already established network of other Express5800 servers under the ESMPRO Management Suite (not included). It permits server performance and numerous other system instrumentation to be monitored from a distance.

System installation software: KickStart CD

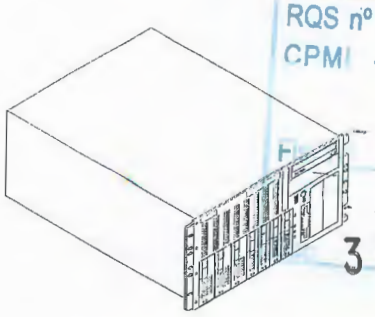
KickStart CD provides the BIOS, hardware drivers and ESMPRO Agent on a single CD to make getting your system up and running a simple affair.

Space conscious 4U rack

The Express5800 TM1100 is now available in a innovative 4U rack or mini tower to allow you to respond more efficiently to all your expanding business requirements.



Tower-Based System Front View



Rack-Mount System Front View

Warranty

The Express5800 TM1100 systems are backed with a limited three-year on-site warranty, including first year on site maintenance and a second and third year spare part carry in service.

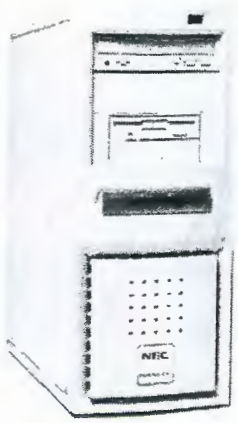
COMPETITION ANALYSIS

	EXPRESS5800 TM1100	COMPAQ ProLiant 400	COMPAQ Prosignia 720	HEWLETT PACKARD NetServer E60	IBM Netfinity 1000	IBM Netfinity 3000	DELL OptiPlex GX1	SIEMEN Primergy 170 N
Form factor	Minitower or 4U rack	Tower or optional 4U rack	Tower	Tower	Mini-Tower	Mini-Tower	MiniTower	Minitower or 5U rac
Max # of CPU	1	1	1	1 (upgrade to 2)	1	1	1	1
Processor Type	Pentium III 500 to 600MHz	Pentium III 500 to 600MHz Pentium II 450MHz	Pentium III 500 to 600MHz Pentium II 450MHz	Pentium III 500 & 550MHz Pentium II 400 & 450MHz	Pentium III 500MHz Pentium II 400MHz	Pentium III 500 to 600MHz Pentium II 400 & 450MHz	Pentium III 450 to 600MHz Pentium II 450MHz	Pentium III 450 to 500 Pentium II 400MH
Chipset	Intel 440BX	-	-	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	-
L2 Cache	512KB ECC	512KB ECC	512KB ECC	512KB	512KB	512KB	512KB ECC	512KB ECC
Bus speed	100MHz	100MHz	100MHz	100MHz	100MHz	100MHz	100MHz	100MHz
Max RAM capacity	768MB ECC SDRAM	384MB ECC SDRAM	768MB ECC SDRAM	1GB ECC	768MB ECC SDRAM	768MB ECC SDRAM	768MB ECC SDRAM	768MB ECC SDRA
Memory Slots	3 DIMM	3 DIMM	3 DIMM	4 DIMM	3 DIMM	3 DIMM	3 DIMM	3 DIMM
HDD controllers	1 U2W SCSI board option 2 EIDE	1 Integrated U2W SCSI	1 Integrated U2W SCSI	1Integrated U/W SCSI board	1 Integrated U/W SCSI board	1 Integrated U/W SCSI board	EIDE or Ultra2 SCSI board option	1 IDE on board 1 integrated U2W bo
RAID	1-channel U2W SCSI board option	2-channel U2W board option	option	-	-	1-channel U2W SCSI board option	-	1-channel U2W SC board option
CD-ROM	40xIDE	32x speed IDE	32x speed IDE	32x speed IDE	32x speed IDE	32x speed IDE	32 or 40x speed IDE	32x speed IDE
HDD type	EIDE 5400rpm / U2W SCSI 7200rpm	EIDE 5400rpm/ U/W 7200rpm or 10krpm	UW SCSI 7200rpm	U/W SCSI 7200rpm or 10krpm	U/W SCSI 7200rpm	U/W SCSI 7200rpm	EIDE 7200rpm or U2W SCSI 10krpm	IDE or U2W SCSI 7200rpm
Max internal disk cap	40.8GB EIDE/ 72.8GB SCSI	54.6GB	54.6GB	72GB	72.8GB	72.8GB	28.8GB EIDE/27.3GB U2 S	108GB
# of drive bays	2x 1" EIDE 4 x 1" or 3x 1.6"SCSI	2 x 1"+1x1.6"	2x1" + 1x1.6"	4x18.2GB (1" or 1.6"?*)	4x1"	4x1"	1x 1"+1x1.6"	IDE 2X1" / SCSI 3x1
Hot swap disks	-	-	-	-	-	-	-	-
# of media bays	4 (3x5.25" + 1x3.5")	3 (2x5.25"+1x3.5")	3(2x5.25"+x1x3.5")	2 (1x5.25" + 1x3.5")	6 (2x5.25" +4x3.5")	6 (2x5.25" +4x3.5")	4 (3x5.25" + 1x3.5")	3 (2x5.25" +1x3.5"
Total I/O expansion	7 (2I+3P+1P/I+1AGP)	6 (1I+3P+1P/I+1AGP)	6 (1I+3P+1P/I+1AGP)	6 (5P+1P/I)	6 (3P+3I)	6 (3P+3I)	7 (3P+2P/I+2I)	7 (4P+1I+1P/I+1AG
32 bits PCI slots	4	4	4	6	3	3	5	5
64 bits PCI slots	-	-	-	-	-	-	-	-
Ethernet	Integrated 10/100Mbps brd	10/100Mbps on board	Integrated 10/100Mbps brd	Integrated 10/100Mbps brd	10/100Mbps Ethernet on brd	10/100Mbps Ethernet on brd	10/100Mbps Ethernet on brd	10/100Mbps on boa
Remote management	-	-	-	HP Top Tools	-	-	-	-
PSU standard cap	1x235W	1x200W	1x200W	1x256W	1x330W	1x330W	1x200W	1x200W
Max PSU optional	1x235W	1x200W	1x200W	1x256W	1x330W	1x330W	1x200W	1x200W
Cooling fans	standard	2	-	-	3 standard	3 standard	standard	-
Server management	ESMPRO Agent	Insight Manager	Insight Manager	HP OpenView	Netfinity Manager	Netfinity Manager	DM	ServerView
Installation software	KickStart	SmartStart	SmartStart	HP Net Server Navigator	ServerGuide	ServerGuide	-	ServerStart
Standard warranty duration	1std yr on site,2nd and 3rd yr spare part service carry-in	3 years on site	3 years on site	1 year on site	1 years on site	3 years on site	1 yr on site + 3 yrs free parts delivery support	3-year on site
Intervention delay	-	4 hours (option)	4 hours (option)	1 day		4 hours (option)	1 day	4 hours
Advantages TM1100		higher RAM capacity cholce between EIDE/ SCSI higher CD-Rom speed higher no. of media bays	choice between EIDE/SCSI higher CD-Rom speed higher no.r of media bays cooling fans	higher processor speed U2W SCSI controller offer choice between EIDE/SCSI higher CD-Rom speed AGP port cooling fans higher no of media bays RAID offer	higher processor speed U2W SCSI controller offer choice between EIDE / SCSI higher CD-Rom speed higher number of PCI slots AGP port RAID offer	U2W SCSI controller offer choice between EIDE / SCSI higher CD-Rom speed higher number of PCI slots AGP port	higher disk capacity AGP port	higher processor spe higher CD-ROM spe higher no of media b cooling fans

EXPRESS5800 TM1100 TECHNICAL SPECIFICATIONS

ORM FACTOR	
ower-Rack convertible	Minitower or 4U rack
ROCESSOR	
lumber of processors	1
ype	Pentium III from 500 to 600 MHz
ocket / slot type	Slot 1
ntegrated L1 cache	32KB
2 cache std / max / type	512KB ECC L2
RCHITECTURE & MOTHERBOARD	
hipset	Intel 440BX
rocessor front side bus (FSB) speed	100 MHz
EMORY	
le nin / max / type	64MB / 768 MB / 100MHz SDRAM std Or 9-bit ECC SDRAM option
slots	3 DIMM
TORAGE	
ptional Hard disk drives	10.2GB/ 15GB EIDE (5400rpm)12.9 / 20.4GB EIDE (7200rpm) 9.1/18.2GB Ultra2 Wide SCSI
ard disk drive and media controllers	Dual channel EIDE onboard Optional Ultra2 Wide SCSI board
AID controller	Option
laximum internal storage capacity	40.8GB EIDE (2 x 20.4GB) 72.8GB SCSI (4 x 18.2GB)
D ROM drive	40x IDE
loppy disk drive	1.44MB
isk expansion unit	Optional
AYS	
.25" Media bays (total / free)	2 / 1
.5" Media bays (total / free)	2 / 1
.5" Non-Hot Swap HDD bays	4 x 1" or 3 x 1.6"
LOTS	
us slots	2 ISA / 3 PCI / 1 Combo / 1 AGP
us free (ISA / PCI / Combo / AGP)	2 ISA / 2 PCI / 1 or 0 Combo / 0 AGP
ideo controller	AGP SVGA (in AGP)
ideo memory std / max / type	4MB / 4MB VRAM

NETWORK	
Network interface controller	10/100 Ethernet (in PCI)
SECURITY	
2 level passwords	Yes
Front door / Intrusion protection	-
I/O PORTS	
USB ports	2
Serial	2
Parallel port	1
Mouse / keyboard port	2
SVGA video port	1
External SCSI connector	optional
System Management board	-
Ethernet port	RJ45
POWER SUPPLY	
Power supply specs	235W
Power supply numbers	1
PHYSICAL SPECIFICATIONS	
Size (HxWxD)	420 x 205 x 410 mm
Weight	16 kg
Operating constraints	10 to 35° C, 45 to 70% RH
OS AND SOFTWARE	
Operating system	MS-DOS
Management software	ESMPRO Agent
Installation & configuration software	KickStart Set up and Configuration Softwar
Vendor certification	Windows NT Server 4.0, Windows 2000* OS/2 Warp Server, Red Hat Linux 6.1
WARRANTY	
Standard warranty	3 years: 1st year on-site maintenance, 2nd & 3rd year spare part service carry-in
Warranty extension	Optional
REGULATORY & SAFETY	
Year 2000 ready	Yes
Regulatory compliance	UL, CSA, CE



Express5800 TM1100

The TRUSTWORTHY, Powerful, Entry Level Server

EXPRESS5800 TM1100 ACCESSORIES

TM1100 ACCESSORIES

	References	
	Customer installable	Factory installable
MEMORY		
64MB (1x64MB) 100MHz FSB SDRAM Memory upgrade kit	AME-0511-00-00	AME-0511-IN-00
128MB (1x128MB) 100MHz FSB SDRAM Memory upgrade kit	AME-0512-00-00	AME-0512-IN-00
256MB (1x256MB) 100MHz FSB SDRAM Memory upgrade kit	AME-0513-00-00	AME-0513-IN-00
64MB ECC (1x64MB) 100MHz FSB SDRAM Memory upgrade kit	AMS-4064-00-00	AMS-4064-IN-00
128MB ECC (1x128MB) 100MHz FSB SDRAM Memory upgrade kit	AMS-4128-00-00	AMS-4128-IN-00
256MB ECC (1x256MB) 100MHz FSB SDRAM Memory upgrade kit	AMS-4256-00-00	AMS-4256-IN-00
HARD DISK DRIVES		
EIDE Hard Disk Drives		
10.2GB EIDE HDD (5400rpm,1")	ADH-0150-00-10	ADH-0150-IN-10
15GB EIDE HDD (5400rpm,1")	ADH-0110-00-10	ADH-0110-IN-10
[illegible].9GB EIDE HDD (7200rpm, 1")	ADH-0130-00-11	ADH-0130-IN-11
[illegible].4GB EIDE HDD (7200rpm, 1")	ADH-0200-00-10	ADH-0200-IN-10
[illegible]8-pin SCSI 7200rpm Hard Disk Drives		
9.1GB Ultra2 SCSI HDD (6.9/7.4ms,7200rpm,68-pin, 1")	BDH-7930-00-00	BDH-7930-IN-00
18.2GB Ultra2 SCSI HDD (6.9/7.4ms,7200rpm,68-pin, 1")	BDH-7830-00-00	BDH-7830-IN-00
STORAGE CONTROLLERS		
PCI SCSI Controllers		
32bit PCI Ultra2 Wide SCSI single channel controller card (internal : 1x68-pin HD, external : 1x68-pin HD)	AIF-0589-00-00	AIF-0589-IN-00
32bit PCI Ultra2 Wide SCSI controller dual channel controller card (internal : 1x50-pin LD +1x68-pin HD, external : 1x50-pin HD)	AIF-0590-00-00	AIF-0590-IN-00
32bit PCI Ultra Narrow SCSI controller single channel controller card (internal : 1x50-pin LD, external : 1x50-pin HD)	AIF-0591-00-00	AIF-0591-IN-00
SecuRAID 110, 32 bit PCI Ultra2 Wide SCSI Single Channel RAID card (mode 0, 1, 5, 0+1) including 4MB cache, drivers and documentation	AIF-0677-00-00	AIF-0677-IN-00
SecuRAID 110, 32 bit PCI Ultra2 Wide SCSI Single Channel RAID card (mode 0, 1, 5, 0+1) including 16MB cache, drivers and documentation	AIF-0677-00-16	AIF-0677-IN-16
NETWORK & COMMUNICATION		
32 bit PCI 10/100 Mbps Ethernet (Intel Pro+ Server) Adapter	ALN-0519-00-00	ALN-0519-IN-00
32 bit PCI 10/100Mbps Dual Port Ethernet Adapter (Intel Pro100+Dual Port Server) Adapter)	ALN-0619-00-00	ALN-0619-IN-00
32 bit PCI 10/100Mbps Ethernet Adapter (3COM)	ALN-0922-00-00	ALN-0922-IN-00
[illegible]xternal Fax/Modem 56KBps	ACC-0056-**-00	
[illegible] = Country codes: BB=British, FF=French, DD=German, TT=Italian, EE=Spanish, JJ=Dutch, SS=Swedish		
[illegible]MEDIA PERIPHERALS		
40x internal IDE CD-ROM drive	ADR-0400-00-00	ADR-0400-IN-00
4GB IDE TR4 Travan Tape Drive incl. media and cleaning kit	ADT-0800-00-00	ADT-0800-IN-00
4/8GB SCSI DDS-2 DAT internal drive incl. blank cartridge & cleaning kit	ADT-0409-00-00	ADT-0409-IN-00
12/24GB SCSI 4mm DDS-3 DAT internal drive incl. blank cartridge & cleaning kit	ADT-2400-00-00	ADT-2400-IN-00
20/40GB SCSI 4mm DDS-4 DAT internal drive incl. blank cartridge & cleaning kit	ADT-2000-00-00	ADT-2000-IN-00
MISCELLANEOUS		
Ultra2 SCSI cable Kit for internal HDD and Media device support (68-pin, 7 connectors)	ACN-0025-00-00	ACN-0025-IN-00
SCSI cable Kit for internal UN Media device support (50-pin, 4 connectors)	ACN-0026-00-00	ACN-0026-IN-00
SCSI Wide (68-pin) to Narrow (50-pin) convertor	ACT-0010-00-00	
2 Button Mouse	AIM-0110-00-00	
RACK SOLUTIONS		
Rack Frames and Rack Mount options		
19"Rack frame 42U	AZA-4200-00-00	
19"Rack frame 36U	AZA-3600-00-00	
19"Rack frame 27U	AZA-2700-00-00	
Rack Mount Kit	NZA-1100-00-00	NZA-1100-00-00
FACTORY INSTALLED SOFWARE PRELOAD FOR EXPRESS5800 SERVERS		
Microsoft Windows NT 4.0 (1)		
Microsoft Windows NT Server 4.0, 10 users (including SP 6)	NUT-N400-IN-**	NUT-N400-IN-**
Microsoft Windows 2000 (2)		
Microsoft Windows 2000 Server,5 users (2)	NUT-S200-IN-**	NUT-S200-IN-**

(1) Microsoft Factory installed Software Preloads are ONLY available at the initial

purchase of an Express5800 system
(2) Microsoft Windows 2000 Preload References will be available for shipment starting February 17th 2000
= Product and preload code, to be selected from the above matrix
*** = Country Code/Pre-load language: **FF, CF, YF**: with national keyboard and French preload, **EE** : with Spanish keyboard and preload, **DD, CD** : with German keyboard and preload,*
***BB,TT,JJ,SS,AA,NN,UU,YB,TU,YY** with national keyboard and English preload*

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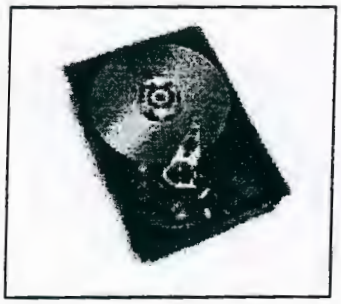
Specifications and prices are subject to change without notice.

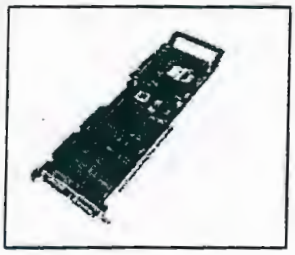
Competitive product information is based on competitors' current published specifications.

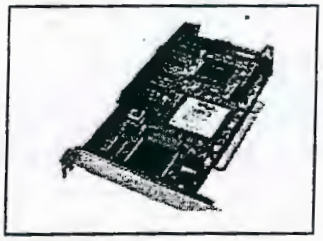
Printed May 2000.

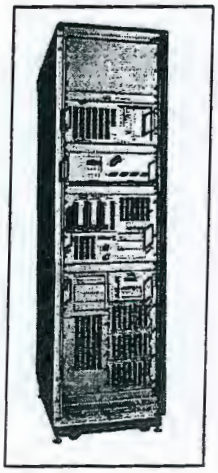
ACCESSORIES GUIDE

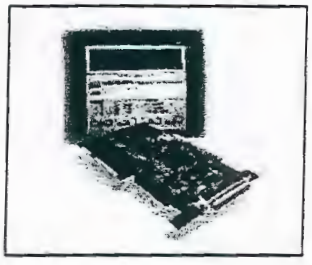
JANUARY 2000

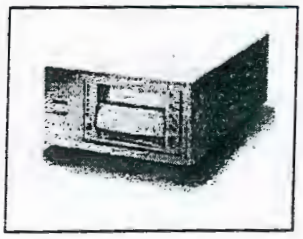


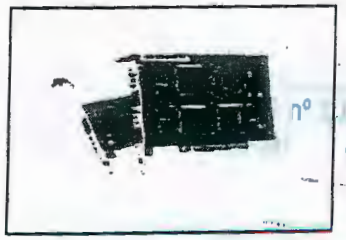












Created by Mark Carr

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TECHNOLOGY REFERENCE

MEMORY TECHNOLOGY

WHAT IS SDRAM?

- *Synchronous DRAM - a fast high-bandwidth memory designed to work best with systems employing high-performance chipsets and processors*
- *Can Synchronise itself with the system clock that controls the CPU, eliminating time delays + improving processor efficiency.*
- *Bandwidths of up 100Mhz — twice the bandwidth of EDO-SDRAM is a result of a major shift from EDO and Fast Page Mode DRAMs.*

WHAT IS EDO?

- *Extended Data Out is a memory technology that can provide approximately a 5-30% boost in the memory subsystem speed versus Fast-Page Mode.*
- *EDO provides increased performance by loading data at the same time it is searching for new information.*
- *EDO reduces the bottlenecking in data transfers between high-speed processors that need to get data quickly*

WHAT IS ECC?

- *Error checking and correcting memory automatically checks and corrects single-bit errors without bringing the system.*
- *The system will halt when 2-, 3-, 4-bit errors are detected.*
- *ECC memory requires more overhead than parity memory for storing data and causes approximately 3% performance degradation in the memory subsystem, but the resulting error detection and correction can make the trade-off well worth it.*

WHAT IS PC133 memory?

- *PC133 provides a one to one speed match with a FSB that is running at 133MHz. It is the bridge between PC100 SDRAM and future DDR SDRAM.*
- *PC133 improves overall memory timings and it also transfers data 33% faster between the memory and the microprocessor,*
- *The evolution of this new technology gives extra memory performance for the end user*

HARD DISK DRIVE TECHNOLOGY

WHAT IS ULTRA SCSI?

- *Also known as Fast-20, Ultra SCSI supports up to 20MBps burst transfers across 8-bit paths and up to 40MBps burst transfers across Wide 16-bit paths.*
- *As it is pin- and cable-compatible with SCSI-2 Fast and Fast/Wide, there's no need to change the physical connection, although you are restricted to shorter cables for external attachments.*

WHAT IS ULTRA 2 SCSI?

- *Ultra 2 SCSI technology is a doubling of the bus data rates of Ultra SCSI.*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *While Ultra 2 drives are implemented allowing operations on Ultra SCSI data buses, the new performance levels only exist in buses that are Ultra 2 exclusive.*

WHAT IS ULTRA-160/M SCSI?

- *Ultra-160/m SCSI technology provides data transfer rates of up to 160MB/s, thus doubling the bus rates of Ultra2 SCSI*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *Gives improved scalability and accommodation of faster devices, thus becoming an important building block in creating the worlds' fastest servers.*

Table showing current SCSI categories:

STA TERMS	Bus Speed Mbytes/Sec Max	Bus Width, bits	Max. Bus Lengths, Meters			Max. Device Support
			Single ended	LVD	HVD	
SCSI-1	5	8	6	(2)	25	8
Fast SCSI	10	8	3	(2)	23	8
Ultra SCSI	20	8	1.5	(2)	25	8
Ultra Wide SCSI	40	16	-	(2)	25	16
Ultra2 Wide SCSI	80	16	(1)	12	25	16
Ultra3 SCSI or Ultra-160/m (4)	160	16	(1)	12	(3)	16

(1) Single ended is not defined for speeds beyond Ultra
(2) LVD was not defined in the original SCSI standards for this speed. If all devices on the bus support LVD, then 12-meters operation is possible at this speed. However, if any device on the bus is singled-ended only, then the entire bus switches to single-ended mode and the distances in the single-ended column apply.
(3) HVD (Differential) is not defined for speeds beyond Ultra2
(4) After Ultra2 all speeds are wide only

UNINTERUPTIBLE POWER SUPPLIES

What is Uninteruptible Power Supplies?

- *A piece of hardware that help to protect your server from power outages.*
- *We strongly recommend for all Express5800 servers to be accompanied by a UPS (Uninterruptible Power Supply) which will protect data from any power problems and outages. We offer models in both tower based and 3U rack-mount form factors*
- *Our different UPS models provide a back up power supply to allow the server to overcome power problems. In the event of a complete power failure, the back up time allows the user to shut down the machine without losing important data.*
- *The table below shows the UPS options available. Firstly, calculate the total VA power of the configuration to be connected to the UPS by adding the power of all items of the configuration. Then, select the UPS corresponding to the calculated VA power and the required autonomy (in minutes) supplied by the UPS.*
- *It is recommended that you allow some UPS power margin for future configuration expansion.*

Table 1 : Typical and Maximum VA power of Express5800 servers

Model	Typical VA (a)	Max VA (b)	Typical VA (a)	Max VA (b)	Max VA
TM1100	286	407	HX4600	1007	1438
LC1400	364	520	HV8600	1510	2157
LS2400	315	451	ST8000	365	520
MC2400	364	520	ST1400	365	520
120Ld	238	340	4-Port concentrator	36	52
120Mc2	268	383	8-Port concentrator	36	52
120Mc3	285	407	Monitor 15"	104	138
MH4500	719	1027	Monitor 17"	171	224
HX4500	755	1079	Monitor 19"	189	243

Table 2 : UPS autonomy (in minutes)

VA	SU700	SU1000	SU1400 SU1400RM	SU2200 SU2200RM	SU3000 SU3000RM
300	20	36	60	130	116
350	17	28	49	112	101
400	14	24	41	98	89
450	11	20	36	86	79
500	9	18	32	76	70
550	7	15	28	68	63
600	6	13	25	61	57
700	5	11	21	50	46
800	-	9	17	41	39
900	-	7	14	35	34
1000	-	6	11	31	30
1200	-	-	9	24	24
1400	-	-	7	19	19
1600	-	-	-	16	16
1800	-	-	-	13	13
2000	-	-	-	10	10
2200	-	-	-	9	9
2500	-	-	-	-	8
3000	-	-	-	-	7

What is a Smart Slot Interface and a UPS Share Box?

- *These two options provide added data protection for Multiple servers that are using a single UPS. If you are managing multiple servers, we propose that you use a Smart Slot Interface or a UPS share box ...*

TAPE DRIVE TECHNOLOGY

What is DAT?

- *Digital Audio tape (DAT) was originally designed specifically for digital audio recording applications.*
- *When it was realised that 4mm tape could store large amounts of digital data, produce fast data transfer rates and deliver reliability, hence DAT was introduced as a tape backup medium.*

What is DLT?

- *Digital Linear Tape (DLT) - latest development in tape backup technology.*
- *Uses symmetric phase recording technology that alternates head angles to help eliminate cross-track interference.*

MEMORY

- 64MB, 128MB, 256MB 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 133MHz FSB SDRAM Memory
- 128MB, 256MB, 512MB, 1GB ECC DIMM Memory
- 256MB, 512MB, 1GB ECC DIMM Memory

64MB, 128MB, 256MB 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AME-0511-00-00	AME-0511-IN-00	64MB (1x64) 100MHz FSB SDRAM Memory
AME-0512-00-00	AME-0512-IN-00	128MB (1x128)100 MHz FSB SDRAM Memory
AME-0513-00-00	AME-0513-IN-00	256MB (1x256) 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AME-0511-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0512-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0513-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB ECC 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-4064-00-00	AMS-4064-IN-00	64MB (1x64) ECC 100MHz FSB SDRAM Memory
AMS-4128-00-00	AMS-4128-IN-00	128MB (1x128) ECC 100MHz FSB SDRAM Memory
AMS-4256-00-00	AMS-4256-IN-00	256MB (1x256) ECC 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-4064-xx-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4128-xx-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4256-xx-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB, 512MB ECC 133MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-5064-00-00	AMS-5064-IN-00	64MB (1x64) ECC 133MHz FSB SDRAM Memory
AMS-5128-00-00	AMS-5128-IN-00	128MB (1x128) ECC 133MHz FSB SDRAM Memory
AMS-5256-00-00	AMS-5256-IN-00	256MB (1x256) ECC 133MHz FSB SDRAM Memory
AMS-5512-00-00	AMS-5512-IN-00	512MB (1x512) ECC 133MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-5064-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5128-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5256-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5512-00-00	64M bit x 72 Synchronous Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-6256-00-00	AMD-6256-IN-00	256MB ECC (4x64) 60ns DIMM Memory Upgrade kit
AMD-6512-00-00	AMD-6512-IN-00	512MB ECC (4x128) 60ns DIMM Memory Upgrade kit
AMD-6010-00-00	AMD-6010-IN-00	1GB ECC (4x256) 60ns DIMM Memory Upgrade Kit
Same characteristics for the AMD-7256-00-00, AMD-6512-00-00 and AMD-6010-00-00.		

TECHNICAL SPECIFICATIONS

AMD-6256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-6512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-6010-00-00	32Mx72bits Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-8256-00-00	AMD-8256-IN-00	256MB ECC (4x64) 50ns DIMM Memory Upgrade kit
AMD-8512-00-00	AMD-8512-IN-00	512MB ECC (4x128) 50ns DIMM Memory Upgrade kit
AMD-8010-00-00	AMD-8010-IN-00	1GB ECC (4x256) 50ns DIMM Memory Upgrade Kit

TECHNICAL SPECIFICATIONS

AMD-8256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-8512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-8010-00-00	32Mx72bits Dynamic RAM high density memory module

HARD DISK DRIVES

- The 5,400rpm EIDE 10.2GB, 15GB HDD
- The 7,200rpm EIDE 12.9GB, 20.4GB HDD
- The 7,200rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 7,200rpm Ultra2 80-pin SCSI 9.1GB, 18.2GB, 36.4GB HDD
- The 7,200rpm Ultra2 68-pin SCSI 9.1GB, 18.2GB HDD
- The 10,000rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 10,000rpm Ultra2 80-pin SCSI 9.1GB, 18.2, 36.4GB HDD

HARD DISK DRIVES

PRICE PERFORMANCE

10.2GB,15GB (1")
5,400rpm
AST : 9/9.5ms
ITR : up to 158Mbit/s
ETR : 33MB/sand
66MB/s
Cache: 128KB to 512KB

12.9GB, 20.4GB (1")
7200rpm
AST : 9ms
ITR : up to 158Mbit/s
ETR : 33MB/s
Cache: 128KB to 512KB

9.1GB, 18.2GB (1")
7,200rpm
68-pin
AST : 6.9 to 8.2ms
ITR : up to 192Mbit/s
ETR : 80MB/s
Cache: 512KB

9.1GB, 18.2GB (1") 36.4GB (1.6") 7,200rpm 80-pin
AST : 6.9 to 7.6ms
ITR : up to 190Mbit/s
ETR : 80MB/s
Cache: 512KB to 1MB

9.1GB, 18.2GB (1"),**36.4GB** (1.6")
10,000rpm
AST : 5.4 to 6.7ms
ITR : up to 231Mbit/s
ETR : 80MB/s
Cache: up to 4MB

9.1GB, 18.2GB (1"),**36.4GB** (1.6")
7,2000rpm
AST : 6.9 to 7.5ms
ITR : up to 231Mbit/s
ETR : 160MB/s
Cache: up to 2MB

9.1GB, 18.2G
(1"),**36.4GB** (1.
10,000rpm
AST : 5.4 to 6.
ITR : up to 231
ETR : 160MB
Cache: up to 2M
with Fibre Cha

AST : Average Seek Time
ITR : Internal Transfer Rate
ETR : External Transfer Rate

EIDE

U2W SCSI

U-160/m SCSI

EIDE vs SCSI

	EIDE	SCSI
ENVIRONMENT		
	Offers low cost and performance equal to SCSI in Entry level servers and Mobile environments.	Delivers excellent performance for network computers with Intel-Based processors. Data-intensive applications and large numbers of users in LAN Environments.
PERFORMANCE		
	In one to one HDD performance comparison EIDE performs equally well.	A SCSI interface offers the performance edge, especially when coupled with Windows NT.
PRICE		
	Generally least expensive. The controller is standard on the system board Chipset.	Drives are a little more expensive for the same capacity and rotational speed as EIDE. May also require a SCSI adapter.
EXPANDABILITY		
	Can support high hard drive capacity, as well as CD-ROM and tape devices up to 4 devices in all.	Holds more than 9GB. Offers high capacity and performance for multiple hard disks, a wide variety of devices and long cable connectors for more convenient attachment of external devices. Backwards compatible.
EASE OF INSTALLATION		
	Although most PCs ship with an EIDE interface, ensure that your system's EIDE interface and BIOS support all the new drive's Functionality.	You may need to install a SCSI adapter.

The 5,400rpm EIDE 10.2GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0110-00-10	ADH-0110-IN-00	10.2GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0100-xx-00
Formatted Capacity	
ADH-0100-xx-00	10.2 GB
Interface	ATA-4/Ultra DMA

DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
ADH-0100-##-00	3
Tracks per Surface (Cylinders)	11,530
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320

PERFORMANCE SPECIFICATIONS	
Buffer Size	256 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.56ms
Rotation Speed (±0.1%)	5,400 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 18.6 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 7.5 sec typical

[1] - *Controller overhead not included.*

RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.77 (146.6)
Width inches (mm)	4.02 (102.1)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating ^{0} C	5 to 55
Non-operating ^{0} C	-40 to 71
Operating/Non-operating Relative ^{0} C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb (^{0} C)	27

POWER REQUIREMENTS

MODE	12V ± 5%	5V ± 5%	Power
Spin-up (peak)	1600mA	200mA	20.2W
Seek	650mA	340mA	9.6W
Read/Write	250mA	350mA	4.8W
Idle	250mA	280mA	4.4W
Standby	8mA	160mA	0.9W

The 5,400rpm EIDE, 15GB Hard Disk Drive

- 3.5" high performance hard drives
- Fast average seek time 9.5ms

Fast data transfer rate (up to 66MB/sec)

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0150-00-10	ADH-0150-IN-10	15GB (1") Fast ATA

KIT CONTENTS
HDD + 4 screws

APACITY AND INTERFACE	ADH-0150-00-10
Interfaces	Ultra ATA
Formatted Capacity	15.367
DISK DRIVE ORGANISATION	
Heads	3
Disks	2
PERFORMANCE SPECIFICATIONS	
Buffer Size (KB)	512
Buffer type	SDRAM
Typical Seek Times* (ms)	
Average	9.5
Track-to-Track	1
Rotational Speed (rpm)	5,400
Average Rotational Latency (ms)	5.55
Start time (0-drive ready)	7.3sec typical
Integrated Controller	ATA-5/UDMA
Data Zones per surface	16
Bytes per sector/Block	512
DATA TRANSFER RATES	
To/From Interface	Up to 66.7MB/sec
o/From Media VL20 Series	Up to 36.9MB/sec
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles (min)	50,000
Component Design Life (min)	5 years
Non-recoverable Data Errors(per bits read)	<10 per 10^{14}
Annual return rate	<1%
PHYSICAL DIMENSIONS	
Width (Inches /mm)	4.00/102.0
Length-(Inches /mm)	5.78/146.7
Height-(Inches /mm)	1.02/25.9
Weight-(pounds/kg)	1.30/0.59
ENVIRONMENTAL LIMITS	
Operating Temperature(^{0}C)	5-55
Non Operating (^{0}C)	-40 to 71
Operating/Non-operating Humidity %(non-condensing)	5-95
Maximum Wet Bulb (^{0}C)	30

POWER REQUIREMENTS			
MODE	**12V ± 10%**	**5V ± 5%**	**Power**
Spin-up (peak)	2100mA	275mA	
Seek	740mA	420mA	11.0W
Read/Write	295mA	440mA	5.7W
Idle	230mA	380mA	4.7W
Standby	20mA	220mA	1.3W

The 7,200rpm EIDE 12.9GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- 66/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0130-00-11	ADH-0130-IN-11	12.9GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0130-00-11
Formatted Capacity	12.9 GB
Interface	ATA-4/Ultra DMA/66

DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
Recording Surfaces	4
Tracks per Surface (Cylinders)	16,383
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320

PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.55ms
Rotation Speed (±0.1%)	7200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 22.0 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical

[1] - *Controller overhead not included.*

RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 10 per 10^{15} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	4.00 (101.6)
Length inches (mm)	5.75 ()146.1)
Width inches (mm)	1.00 (25.4)
Weight lbs. (kg)	1.26 (0.5)

ENVIRONMENTAL LIMITS

Temperature	
Operating^0 C	5 to 55
Non-operating^0 C	-40 to 65
Operating/Non-operating Relative^0 C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb^0 C	27

POWER REQUIREMENTS

Nominal Voltage	**+5/ +12**
Voltage Margin (%)	+5/ +12
Typical Power Draw (W)	
Idle	6.2
Operating	8.8
Peak Current (mA on +5/ +12V)	700/1,830

The 7,200rpm EIDE 20.4GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- Up to 33MB/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0200-00-10	ADH-0200-IN-10	20.4GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0200-00-10
Formatted Capacity	20.4GB
Interface	ATA-4/Ultra DMA
DISK DRIVE ORGANISATION	
Data Surfaces/Heads	8
Tracks per Surface (Cylinders)	14,850
Track Density	14,522 tpi
Areal Density	3,800Mb per in^2
Recording Density	204-255 Kbit/inch
Flux Density	217-271 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	240-403
PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	1 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	4.18ms
Rotation Speed (±0.1%)	7,200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 31.2 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.78 (146.7)
Width inches (mm)	4.00 (102.0)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating^0 C	5 to 55
Non-operating^0 C	-40 to 71
Operating/Non-operating Relative^0 C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb^0 C	27

POWER REQUIREMENTS

MODE	12V ± 8%	5V ± 10%	Power
Spin-up (peak)	2400mA	200mA	29.8W
Seek	860mA	340mA	12.1W
Read/Write	460mA	325mA	<8W
Idle	475mA	250mA	<7W
Standby	8mA	160mA	<1W

The 7,200rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Advanced SCSI interface support data transfer rates of up to 160MB/s
- 7,200rpm, 6.19ms average seek time, 21MB/sec maximum sustained
- throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-7945-00-00	CDH-7945-IN-00	9GB Ultra-160/m SCSI,1"
CDH-7845-00-00	CDH-7845-IN-00	18GB Ultra-160/m SCSI,1"
CDH-7645-00-00	CDH-7645-IN-00	36GB Ultra-160/m SCSI,1.6"

KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-7945-00-00	CDH-7845-00-00	CDH-7645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	2	4	8
Number of heads	4	8	16
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
:otational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1011	10 per 1011	10 per 1011
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.6/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91

NVIRONMENTAL LIMITS			
Operating Temperature	5* to 55*	5* to 55*	5* to 55*
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	1.0	1.0	1.0
Sound Power (bels, Idle)	3.6	3.6	4.0
Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (|G, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC+ 5%/12V DC+ 5%/	5V DC+ 5%/12V DC+ 5%/	5V DC+ 5%/12V DC+ 5%/
Typical Power Draw (W, Idle)	6.5	7.9	10.8
Typical Current Draw (A, Operating)			
5V	0.5	0.5	0.5
12V	0.85	0.90	1.20

The 7,200rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 80MB/s
- 7,200rpm, 4.17ms average latency

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-794#-00-00	BDH-794#-IN-00	9.1GB Ultra2 SCSI,1"
BDH-784#-00-00	BDH-784#-IN-00	18.2GB Ultra2 SCSI,1"
BDF-764#-00-00	BDF-764#-00-00	36.4GB Ultra2 SCSI,1.6"

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500	8	
1		3		5		7	HX4500, HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-794#-00-00	BDH-784#-00-00	BDF-764#-00-00
Interface	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
DISK DRIVE ORGANISATION			
Number of disks	3	5	10
Number of heads	5	10	20
Areal density (maximum)	N/A Mbits/sq.inch	N/A Mbits/sq.inch	N/A Mbits/sq.inch
Recording density (maximum)	223,000 bits/inch	223,000 bits/inch	223,000 bits/inch
User cylinders	11,737	11,721	11,721
Track density (T/inch)	12,580	12,580	12,580
Sector size	512 Bytes	512 Bytes	512 Bytes
Recording Method	16/17 EPR4	16/17 EPR4	16/17 EPR4
PERFORMANCE SPECIFICATIONS			
Data buffer	1,024KB	1,024KB	1,024KB
Rotational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	80MB/s	80MB/s	80MB/s
Average seek time	6.9/7.4ms	6.9/7.4ms	7.6ms
Track-to-Track	0.8ms	0.8ms	0.9ms
Full track	15ms	15ms	16ms
RELIABILITY SPECIFICATIONS			
Non recoverable read errors	10 per 10^{15}	10 per 10^{15}	10 per 10^{15}
S.M.A.R.T	Yes	Yes	Yes
MTBF (hours)	1,000,000	1,000,000	1,000,000
PHYSICAL DIMENSIONS			
Height in/mm	1.0/25.4	1.0/25.4	1.63/41.7
Width in/mm	40.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146	5.75/146	5.75/146
Weight (max.)lb/ kg	1.5/0.68	1.5/0.68	2.1/0.93

ENVIRONMENTAL LIMITS			
Idle Accoustics (mean/max Bels)	4.1/4.4	4.1/4.4	4.2/4.6
Operating Temperature	5* to 50*	5* to 50*	5* to 50*
Nonoperating temperature	-40* to 70*	-40* to 70*	-40* to 70*
Operating Shock	15	15	15
Nonoperating shock	75	75	75
Operating vibration (5-350 Hz)	0.5	0.5	0.5
Nonoperating vibration (350 Hz)	2.0	2.0	2.0
POWER REQUIREMENTS			
Start up current (amps)	1.4	1.5	1.4
Idle power (typ.Watts)	9.8	9.8	13.4

The 7,200rpm 68-pin Ultra2 SCSI 9.1GB, 18.2GB, Hard Disk Drives

- Formatted capacities of 9.1 to 36.4 Gbytes
- 7,200-rpm, 4.17 msec average latency
- Ultra2 SCSI (LVD) and Fibre Channel Interfaces
- Advanced SCSI Architecture (ASA II)
- MR heads, embedded servo and PRML channel

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-7930-00-00	BDH-7930-IN-00	9.1GB LVD Ultra2SCSI 68-pin
BDH-7830-00-00	BDH-7830-00-00	18.2GB LVD Ultra2SCSI 68-pin

KIT CONTENTS
H[illegible] + 4 screws

CAPACITY & INTERFACE	BDH-7930-00-00	BDH-7830-00-00
Formatted Gbytes	18.2	36.4
Interface	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)
Interface type	68-pin	68-pin
PERFORMANCE		
Internal Transfer Rate	137 to 240 Mbits/s	137 to 240 Mbits/s
Internal Formatted Transfer Rate	12.9 to 22.5 Mbytes/s	12.9 to 22.5 Mbytes/s
External Transfer Rate -Mbytes/s Ultra2 SCSI/Fibre Channel	80/100 per loop	80/100 per loop
Multisegmented Cache, Ultra2 SCSI/FC	1,024 (4,096 optional)	1,024 (4,096 optional)
Track to Track Seek, Read/Write	0.8/1.1 msec	0.8/1.1 msec
Average Seek, read/Write	6.9/7.4 msec	7.4/8.2 msec
Average Latency	4.17 msec	4.17 msec
Spindle speed	7,200	7,200
D[illegible]/Heads	3/5	5/10
[illegible]	Embedded	Embedded
[illegible]ctors/ track (512bytes/sector)	304	304
Cylinders	11,737	11,721
Recording Method (PRML)	16/17 EPR4	16/17 EPR4
S.M.A.R.T Capable	Yes	Yes
Recoverable Read Errors per Bits Read	10 per 10^{12}	10 per 10^{12}
NonRecovarable Read Errors per Bits Read	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	10 per 10^{8}	10 per 10^{8}
Service Life/Limted Warranty	5/5 years	5/5 years
POWER REQUIREMENTS		
+ 12 VDC + 5% (amps) Ultra SCSI, Ultra2 SCSI	0.9/0.9	1.2/1.2
+ 5 VDC + 5% (amps) Ultra SCSI/Ultra2 SCSI	0.8 [1.2]	1.2 [1.25]
Power (Idle watts) Ultra SCSI/Ultra2 SCSI [FC]	9.75 [11.3]	13.35 [15.5]
ENVIRONMENTAL		

Idle Acoustics (mean/max bels)	4.1/4.4	4.2/4.5
Operating Temperature (^{0}C)	5 to 50	5 to 50
Nonoperating Temperature(^{0}C)	-40 to 70	-40 to 70
Shock (Gs) Operating/Nonerating	15/75	15/75
Vibration (Gs) Operating(5-350Hz)		
Nonoperating (-350 Hz)		
Shock (Gs) Operating	0.5 (5-350 Hz)	0.5 (5-350 Hz)
Nonoperating	2.0 (<350Hz)	2.0 (<350Hz)

PHYSICAL

Height (in/mm)	1.0/25.4	1.63/41.7
Width (in/mm)	4.0/101.6	4.0/101.6
Depth (in/mm)	5.75/146.0	5.75/146.0
Weight (lb/Kg)	1.5/0.68	2.1/0.93

The 10,000rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 160MB/s
- 10Krpm, 5.0ms Seek time, 26MB/sec sustained throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-1945-00-00	CDH-1945-00-00	9GB Ultra-160/m SCSI,1"
CDH-1845-00-00	CDH-1845-00-00	18GB Ultra-160/m SCSI,1"
CDF-1645-00-00	CDF-1645-00-00	36GB Ultra-160/m SCSI,1.6"

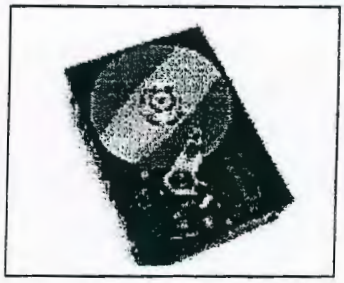
KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-1945-00-00	CDH-1845-00-00	CDF-1645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	3	6	12
Number of heads	6	12	24
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
Rotational speed	10Krpm	10Krpm	10Krpm
Latency (average)	3.0ms	3.0ms	3.0ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1012	10 per 1012	10 per 1012
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.6/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91

NVIRONMENTAL LIMITS			
Operating Temperature (@C)	5 to 50	5 to 50	5 to 50
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	0.5	0.5	0.5
Sound Power (bels, Idle)	4.0	4.0	4.2

Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (|G, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC± 5%/+12V DC± 5%/	5V DC± 5%/+12V DC± 5%/	5V DC± 5%/+12V DC± 5%/
Typical Power Draw (W, Idle)	8/10	10/12	15.5/17.5
Typical Current Draw (A, Operating)			
5V	0.50	0.50	0.55
12V	0.65	0.80	1.25

The 10,000 rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives



- 10,000rpm 3.5 inch disc drive
- Average seek times as fast as 5.2ms
- Unsurpassed formatted data rates of 14.5 to 21.3 Mb/S
- High-Performance Ultra2 SCSI interface

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-194#-00-00	BDH-194#-IN-00	9.1GB HDD Ultra2 SCSI, 1'
BDH-184#-00-00	BDH-184#-IN-00	18.2GB HDD Ultra SCSI, 1'
BDF-164#-00-00	BDF-164#-IN-00	36.4GB HDD Ultra SCSI, 1.6'

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500 (9GB only)	8	
1		3	ST8000	5	LC1400, MC2400, ST1400	7	HX4500/ HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-194#-xx-00	BDH-184#-xx-00	BDF-164#-xx-00
Formatted GB (512 bytes/sector)	9.1GB	18.2GB	36.4GB
Interface	Ultra2 SCSI	Ultra2 SCSI	Ultra2 SCSI
Interface type	80-pin	80-pin	80-pin
DISK DRIVE CONFIGURATION			
Disks/Heads	3 / 6	6 / 12	12 / 24
Sectors per drive (512 Bytes/Sector)	21	28	28
Cylinders	6,962	9,801	9,772
Recording Method	16/17 PR4	16/17 PR4	16/17 PR4
PERFORMANCE SPECIFICATIONS			
Internal Transfer Rate (Mbits/s)	152 to 231	193 to 308	179 to 313
Internal Formatted Transfer Rate (MB/s)	15 to 21	18 to 28	18 to 28
External Transfer Rate	80	80	80
Multi-segmented Cache (KB)	1,024	1,024	1,024
Optional Cache (KB)	4,096	4,096	4,096
Track-To-Track Seek (Read/Write/ms)	0.6 / 0.9	0.6 / 0.9	0.6 / 0.9
Average Seek, Read/Write (ms)	5 / 6	5.2 / 6	5.7 / 6.5
Maximum Seek, Read/Write (ms)	12.2 / 13.2	12.2 / 13.2	14 / 15
Average Latency (ms)	2.99	2.99	2.99
Spindle Speed (RPM)	10,025	10,025	10,016
RELIABILITY SPECIFICATIONS			
MTBF (Power-On hours)	1,000,000	1,000,000	1,000,000
S.M.A.R.T.	Yes	Yes	Yes
Recoverable Read Errors (per Bits)	1 per 10^{10}	1 per 10^{10}	1 per 10^{10}
Non-recoverable Read Errors (per Bits)	1 per 10^{15}	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	1 per 10^{8}	1 per 10^{8}	1 per 10^{7}
Service (years)	5	5	5

PHYSICAL DIMENSIONS			
Height (mm)	25.4 (1")	26.1 (1")	40.6 (1.6")
Width (mm)	101.6	101.6	101.6
Depth (mm)	146.1	147	146.1
Weight (kg)	0.54	0.59	0.91
ENVIRONMENTAL LIMITS			
Non-operating Temperature (°C)	-40 to 70	-40 to 70	-40 to 70
Operating Temperature (°C)	5 to 50	5 to 50	5 to 50
Operating Shock (Gs @ msec)	2	5	5
Operating Vibration (Gs @ 5-530 Hz)	0.5	0.5	0.5
Non-Operating Vibration (Gs @ 5-530 Hz)	2	2	2
POWER REQUIREMENTS			
+12 VDC± 5% (amps typical)	0.3	1	1.5
+5 VDC± 5% (amps typical)	0.8	1.1	0.8
Power (Idle watts)	11.1	10.4	15.6

STORAGE CONTROLLERS

PCI SCSI Controllers

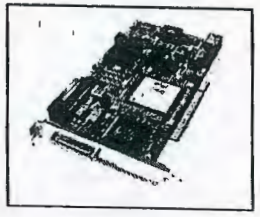
- The PCI Ultra - Wide Single-Ended Differential SCSI-3 Single Channel Controller Card
- The PCI Ultra-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI Single channel Controller Card

PCI RAID Controllers

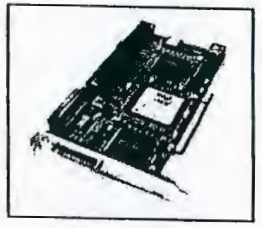
- The SecuRaid 110, PCI RAID Ultra2 SCSI Single Channel RAID Card
- The SecuRaid 210, PCI Ultra-2 SCSI Single Channel RAID card
- The PCI RAID Ultra-Wide SCSI-3 Single Channel RAID card
- The SecuRaid 530 64 bit PCI Ultra2 SCSI Tri-channel
- The Differential Ultra-Wide SCSI to SCSI RAID Kit

RAID CONTROLLERS

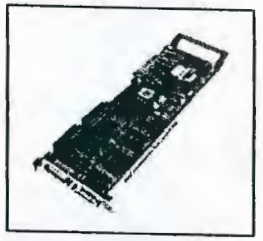
PRICE PERFORMANCE



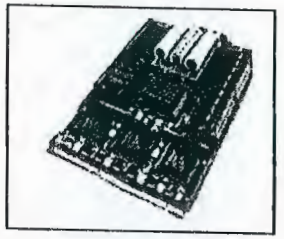
SecuRAID110
1-channel ; Ultra2 Wide SCSI
33Mhz i960 RISC processor
4MB and 16MB cache



SecuRAID210
1-channel ; Ultra2 Wide SCSI
66Mhz i960 RISC processor
8-16-32-64MB cache



SecuRAID530
3-channel ; Ultra2 Wide SCSI
233Mhz StrongArm processor
16-32-64MB cache with or without battery backup



U/W SCSI to SCSI RAID
3-channel (2 drive – 1 host)
U/W SCSI
33Mhz i960 RISC processor
16-32-128MB cache

Internal Storage (PCI based)

The PCI Ultra- Wide SCSI-3 Single Channel Controller Card

- 40 MB/s Ultra Wide SCSI data transfer rate
- Connectivity for up to 15 SCSI peripheral devices in a single PCI slot
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0585-00-00	AIF- 0585-IN-00	Ultra-Wide SCSI-3 Single-Channel
AIF-0586-00-00	AIF-0586-IN-00	Ultra-Wide Differential SCSI-3 Single Channel

KIT CONTENTS
32 Bit Single-ended/Differential SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0585-xx-00 AIF-0586-xx-00
Computer Bus	32-bit PCI Local Bus
PCI Compliance:	PCI 2.0 specification, (PCI 33MHz)
Interface Protocol	Bus master DMA
Host bus Burst data Rate	133 MB/s
Peripheral Bus	8-bit and 16-bit wide Ultra SCSI
SCSI Synchronous	40 MB/s
SCSI Asynchronous data Rate	3.3 MB/s
Device Protocol	SCSI-1, SCSI-2, SCSI-3, Wide Ultra SCSI
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	One 68-pin high density
External Connectors:	One 68-pin high-density
External Drivers :	
IF-0585-xx-00	Single-ended, active termination
AIF-0586-xx-00	Differential, active termination
Device Support	Up to wide 15 devices
OPERATING SYSTEM SUPPORT	
Regulatory Compliance:	FCC Class B, CE, IEC
PHYSICAL DIMENSIONS	
Length inches (cm)	6.87 (17.0)
Height inches (cm)	3.87 (9.5)
ENVIRONMENTAL LIMITS	
Storage Temperature ^{0}C	-55 to 85
Operating Temperature ^{0}C	0 to 55
Operating Humidity %	10 to 90, non-condensing
Power Requirements	5 V +/-5% at 2.0 amps maximum

The PCI Ultra-Wide SCSI-3 Dual channel Controller Card

- Up to 80 MB/s across two SCSI channels in a single PCI slot
- Connection for up to 30 SCSI devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0587-00-00	AIF-0587-IN-00	PCI Ultra-Wide SCSI-3 Dual Channel

KIT CONTENTS
SCSI Controller Card EZ-SCSI software

CONTROLLER SPECIFICATIONS	AIF-0587-xx-00
Computer Bus	PCI Local bus PCI 2.0 specification, (PCI 33MHz), Two fully independent PCI SCSI channels bridged to systems PCI bus
Interface Protocol	Bus master DMA
Device Protocol	16-bit Ultra SCSI
Host Bus Data Transfer Rate	Up to 133 MB/s
SCSI Synchronous Data Rate	80 MB/s (6 MB/s per channel)
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	Two 68-pin, high-density internal connector
External Connector	One 68-pin, very high density external connector
Electrical Drivers	Single-ended, active termination
Device Support	Up to 30 devices

OPERATING SYSTEM SUPPORT	
I/O Operating Environment	DOS, Windows, Windows95, Windows NT, Windows for Workgroups, OS/2, NetWare, UNIX (SCO, UnixWare)
Regulatory compliance	FCC class B, CE, IEC

PHYSICAL DIMENSIONS	
Length inches (cm)	6,875 (17.463)
Width inches (cm)	4.0 (10.16)

ENVIRONMENTAL LIMITS	
Operating Temperature: °C	-5 to 60
Storage Temperature°C	-60 to 95
Operating Humidity %	10 to 95, non-condensing
Power requirements	5V ± 5% at 2.0 amps max.

The PCI Ultra-Narrow SCSI-3 Single channel Controller Card

- Easy Plug and Play installation of up to seven Fast SCSI hard drives, CD-Re-writaeable drives, scanners, DAT and DLT media peripherals
- Fast SCSI data transfer rate of up to 10MB/sec

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0588-00-00	AIF-0588-IN-00	PCI Ultra-Narrow SCSI-3

KIT CONTENTS
SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0588-xx-00
PC Bus Type	32-PCI
Interface Transfer Method	Bus Master DMA
Total Devices supported	7 total (internal or external)
Data Transfer rate	10MB/s
Supported Protocols	SCSI-1, SCSI-2, and Fast SCSI-2
Boot support	Bootable (on board BIOS)
Internal Connector	50-pin standard (male)
External Connector	50-pin high-density SCSI-2 (female)
OPERATING SYSTEM SUPPORT	IBM-compatible PC-486, Pentium, or above Windows NT, Windows 95, Windows 3.1, MS-DOS 6.0, OS/2, SCO UNIX or UnixWare OS, PCI expansion slot SCSI peripheral
PHYSICAL DIMENSIONS	
Length inches (cm)	4.7" (11.9)
Height inches (cm)	3.0 (7.6)
Weight lbs	Approx 1.5
ENVIRONMENTAL LIMITS	
Operating temperature	-5 to 60
Non-Operating temperature	-55 to 60
Relative Humidity	10 to 90 non-condensing
	5.0v+ /-0.25 at 2.0 amps maximum

The PCI Ultra2 Wide SCSI-3 Single channel Controller Card

- Up to 80MB/s across one SCSI channel in a single PCI slot
- Connection for up to 15 SCSI-2 or SCSI-3 devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0589-00-00	AIF-0589-IN-00	PCI Ultra 2-Wide SCSI-Single Channel

KIT CONTENTS
Symbols SYM8952U

CONTROLLER SPECIFICATIONS	AIF-0589-00-00
SUPPORTED BUSES	
	32-bit, PCI Local bus 16-bit, Wide SCSI bus Single-ended SCSI asynchronous transfers, single-ended Fast/Ultra SCSI synchronous transfers, LVD Ultra2 SCSI Synchronous transfers
SCSI BUS TERMINATION	
	Active, automatic terminating, Universal LVDlink with automatic switching to single-ended Termination power: current limited, self-resetting
SCSI BUS CONNECTION	
	Up to 15 SCSI, SCSI-2 or SCSI-3 devices
BOARD CONNECTORS	
Internal	68-pin, right angle, high density, SCSI bus 4-pin for off-board SCSI Active LED
External	68-pin, high-density connector interconnect
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI asynchronous	Up to 14 MBps
SCSI synchronous single ended	
FAST	Up to 20MBps
ULTRA	Up to 40MBps
SCSI synchronous LVD	
ULTRA2	Up to 80 MBps
PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size	3.5in. x 6.0in
Form Factor	PCI 2.1 universal board
Bracket	ISA/EISA style
Operating temperature	5^0C to 55^0C
Relative humidity range	5^0 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage Temperature	-40^0C to 85^0C
Electrical	5V +/- 5% (1,5A max) 12V +/-5% (50mA max)
MTBF	<500,000 hours
PCI Maximum power dissipation	15 Watts
PRSNT1#	Open
PRSNT2#	**Ground**

The PCI Ultra2-Wide SCSI Dual channel controller Card

- Supports Fast/ Ultra SCSI bus speeds of up to 20 or 40MBps
- Connects up to 15 Fast or Ultra devices

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0590-00-00	AIF-0590-00-00	PCI - ULTRA2 SCSI Dual Channel Host Adapter

KIT CONTENTS
Symbios SYM21002

SUPPORTED BUSES

AIF-0590-00-00

8-/16-bit Fast/Ultra SE SCSI bus (up to 15 SCSI devices
16-bit Ultra/Ultra2 SE or LVD SCSI bus (up to 15 SCSI devices) up to 80 MBps (Channel B)

SCSI BUS TERMINATION

Active Termination with Tolerant. (active negation) technology on both channels
Channel A: Single-ended SCSI
Channel B: Universal LVDlink SCSI with automatic switching to single-ended when single-ended devices are connected to SCSI bus

SCSI BUS CONNECTION

Up to 15 Fast SCSI Ultra SCSI peripherals on Channel A
Up to 15 Fast SCSI, Ultra or Ultra2 SCSI peripherals on Channel B

CARD CONNECTORS

Internal	Universal, 32-bit PCI edge connector Channel A 68-pin, right angle, high density latching SCSI bus Channel A 50-pin low density Channel B 68-pin, right angle, high density latching SCSI bus
External	Channel A 50-pin High Density
Off-board LED Indicator:	Channel A and B SCSI Bus Active 4-pin header for off-board LEDs
On-board jumpers:	The standard SYM21002 is a jumper-less solution

PERFORMANCE

PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 14 MBps (per channel)
SCSI Synchronous single-ended	Fast-up to 40 MBps (per channel)
SCSI Synchronous LVD	Ultra-up to 40 MBps (per channel) Ultra2-up to 80MBps (per channel)

PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS

Board Size:	Approximately 4in. X 7.5in.
Form Factor:	PCI 2.1, 32-bit Universal Board
Bracket:	ISA/EISA style
Operating temperature	0^0C to 55^0
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-40^0 C to 85^0C
MTBF	>400,000 hours
Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts
	PRSNT1#- open
	PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B
	CE
	VCCI
	UL94V0

The PCI Ultra-Narrow SCSI Single channel controller Card

- Fastest standard systems bus available today, offering high performance Fast SCSI I/O technology
- Connects up to 7 SCSI devices
- Data transfer rate of up to 10MBps.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0591-00-00	AIF-0591-00-00	PCI - Fast SCSI host adapter

KIT CONTENTS
Symbios SYM20810

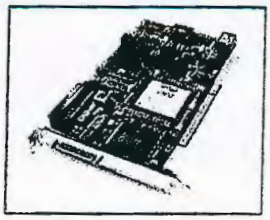
SUPPORTED BUSES	AIF-0591-00-00
	32-bit, DMA bus master, PCI local bus
	8-bit, single-ended SCSI-1, SCSI-2 (Fast SCSI)
SCSI BUS TERMINATION	
	Single-ended with active, auto termination for SCAM (SCSI Configured Automatically) support.
	Fused, self - resetting termination power
SCSI BUS CONNECTION	
	Up to 7 SCSI or SCSI-2 devices
BOARD CONNECTORS	
Internal	50-pin, low density 8-bit SCSI (SYM20810 only)
External	50-pin, high density 8-bit SCSI (SYM20810 / SYM20811)
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 7 MBps
SCSI Synchronous	Up to 5 MBps
Fast SCSI-synchronous	Up to 10 MBps
Direct(bus master) memory access for low overhead, 32-bit data burst transfers at PCI bus bus transfer rates	✓
Zero wait state PCI transfer rate	✓
Up to 64-byte PCI burst size to maximise the PCI data transfer rate	✓

PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size:	
Form Factor:	2.5" x 4.75"
Bracket:	ISA/EISA style
Operating temperature	5 to 55
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-55 to 8'c
MTBF	>400,000 hours

Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts
	PRSNT1#- open
	PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B
	CE
	VCCI
	UL94V0

The SecuRAID 110, PCI Ultra2 Wide SCSI Single channel RAID card

- Onboard Intel i960RP 33MHz RISC processor
- Single Channel PCI-to-Ultra2 SCSI LVD
- I_20 Ready
- Quick and easy configuration with (GAM) DACCF Software



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0677-00-00	AIF-0677-IN-00	PCI Ultra2 SCSI Single Channel

KIT CONTENTS
RAID card 4MB.16MB cache

CONTROLLER SPECIFICATIONS AIF-0677-xx-00

- Intel i960RP 33MHz RISC processor
- PCI 2.1 compliant
- I_2O compliant
- ECC EDO RAM
- 4MB cache, Flash EEPROM, 512K x 8 (72 pin JEDEC SIMM)
- BIOS resident configuration Utility

Internal Connectors
- 1 68-pin High-Density

External Connector
- 1 68-pin Very High-Density

SCSI SPECIFICATIONS

- 1 Ultra2 LVD channel on controller
- SISL Features
- Up to 80MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect/reconnect
- 64 concurrent host commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- RAID Clustering
- Transparent disk drive rebuild
- Background Initialisation
- Immediate RAID Availability
- RAID Migration
- RAID expansion
- Drive travelling during Power-Off
- Automatic detection of failed drives
- Automatic and transparent re-build of replacement drive
- On-line RAID expansion
- Hot Spare drive support

- Hot Drive Swapping support
- SAF-TE enclosure management
- RAID configuration stored on disk and NVRAM

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client Server GUI Interface
- Create, manage, expand and monitor program
- Error statistics and performance
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEMS SUPPORT

- Windows 95 & Windows 98
- Windows NT 3.51, 4.0 Workstation and Server
- NetWare 3.x, 4.x, 5.x & SMP
- SCO UnixWare 2.1
- SCO UNIX OSR 5.x
- DOS 5.x, 6.x & above
- 120 supported platforms and OS environments

PHYSICAL DIMENSIONS

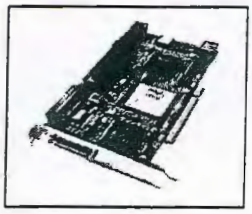
Length inches	7.225
Width inches	4.2
Max.Component inches	0.105 solder side
Height	0.570 component side
Board	Not to exceed the width of one PCI slot

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to + 55
Non-operating Temperature ^{0}C	-20 to +70
Operating Humidity %	10 to 90 relative humidity (non-condensing)
Non-Operating Humidity %	10 to 90 relative humidity (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

The SecuRaid 210, PCI Ultra2 Wide SCSI Single Channel RAID card

- 32bit PCI Ultra2 Single Channel RAID controllers
- Embedded Intel i960RD 66MHZ processor
- Monolithic NT driver that increases overall system throughput



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0685-00-HU	AIF-0685-IN-HU	PCI RAID Ultra2 SCSI Single Channel
AMR-0508-00-00	AMR-0508-IN-00	8MB Cache Memory Module for SecuRAID 210
AMR-0516-00-00	AMR-0516-IN-00	16MB Cache Memory Module for SecuRAID 210
AMR-0532-00-00	AMR-0532-IN-00	32MB Cache Memory Module for SecuRAID 210
AMR-0564-00-00	AMR-0564-IN-00	64MB Cache Memory Module for SecuRAID 210

KIT CONTENTS
RAID card Documentation

CONTROLLER SPECIFICATIONS — AIF-0685-xx-HU

- Intel i960RD RISC Processor / 66MHz
- PCI 2.1 Compliant
- I_2O Ready
- 8/16/32/64MB cache
- ECC EDO RAM in a 72 pin JEDEC SIMM
- RAID firmware on 1 MB Flash EEPROM
- Hardware XOR
- ECC Memory Support

SCSI SPECIFICATIONS

- Supports SCSI1, SCSI2, Ultra SCSI and Ultra2 SCSI devices
- Full support for Low Voltage Differential (LVD) devices
- SISL Features
- Up to 80 MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect / reconnect
- 64 concurrent host commands
- 256 tagged commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- Transparent disk drive rebuild
- On-Line RAID expansion (M.O.R.E.)
- Up to Eight Controllers per System (NT)
- Logical drive size of 2 Terabytes, 32 logical drives per controller
- Background initialisation; Immediate RAID Availability
- RAID migration

- Variable stripe size per controller
- Variable cache line size per controller
- Up to 8 non-disk devices per controller
- Drive travelling during power off
- SAF-TE enclosure management
- Automatic error recovery
- Write through or write back cache support / logical device
- Automatic detection of failed drives
- Automatic rebuild of hot spare drive
- Hot drive swapping support
- ECC detection/correction on cache memory
- Support for SMART capable drives
- Configuration data stored on disk and NVRAM

RAID MANAGEMENT

- Client Server GUI Interface
- Global Array Manager
- Create, manage, expand and monitor program
- Error statistics and performance information
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEM SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare 3.x, 4.x (non NWPA) & SMP
- SCO UnixWare 2.1, 7.0, UNIX OSR 5.x
- OS/2.x,3.x &SMP
- DOS 5.x, 6.x and above

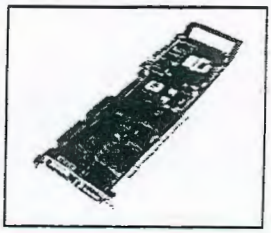
PHYSICAL DIMENSIONS

- Half Length PCI Footprint (7.225" x 4.2")

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to 55
Power Requirements	+5.0V (+- 5%), 3.5 A (max); 17.5 watts max.
MTBF Hrs	200.000

The SecuRaid 530 64 bit PCI Ultra2 Wide SCSI Tri-channel RAID card



- A 64bit PCI Ultra2 SCSI RAID Controller for extreme performance
- Intel's leading edge DSP a 233MHZ StrongArm micro-controller
- Offers Uncompromising fault tolerance, data availability , superior configuration and management flexibility.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0690-00-HU	AIF-0690-IN-HU	64 bit PCI Ultra2 SCSI Tri-channel
AMR-0616-00-00	AMR-0616-IN-00	16MB Cache Memory Module for SecuRAID530
AMR-0617-00-00	AMR-0617-IN-00	16MB Cache Memory Module+ Battery Backup Unit for SecuRAID53
AMR-0632-00-00	AMR-0632-IN-00	32MB Cache Memory Module for SecuRAID530
AMR-0633-00-00	AMR-0633-IN-00	32MB Cache Memory Module + Battery Backup Unit for SecuRAID5
AMR-0664-00-00	AMR-0664-00-00	64MB Cache Memory Module for SecuRAID530
AMR-0665-00-00	AMR-0665-00-00	64MB Cache Memory Module + Battery Backup Unit for SecuRAID5

KIT CONTENTS
RAID card Disks Documentation

CONTROLLER SPECIFICATIONS — **AIF-0690-xx-HU**

- Intel DSP 233MHz RISC micro-controller
- 64Bit PCI Hot plug support
- 8MB to 64MB
- 1_2O Hardware ready
- SDRAM in a 72 pin JEDEC SIMM
- RAID Hardware on 4MB FLASH EEPROM
- Hardware XOR
- ECC Memory Support

SCSI SPECIFICATIONS

- 3 Ultra2 SCSI channels
- Full support for Low Voltage Differential (LVD) devices
- Up to 80Mb/s Burst data rate
- Automatic SCSI bus termination
- Disconnect/reconnect
- Support of embedded SCSI controllers through a specific I/O Slot (SSIL feature)
- 256 tagged commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID Levels 0,1,0+1, 5 and JBOD
- Transparent disk drive rebuild
- Up to 16 controllers per system (NT)
- Onboard BIOS: Embedded in the firmware

- On-line RAID expansion (M.O.R.E)
- Automatic Detection of failed drives
- Automatic and transparent re-build of replacement drives
- Automatic error recovery
- SAF-TE enclosure management
- Write through or write back cache support/ logical device
- Hot Drive Swapping support
- RAID configuration stored on disk and NVRAM
- Memory write and Invalidate command

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client GUI Interface (GAM client)
- Create manage, expand system drives, error statistics and performance information
- BCU BIOS config utility with RAID manager (DACCF)

OPERATING SYSTEMS SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare3.x, 4.x & SMP
- SCO UnixWare 2.1
- SCO UnixWare 2.1
- DOS 5.x, 6.x & above
- Sun Solaris
- I_2O supported platform and OS environments

PHYSICAL DIMENSIONS

Length inches	12,280
Width inches	4,750
Max Component inches	0.105 solder side of board
Height inches	0.570 component side of board

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to +55
Non-Temperature ^{0}C	-20 to +70
Operating Relative Humidity %	10 to 90 (non-condensing)
Non-Operating Relative Humidity %	10 to 90 (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

SERVER OPTIONS

Server Management

- The ISA Server Management Board

Network & Communication

- The 32bit PCI 10/100Mbps Ethernet (Intel Pro100+ Server)Adapter
- The 32bit Dual Port 10/100Mbps Ethernet (Intel Pro100+Dual Port Server) Adapter
- The 32 bit PCI 10 / 100Mbps Ethernet Adapter (3COM)
- The External Fax Modem 56Kbps
- The 32 bit PCI Gigabit Ethernet (Alteon ACenic)Adapter

CD-ROM Drives

- The 40x Internal SCSI CD-ROM drive
- The 40x Internal IDE CD-ROM drive

Tape Backup Options

- The 4GB IDE Internal Tape Drive
- The DDS2 4/8GB, DDS3 12/24GB, Autoloader 48/96GB SCSI DAT Tape Backup
- The DDS4 20/40GB SCSI DAT Tape Backup
- The 20/40GB SCSI DLT External/Internal Tape Drive
- The 35/70GB SCSI DLT External/Internal Tape Drive

ISA Server Management Board

- Supported in ESMPRO Management Suite 1.5 and above
- Optional External modem
- Security (user name, password, call back feature)

CUSTOMER INTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0702-00-00	AIF-0702-IN-00	ISA Server Management Board

KIT CONTENTS
ISA Server Management Board
AC Power Module
Cables x 2
Installation Documents

! Requires an external modem

FUNCTIONS	AIF-0702-000
BUSI/F	ISA
Processor	H8/3003
NVRAM	128K
Serial port	Dual A sync Serial port
Battery	Internal
AC adapter	External
Modem	External
RTC	Internal
Reset I/F	Requires same cable as NEC's SMB
Power control	Requires same cable as NEC's SMB
Sensor	Temperature, Voltage, Optic chassis open
Interrupt	1
WDT	Internal
MONITORING	✓
Post monitoring	✓
BOOT monitoring	✓
Watch dog Timer+	✓
Shutdown (Shut down at trouble, User shut down)	✓
Temperature, Voltage, Chassis open	✓
OS Hang (Stall panic)	✓
LOG	
HW Error Log (ex. Troubles detected by monitoring)	✓
NT Event Log (System, Application, Security)	✓
OS Event Log area	✓
ALERT	
Information capturing (POST code)	✓
WAN (Atomic Alert)	✓
Pager	✓

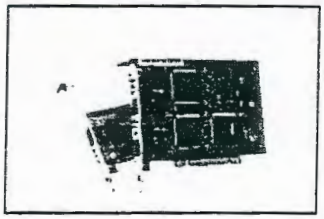
REMOTE MAINTENANCE	
Shutdown	✓
Remote Power Control (Reset, Power OFF, ON)	✓
Remote SMB configuration	✓

OTHER	
FW update	N/A
Set Threshold	✓
Security (user name, ID, Password)	✓

SOFTWARE ENVIRONMENT	
ESMPRO	✓
EV2701	✓
Windows NT,	✓
Netware	✓

The 32bit PCI 10/100Mbps Ethernet (Intel Pro 100+ Server) Adapter

- Scalable performance (up to 800Mbps) reduces server bottlenecks
- Redundant connections maximise server uptime
- Remote Server Management increases IT staff efficiency



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0519-00-00	ALN-0519-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter
1 NT disk
1 Netware disk
1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0519-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Connectors	Single: RJ-45
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	6K cache
Interrupt levels	INTA
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558

NETWORK-MANAGEMENT	
WfM baseline v2.0 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
Intel Pro/	✓
SNMP-manageable	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓

Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓

ENVIRONMENTAL LIMITS

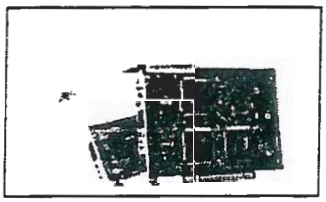
Operating temperature ^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT

	.67 Watts @ +5VDC

The 32bit PCI 10/100Mbps Ethernet (Intel Ethernet Pro 100+Dual Port Server) Adapter

- Two 10/100Mbps ports on one card
- Aggregate bandwidth up to 800Mbps
- PCI Hotplug lets you swap out an adapter with the server
- High-link availability through Adapter Fault Tolerance



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0619-00-00	ALN-0619-IN-00	

CONTROLLER SPECIFICATIONS	ALN-0619-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	Dual: PILA8472
Connectors	Dual: RJ-45

ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	12K cache
Interrupt levels	INTA and INTB
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558

NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
SNMP-manageable	✓
ACPI Support	✓

OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓
Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓
OS/2	✓
DOS	✓

ENVIRONMENTAL LIMITS	
Operating temperature ^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT	
	6.5 Watts @+5VDC

The 32bit PCI 10/100Mbps Ethernet Adapter (3COM)

- DMI 2.0 support which enables PC asset Management and diagnostics via standard DMI browsers
- Integrated Managed PC Boot Agent (MBA) allows for after hour updates, installations and repairs.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0922-00-00	ALN-0922-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter
1 NT disk
1 Netware disk
1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0918-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	3C905B-TX
Connectors	Single: RJ-45 (female)

ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5 packs
Switchless board configuration	
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	
Data rate(s) supported per port	10 & 100Mbps
On-board memory	4K cache
Interrupt levels	
IEEE support	802.3
Data path width	32-bit
Hardware certifications	
Data transfer mode	
Controller or processor	

NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	
DMI 2.0 support	✓
Board and network diagnostics	
SNMP	Optional
RMON	✓
ACPI Support	✓

OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓

Windows* 95,98	✓
Novell NetWare* 3.x and 4.x server drivers	✓
SCO UnixWare*	✓
OS/2 ODI	✓
DOS Windows 3.x	✓
Windows for Workgroups	✓
SCO Open Server 5	✓
LAN Manager	✓

ENVIRONMENTAL LIMITS

Operating temperature ^{0}C	0-70
Operating humidity %	10-90%

The NICs described in the table above can support the latest 3 sophisticated technologies:

- ✓ **Adapter Fault Tolerance**
- ✓ **Asymmetric Port Aggregation (aka "Adaptive Load Balancing")**
- ✓ **Symmetric Port Aggregation (aka "Fast EtherChannel")**

For more information visit our website at www.neccsd-europe.com and look in our Technology section.

The 32bit PCI 1Gigabit Ethernet Adapter (Alteon ACEnic)

- Full-duplex Gigabit Ethernet Interface
- Replaces multiple 100Mbps interfaces in congested servers
- Adaptive interrupt frequency
- Completely interoperable with existing Ethernet equipment

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0400-00-00	ALN-0400-IN-00	32-bit PCI Gigabit Ethernet Adapter

KIT CONTENTS
Server Adapter 1 NT disk 1 Netware disk 1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0400-00-00
Bus interface	PCI bus master, 32/64-bit, 33/66 MHz Adaptive DMA
Connections	SC Fiber connector for 62.5/125 micron fiber or 50/125 micron fiber

ADAPTER PRODUCT FEATURES	
Adaptive Interrupt Technology	✓
Separate Read & Write DMA	✓
Aggregate bandwidth	2Gbps
Full-duplex capable	✓
Data rate(s) supported per port	1Gbps
IEEE support	802.1Q
Data path width	32-bit
Maximum IP addresses per adapter	64
Embedded 32-bit RISC processor	✓

OPERATING SYSTEM SUPPORT	
Windows NT 4.0	✓
Novell NetWare 4.10 & 4.11	✓
Solaris 2.5.1, 2.6 & 2.7	✓

ENVIRONMENTAL LIMITS	
Operating temperature °C	0-50
Operating humidity %	5-85% (non-condensing)

OPERATING DISTANCES	
62.5 MICRON MM fiber	2-260 meters
50 mi	2-550 meters

The External Fax/Modem 56 Kbps

- Up to 56 Kbps Internet Connectivity
- K56flex upgradeable to ITU/TIA standard
- Enhanced ADPCM/PCM voice operation with concurrent DTMF detection

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESRIPTION
ACC-0056-**-00		External Modem 33.6KBps

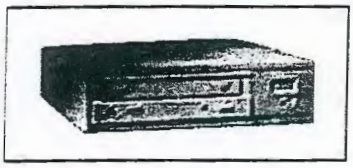
**country code BB=British, FF=French, DD=German, TT=Italian, EE=Spanish, JJ=Dutch, SS=Swedish, AA=Danish, NN=Norwegian, YB=Belgian/English, CF=Swiss/French.

KIT CONTENTS
Modem adapter Cable for power socket

MODEM FEATURES	DCC-115-AO
Modem Speed	56 Kbps Internet connectivity
Chipset Resolution	Rockwell RCVDL56ACFW/SP modem chip Downloadable MCU & Data Pump firmware from Host
DATA Modem	56 Kbps Internet connectivity (K56flex upgradeable to ITU/TIA standard) V.34bis (33.6) V.34 (28.8 Kbps) V.32 bis (14.4 Kbps) V.32, V.23, V.22, V.22 A/B, V.21 Bell 212A, Bell 103
Data Compression	V.42 bis, MNP 5
Error Correction	V.42LAPM, MNP 2-4
Fax Modulations	V.17, V.29, V.27ter
Fax Control/Protocol	Class 1, V.21 Channel 2 and Group 3 fax mode
OPERATING SYSTEM SUPPORT	
	Windows 3.1x Widows 95 Windows NT3.5x TAPI compliant
MODEM COMPONENTS	
Indicator lights	AA (auto Answering lights up when the modem is configured to answer the ring automatically TR (Data Terminal Ready) lights up when the computer raises the Data Terminal Ready (DTR) line, indicating it is ready to begin communications. CS (Clear to send) lights up when the data transfer path is clear for data transmission. OH (Off Hook) lights up when modem is connected to another modem and off hook CD (Data Carrier Detect) lights when modem detects a carrier signal the telephone line. SC (Send Data) lights up when the modem transmits data to the computer RD (Receive Data) lights up when data is receive by the modem.
CONNECTORS AND SWITCHES	
	1 x ON/OFF rocker switch 1 POWER socket for supplied cable 1 x 9-pins SERIAL PORT connector RJ11 Telephone socket for telephone line/handset 3.5mm jack for Mono Mic-Input

The 40x Internal SCSI, CD-ROM

- Up to 6,000KB/s Sustained Transfer Rate
- SCSI Interface
- 80ms Average Random Access
- 256KB Buffer



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADO-5703-00-00	ADO-5703-IN-00	40x internal SCSI CD-ROM

KIT CONTENTS
CD-ROM + Screws
Users Guide

CAPACITY AND INTERFACE	ADO-5703-xx-00
Interface	Internal SCSI-2 (ID 0 to 7)

FORMAT SPECIFICATIONS	
Average Random Access (32X)	80 ms
Compatible CD Roms Standards:	Red-Book, Yellow-Book, CD-ROM XA, CD-I Bridge (Photo-CD, Video CD), CD-I, CD-I Ready, CD-G and Multisession (Photo-CD, CD-Extra, CD-RW, CD-R), CD-TEXT

PERFORMANCE SPECIFICATIONS	
Sustained Mode 40X	2,595KB/s (20MB/s Sync.)
Burst (SCSI)	6,000 KB/s (20MB/s Sync)
Buffer Cache Size	256KB

RELIABILITY SPECIFICATIONS	
ERROR RATES	
UNRECOVERABLE-Mode 1	< 1 in 10^{15}
UNRECOVERABLE-Mode 2	< 1 in 10^{12}
Seek	< 1 in 10^{6}
MTBF	1000,000 POH @ 20% Duty Cycle

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 50
Storage Temperature ^{0}C	-10 to 60
Operating Humidity %	8 to 80 non-condensing
Wet Bulb	27 ^{0}C max

POWER REQUIREMENTS	
Avg. DC +12v, +5v (± 5%)	6.9W
Standby DC +12v, +5v (± 5%)	0.5W

The 40x Internal IDE CD ROM

- 6 MB/sec maximum data transfer rate
- 100 ms average access time
- 256 KB buffer memory
- MPC-III compliant
- E-IDE/ATAPI interface

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADR-0400-00-10	ADR-0400-IN-10	40x Internal IDE CD-ROM

KIT CONTENTS
CD-ROM + Screws
Users Guide

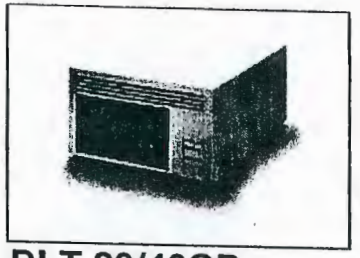
CAPACITY AND INTERFACE	ADR-0400-00-10
Interface	E-IDE/ATAPI
FORMAT SPECIFICATIONS	
Supported Formats	ISO 9660, High Sierra Group, Photo CD multisession, CD-ROM XA Mode 2 Form 1 & 2, CD-ROM mode 1& 2, CD-i FMV*, Video CD*, CD-DA, Enhanced-CD, MPC-III compliant, CD-RW, CD-R
PERFORMANCE SPECIFICATIONS	
Transfer Rate	Maximum data transfer rate 6 MB/sec
Average Access Time	100 ms(typical)
Rotation Method	CAV (constant angular velocity)
Buffer	256 KB
RELIABILITY SPECIFICATIONS	
MTBF	: 60,000 hours 10% duty cycle
PHYSICAL DIMENSIONS	
Width inches (mm)	5.87,5.87, 5.87(149)
Depth inches (mm)	7.95, 7.87, 7 (202) (200) (178)
Height inches (mm)	1.65, 1.65, 1.65 (42)
Weight kg (lbs)	1.0kg (2.2)
ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 40
Storage Temperature^{0}C	-10 to 60
Relative Humidity %	20% to 85%RH
POWER REQUIREMENTS	
Voltage Tolerance-5V DC	± 5%
Voltage Tolerance-12V DC	± 5%
Ripple+Noise Tolerance-peak to peak-5V DC	< 90 mVpp
Ripple+Noise Tolerance-peak to peak-12V DC	< 90 mVpp
Hold Track (max.)-5V DC	1200mA
Hold Track (max.)-12V DC	500mA
Seeking current (peak)-5V DC	1200mA
Seeking current (peak)-12V DC	700mA

BACKUP TAPES

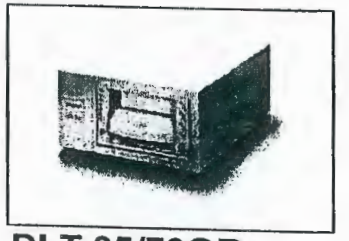
PRICE PERFORMANCE

Travan 4/8GB
STR : 300/600KB/s
Interface : IDE ATAPI (4MB/s)

DDS-2 4/8GB,
DDS-3 12/24GB
DDS-4 20/40GB
DDS-3 Autoloader 48/96GB
STR DDS2-Autoloader:
1,100/2,200KB/s
STR DDS3: 550/1,100KB/s



DLT 20/40GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast
(10MB/s)



DLT 35/70GB
DLT 40/80GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast/Wide
(20MB/s)

STR : Sustained Transfer Rate

Travan

DAT

DLT

The 4GB IDE Internal Tape Drive

- Up to 2,000- Kbyte per second native transfer rate
- Read-after-write , four head design
- High-performance 1-Mbyte buffer
- Compatible with most popular operating systems

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0800-00-00	ADT-0800-IN-00	4GB ATAPI Tape Drive

KIT CONTENTS
Internal Tape Drive
Cleaning Kit
4 screws
Tape Band
Users Guide

CAPACITY AND INTERFACE	ADT-0800-xx-00
Capacity	
Native	4.0
Interface	
Physical	IDE/ATAPI

TAPE FORMAT SPECIFICATIONS	
Compatibility	
Read only Media Compatibility	QIC-3020 QIC-3010 QIC-80
Read/Write Media Compatibility	3M Travan TR-4 Seagate8000TR4 Seagate 4000QT Sony QW-3080XLF

PERFORMANCE SPECIFICATIONS		
Performance		
Transfer Rate (Kbytes/sec)		600/450/300**
Tape Speed	Read/Write (ips)	92/69/46
	Search/Rewind (ips)	100
Backup Rate, Sustained (Native Mbytes/min, max)		30

RELIABILITY SPECIFICATIONS	
Read While write	No
MTBF (20% duty cycle)	330,000

PHYSICAL DIMENSIONS
1-inch high; configurable as 3.5-inch x 1.0-Inch or 5.25-inch x half-height (1.7inch)

ENVIRONMENTAL LIMITS	
Operating Temperature	
Internal ^{0}C	5 to 45
External ^{0}C	5 to 35

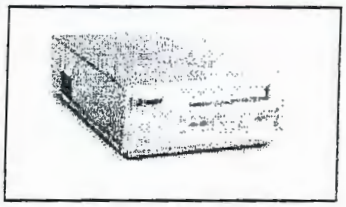
Non-Operating Temperature ^{0}C	-40 to 65
Relative Humidity %	20 to 80 non-condensing
Wet Bulb Temperature	26^{0}C

POWER REQUIREMENTS	+5V ± 5%		+12V ± 5%
Operating Internal			
Idle/Stepping (amps)	0.63/1.0		0.25/1.8
Idle Watts		0.15	
Normal Watts		15	
Max Watts		17.0	

**Based on fast sense capability

The DDS2 4/8GB, DDS3 12/24GB,DDS3 Autoloader 48/96GB SCSI DAT Tape Backup

- Native transfer rates up to 1,100 Kbytes per second
- Read-after-write, four head design
- High-performance 2-MB buffer
- Compatible with most popular operating systems



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0409-00-00	ADT-0409-IN-00	4/8GB DDS-2 DAT
ADT-2400-00-00	ADT-2400-IN-00	12/24GB DDS-3 DAT
ADT-4896-00-00	ADT-4896-IN-00	48/96GB DDS-3 DAT Autoloader

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-0409-xx-00	ADT-2400-xx-00	ADT-4896-xx-00
Compressed (GB)2			
90 Metre Tape	4.0	4.0	16.0
120 Metre Tape	8.0	8.0	32.0
125 Metre Tape	NA	24.0	96.0
Native			
90 Metre Tape	2.0	2.0	8.0
120 Meter tape	4.0	4.0	16.0
125 Metre tape	NA	120	48.0
Internal Connector			
TAPE FORMAT SPECIFICATIONS			
Recording Method	DDS-DC, DDS Helical Scan (R-DAT) ANAI/ECMA	DDS-DC,DDC Helical Scan (R-DAT) ANAI/ECMA	DDS-2, DDS-3 DDS-C, DDS Helical Scan (R-DAT) ANSI/ECMA
PERFORMANCE SPECIFICATIONS			
Transfer rate			
Native/Compressed(Kbytes/sec)	550/1,100	1,1000/2,200	1,100/2,200
Tape Speed (in/sec, mm/sec)	0.47/11.9	0.47/11.9	0.47/11.9
Head to Tape Speed (in/s, mm/s)	270/6,858	270/6,858	270/6,858
Search/Rewind speed (x normal speed)	200	200	200
Average access Time			
90 Metre Tape (sec.)	30	30	30
120 Metre tape (sec.)	40	40	40
125 Metre Tape (sec.)	NA	40	40
Buffer (Mbytes)	Flash	Flash	Flash
EEPROM	DDS-2	DDS-2	DDS-2, DDS-3
RELIABILITY SPECIFICATIONS			
MTBF (20% duty cycle)			

Internal (hours)	265,000	265,000	135,000
External (hours)	150,000	150,000	80,000
Error Rate (bits)	<1 per 10^15	<1 per 10^15	<1 per 10^15
Limited Warranty(years)	2	2	2
MTTR	<30 minutes	<30 minutes	<30minutes

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)			

ENVIRONMENTAL LIMITS

Operating Temperature			
Internal (hours)	5 to 45	5 to 45	5 to 45
External (hours)	5 to 35	5 to 35	5 to45
Non-operating Temperature Relative ^{0}C	-40% to 65	-40 to 65	-40 to 65
Humidity (%non-condensing)	20^{0}C to 80	20 to 80	20 to 80
Wet Bulb Temperature (°C)	26	26	26

POWER REQUIREMENTS

Internal +5V+12V	0.44/0.28	0.48/0.3	1.5/0.8
Watts (typ)	5.5	5.5	17.0
External (VAC universal)	100 to240	100 to 240	100 to240

The DDS4 20/40GB SCSI DAT Tape Backup

- Compressed data-transfert rates up to 5.5 Mbytes per second and 20Gbytes per hours
- Highest reliability with an MTBF of over 400,000 hours
- Read-after-write, four-head design
- High-performance 8-Mbyte buffer
- Compatible with most popular operating systems

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2000-00-00	ADT-2000-IN-00	20/40GB DDS-4 DAT

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-2000-xx-00
Compressed (Gbytes)	
90 Meter Tape	4.0
120 Meter Tape	8.0
125 Meter Tape	24.0
150 Meter Tape	40.0
Native	
90 Metre Tape	2.0
120 Meter tape	4.0
125 Metre tape	12.0
125 Metre tape	20.0
Interface	Ultra2 SCSI

PERFORMANCE SPECIFICATIONS	
Transfer rate	
Native/Compressed(Mbytes/sec)	2.75/5.5
Tape Speed (in/sec, mm/sec)	0.81/20.4
Cylinder speed (RPM)	10,000
Search/Rewind speed (x original DDS-1 speed)	400
Average access Time	
90 Metre Tape (sec.)	9.5
120 Metre tape (sec.)	12.6
125 Metre Tape (sec.)	13.2
150 Metre Tape (sec.)	15.8
Buffer (Mbytes)	8
Recording Method	DDS-4, DDS-3, DDS-2, DDS-DC,DDS, Helical Scan. ANSI/ECMA

RELIABILITY SPECIFICATIONS	
MTBF (20% duty cycle)	
Internal (hours)	>400,000
External (hours)	>200,000
Error Rate (bits)	<1 per 10^{15}
Limited Warranty(years)	3

MTTR	<0.5

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)	✓

ENVIRONMENTAL LIMITS

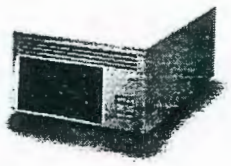
Operating Temperature	
Internal (°C)	5 to 45
External (°C)	5 to 45
Non-operating Temperature Relative ^{0}C	-40 to 65
Humidity (%non-condensing)	20 to 80
Wet Bulb Temperature (°C)	0 to 90

POWER REQUIREMENTS

Internal +5V +/- 5%	0.7/1.5
Internal +12V +/- 10%	0.05/0.25
Watts (typ)	10.5
Auto-ranging Input Voltage (external)	100 to 240

The 20/40GB SCSI DLT External/Internal Tape Drive

- 5MB/sec native transfer rate
- 20 GB native capacity
- 64-bit Cyclical Redundancy Check (CRC)
- SCSI-2 Bus and internal data path.



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2040-00-00		20/40GB SCSI DLT External Tape Drive
ADT-4000-00-00	ADT-4000-IN-00	20/40GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes cable
Blank Cartridge
Cleaning Kit
Documentation

CAPACITY AND INTERFACE	ADT-2040-xx-00 ADT-4000-xx-00
Formatted Capacity	
Native (GB)	20
Compressed (GB)	40*
Average File Access (sec)	68
Interface	SCSI-2 Fast Single-End
Internal Connector	50-Pin

TAPE FORMAT SPECIFICATION	
Recording Format	128 track serial serpentine
Recording Density	82 kbits per inch
Track Density (tpi)	256
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20GB native capacity
DLT Cleaning Tape	20 uses
Read/Write Compatible With All Previous DLT Formats	
Archive Storage	More than 30 years with less than 5% loss in demagnetisation (at 20oC and 40% non-condensing humidity)
Durability	Average 1,000,000 head passes in Typical office/computer environment

Actual transfer rate and capacity will vary depending on data.

PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	1.5
Compressed	3.01
Burst Transfer Rate (MB/sec) Synchronous	10

RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	10,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 x 1017 bits read
Undetected Error Rate	1 x 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including Media
Non-operating Temperature ^{0}C	-40 to 151
Non-Condensing Humidity	10% to 95%
Condensing Humidity %	20to 80

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	25 watts

The 35/70GB SCSI DLT External/Internal Tape Drive

- 5 MB per second native transfer rate
- 35 GB native capacity
- Recording head life of more than 30,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLTtape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-3570-00-00		35/70GB SCSI DLT External Tape Drive
ADT-7000-00-00	ADT-7000-IN-00	35/70GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-3570-xx-00 ADT-7000-xx-00
Formatted Capacity	
Native (GB)	35
Compressed (GB)	70*
Interface	SCSI-2 Fast /Wide Single-ended
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	86 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10 GB native capacities
DLTtape IIIXT	15 GB native capacity
DLTtape IV	20 and 35 GB native capacities
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	5
Compressed	10*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	30,000 hours

Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 1017 bits read
Undetected Error Rate	1 X 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	37 Watts

Read/Write compatible with all previous DLT formats
**Actual transfer rate and capacity will vary depending on data*
***Excluding bezel*

The 40/80GB SCSI DLT External/Internal Tape Drive

- 6 MB per second native transfer rate
- 40 GB native capacity
- Recording head life of more than 50,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLT tape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-4080-00-00		40/80GB SCSI DLT External Tape Drive
ADT-8000-00-00	ADT-8000-IN-00	40/80GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-4080-xx-00 ADT-8000-xx-00
Formatted Capacity	
Native (GB)	40
Compressed (GB)	80*
Interface	SCSI-2 Fast /Wide (SE/LVD or HVD)
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	98 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
MEDIA/FORMAT COMPATIBILITY	
DLTtape III	10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20, 35 and 40GB native capacities
Read/write compatible with all previous	DLT formats
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	6
Compressed	12*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	250,000 hours @ 100% duty cycle
Head Life	50,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 10^{17} bits read
Undetected Error Rate	1 X 10^{27} bits read

PHYSICAL DIMENSIONS	External	Internal**
Width - inches (mm)	6.88 (174.8)	5.7 (144.8)
Length - inches (mm)	12.8 (325.1)	9.0 (228.6)
Height - inches (mm)	6.48 (164.6)	3.25 (82.5)
Weight–pounds (kg)	14 (6.35)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	28 Watts

Read/Write compatible with all previous DLT formats

**Actual transfer rate and capacity will vary depending on data*

***Excluding bezel*

UNINTERRUPTIBLE POWER SUPPLIES

UPS Tower Format

- Smart UPS 230V/ 700VA,
- Smart UPS 230V/1000VA
- Smart UPS 230V/1400VA
- Smart UPS 230V/3000VA

UPS Rack Format (only for AZA-xx-xx rack frames)

- 3U Rackmountable 230V/1400VA UPS
- 3U Rackmountable 230V/2200VA UPS
- 3U Rackmountable 230V/3000VA UPS

UPS Accessories

- Smart Slot Interface Expander
- UPS Share Box
- Signal cable for Interface Expander and Share Box
- Link Power Cord for UPS or PDU

Uninterruptible Power Supplies

- UPS Tower based format
- Increased data protection by supporting network grade batttery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-0700-00-00	Smart UPS 700VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1000-00-00	Smart UPS 1000VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1400-00-00	Smart UPS 1400 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3100-00-00	Smart UPS 3000 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

	ABA-0700-00-00	ABA-1000-00-00	ABA-1400-00-00	ABA-3100-00-00
OUTPUT				
Output Power Cap..VA/ watts	700 / 450	1000 / 670	1400 / 950	3000 / 2250
Output Voltage	230 V	230 V	230 V	230V
Output connections	(4) IEC-320-C13	(4) IEC-320-C13	(4) IEC--320-C13	(8)IEC-320-C13
Waveform Type	Sinewave	Sinewave	Sinewave	Sineware
Transfer Time (ms)	2 (4 ms max)	2 (4 max)	2 (4 ms max)	2 (4 ms max)
Nominal input voltage	230V	230V	230V	230V
Input frequency (auto sensing)	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz
Input connection	IEC- 320-C14	IEC- 320-C14	IEC- 320-C14	IEC- 320-C20
BATTERIES				
Typical backup time (at half load)	18.2 min	20.1 min	24.0 min	18.1 min
Battery type	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte leakproof	Lead-Acid + suspended electrolyte leakproof
Recharge time (hrs)	4.0	4.4	5.14	4.5
Replacement battery catridge	RBC5	RBC6	RBC7	RBC11
COMMUNICATIONS AND MANAGEMENT				
Interface port	RS-232 port	RS-232 port	RS-232 port	RS-232 port
Management Software	PowerChute Smart-UPS bundle	PowerChute UPS bundle	PowerChute Smart-UPS bundle	PowerChute Smart UPS bundle
Control panel (LED status display withload and battery bar-graphs and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓	✓
Audible alarm	✓	✓	✓	✓
Emergency Power Off (EPO)	Optional	Optional	Optional	Optional
SURGE PROTECTION AND FILTERING				
Surge Energy rating (joules)	320	320	320	320
Filtering				

Full time multi pole noise filtering;	✓	✓	✓	✓
% IEEE surge let-through	0.7	0.3	0.3	0.3
0 clamping response time	✓ 0	✓ 0	✓ 0	✓ 0
meets UL 1440	✓	✓	✓	✓

PHYSICAL DIMENSIONS

Height (inches / cm)	6.2 / 15.7	8.5 / 2.6	8.5 / 21.6	17 / 43.2
Width (inches / cm)	5.4 / 13.7	6.7 / 17.0	6.7 / 17.0	7.7 / 19.6
Depth (inches / cm)	14.1 / 35.8	17.3 / 43.9	17.3 / 43.9	21.5 / 54.6
Weight (lbs / kg)	29.0 / 13.2	41.5 / 18.8	58 / 26.3	123 / 55.8

ENVIRONMENTAL

Operating temperature °C / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions °C / F	-15-45 / 32-120	-15-45	-15-45	-15-45
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	41 dBA	41 dBA	45 dBA	53 dBA
On line thermal dissipation	85 BTU / hr	100 BTU / hr	135 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Uninterruptible Power Supplies

- Rack based format
- Increased data protection by supporting network grade battery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-1401-00-00	3U Smart UPS (SU1400RM),1400VA4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-2201-00-00	3U Smart UPS (SU2200RM), 2200VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3001-00-00	3U Smart UPS (SU3000RM), 3000VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

TECHNICAL SPECIFICATIONS	ABA-1401-00-00	ABA-2201-00-00	ABA-3001-00-00
Output Power Capacity VA/ watts	1400 / 950	2200 / 1600	3000 / 2250
Output Voltage	230V	230V	230V
Output connections	(4) IEC-320-C13	(8)-IEC-320-C13 (1)-IEC-320-C19	8)-IEC-320-C13 (1)-IEC-320-C19
Waveform Type	Sinewave	Sinewave	Sinewave
Transfer Time (ms)	2 (4 max)	2 (4 max)	2 (4 max)
Nominal input voltage	230V	230V	230V
Input frequency	50 / 60 Hz +/- 5 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)
Input connection	IEC-320-C14	IEC-320-C20	IEC-320-C20
BATTERIES			
Typical backup time (at half load)	16.9 min	23.2 min	12.4 min
Battery type	Lead-Acid, suspended electrolyte; leakproof	Lead-Acid suspended electrolyte; leakproof	LeadAcid,suspended electrolyte; leakproof
Recharge time (hrs)	4.2	4.5	4.5
Replacement battery catridge	RBC8	RBC12	RBC12
COMMUNICATIONS AND MANAGEMENT			
Interface port	RS-232	RS-232	RS-232
Management Software	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle
Control panel (LED status display withload and battery bar-graphs and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓
Audible alarm	✓	✓	✓
Emergency Power Off (EPO)	optional	optional	Optional
SURGE PROTECTION AND FILTERING			
Surge Energy rating (joules)	320	320	320
Filtering			
Full time multi pole noise filtering;	✓	✓	✓
% IEEE surge let-through	0.3	0.3	0.3
0 clamping response time	✓	✓	✓
meets UL 1440	✓	✓	✓

PHYSICAL DIMENSIONS			
Height (inches / cm)	5.2 / 13.2	5.2 / 13.2	5.2 / 13.2
Width (inches / cm)	19.0 / 48.3	19.0 / 48.3	19.0 / 48.3
Depth (inches / cm)	14.0 / 35.6	25 / 63.5	25.0 / 63.5
Weight (lbs / kg)	58 / 26.3	103 / 46.8	114 / 51.8
Rack height	3U	3U	3U
ENVIRONMENTAL			
Operating temperature °C / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions °C / F	-15-45 / 32-120	-15-45 / 32-120	-15-45 / 32-120
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	45dBA	47 dBA	47 dBA
On line thermal dissipation	135 BTU / hr	275 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Smart Slot Interface Expander and UPS Share Box

- Enables thorough management of servers in mixed OS environments
- Essential tools to properly managing signalling from a single UPS

CUSTOMER INSTALLABLE	DESCRIPTION
AEX-2200-00-00	Smart Slot Interface Expander to manage up to 2 additional servers
AEX-2008-00-00	UPS Share Box to manage up t o 8 servers

FEATURES AND BENEFITS	AEX-2200-00-00 AEX-2008-00-00
Central UPS Management	Use one server to manage the power environment for servers with multiple UPS
Integrates with PowerChute Software	Each server runs its own copy of PowerChute plus software, for monitoring and power management of the UPS
WARRANTY AND APPROVALS	
Product Warranty	2 year warranty
Approvals	Smart Slot Interface Expander :FCC Class B, EN50022, En50082-1 Share UPS-:FCC Class A, EN50082-1

Signal Cable for Interface Expander or Share Box

CUSTOMER INSTALLABLE	DESCRIPTION
ACN-2000-00-00	Kit of 1 Cable for Interface Expander or Share Box
ACN-2001-00-00	Kit of Link Power cord for UPS or PDU

DESCRIPTION	ACN-2000-00-00
Smart Signalling UPS Link Cable	Smart Signalling RS-232 communication cable

DESCRIPTION	ACN-2001-00-00
Power cord	Smart Signalling RS-232 communication cable

MISCELLANEOUS

- Ultra2 SCSI cable Kit for internal HDD and Media device support
- SCSI cable Kit for internal UN Media device support
- SCSI cable Kit for internal UW Media support
- SCSI cable Kit with 68-pin High density External connector
- Y-shape SCSI-3 Termination cable
- SCSI Wide (68-pin) to Narrow (50-pin) connector

Ultra2 SCSI cable Kit for internal HDD and Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0025-00-00	ACN-0025-IN-00	68-Pin internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal Cable to connect Media and HDD SCSI devices

CONNECTORS	7
TYPE	68-pin
Hard Disk	3
Media Devices	3 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	37

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0026-00-00	ACN-0026-IN-00	50-pin Narrow Internal SCSI cable

KIT CONTENTS
SCSI Cable

External 50-pin conductor ribbon for Huron Chassis

CONNECTORS	
Type	50-pin
Media Devices	4
CD-ROM	✓
DAT/DDS 2	✓
DLT	To Be Confirmed
Adaptec 2920	1
PHYSICAL DIMENSIONS	
Length inches	53

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0027-00-00	ACN-0027-IN-00	68-pin Internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
Tape Drive	1 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	10.25

SCSI cable kit with 68-pin High Density External Connector

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0028-00-00	ACN-0028-IN-00	68-pin External SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
External SCSI (HD)	1
Internal SCSI (HD)	1 (50-pin)
PHYSICAL DIMENSIONS	
Length cm	45

SCSI Wide (68-pin) narrow (50-pin) converter

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACT-0010-00-00	ACT-0010-IN-00	SCSI Internal converter 68 pin HD female pins to 50 pin female pins.

KIT CONTENTS
SCSI Converter

Mouse

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
MSS-0392-01-00	MSS-0392-02-00	2 Button Mouse

KIT CONTENTS
1x 2 Button Mouse

TECNICAL SPECIFICATIONS

- 2 Button Mouse
- Resolution 320 dpi
- Microsoft complient

The 16 Bits Sound Card

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASX-0591-00-00	ASX-0591-00-00	16 Bits ISA Sound Card

KIT CONTENTS
1 16 Bits Sound Card

TECNICAL SPECIFICATIONS

- 16 Bits CD-Quality stereo recording and playback
- 32 voices of wave table audio with Creative
- WaveSynth/WG

yboard

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AKB-0587-00-00	AKB-0587-00-00	104 Keys Keyboard

KIT CONTENTS
1 x 104 keys Keyboard

MONITORS

	VR 15 Affordable Viewing Comfort	HR 15 Superior Quality for Advanced Needs	VR 17 Perfect for Business Applications
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT	CRT
Screen diagonal	15"	15"	17"
Viewable diagonal	13.8"	13.7"	16"
Anti-Glare Coating	Yes	Yes	Yes
Anti-Static Coating	Yes	Yes	Yes
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.28	0.28	0,27
Video Bandwidth (MHz)	Over 85	Over 95	Over 110
Horizontal scan frequency (kHz)	30-54	30-70	30-70
Vertical refresh rate (Hz)	50-120	50-150	55-120
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			
Contrast ratio			
Top flicker-free VESA (>75Hz)	800 x 600 @ 85Hz	1024 x 768 @ 85Hz	1024 x 768 @ 85Hz
Max non-interlaced resolution	1024 x 768 @ 60Hz	1280 x 1024 @ 60Hz	1280 x 1024 @ 60Hz
Resolutions supported	640 x 480 @ 60, 75, 85Hz 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60Hz	640 x 480 @ 60, 85, 120Hz 720 x 400 @ 70Hz 800 x 600 @ 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz, 1280 x 1024 @ 60Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz 1280 x 1024 @ 60Hz
OTHER SPECIFICATIONS			
Front panel control	Digital Control	On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	Yes	Yes
TCO 95	No	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 H1		
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 NO	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	380 x 360 x 381mm	376 x 365 x 396mm	420 x 403 x 418mm
Weight	12.5 kg	11.9 kg	15.5 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	Up to 3 years on site	Up to 3 years on site	Up to 3 years on site
Reference	**NCM-1520-H1-00** **French price list only**		
Reference	**NCM-1520-N0-00** **Rest of Europe only**	**NCM-1550-H0-00**	**NCM-1720-N0-00**
Notes	**Our monitors can only be sold together with a PC.**		

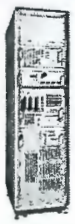
CRT and LCD MONITORS

	HR 17	HR 19	LR 15
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT short length tube	Colour TFT active matrix
Screen diagonal	17"	19"	15"
Viewable diagonal	16"	18"	15"
Anti-Glare Coating	Yes	Yes	-
Anti-Static Coating	Yes	Yes	-
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.26	0,25	0.297
Video Bandwidth (MHz)	Over 200	Over 202	Over 95
Horizontal scan frequency (kHz)	30-95	30-95	31-69
Vertical refresh rate (Hz)	50-150	50-150	56 - 85
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			200cd/m^2
Contrast ratio			200:01:00
Top flicker-free VESA (>75Hz)	1280 x 1024 @ 85Hz	1280 x 1024 @ 85Hz	-
Max non-interlaced resolution	1600 x 1200 @ 75Hz	1600 x 1200 @ 75Hz	-
Resolutions supported	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 75, 85Hz, 1600 x 1200 @ 75Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 60, 75, 85Hz, 1600 x 1200 @ 60, 75Hz	640 x 350 @ 70, 85Hz 640 x 400 @ 70, 85Hz 720 x 400 @ 70Hz 640 x 480 @ 60, 72, 75, 85Hz 800 x 600 @ 56, 60, 72, 75, 85Hz 1024 x 768 @ 60, 70, 75, 85Hz
OTHER SPECIFICATIONS			
Front panel control	One Touch On Screen Display	One Touch On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	No	No
TCO 95	Yes	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO			
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	419 x 410 x 447mm	480 x 468 x 419 mm	384 x 380 x 174 mm
Weight	17.3 kg	22,0 kg	5,0 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	up to 3 years on site	up to 3 years on site	up to 3 years on site
Reference	**NCM-1750-H0-00**	**NCM-1950-H0-00**	**NCL-1500-H0-00**
Notes	**Our monitors can only be sold together with a PC.**		

RACK SOLUTIONS

- The 27U, 36U and 42U 19" Rack Mount Frame
- Rack Mount Concentrator and Options
- The 24A Power Distribution Unit

The 27U, 36U and 42U 19"Rack Mount Frame



- Available in 27U, 36U or 42U form factors
- Designed to host your chosen combination of rackmountable Express5800 servers and storage units

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AZA-2700-00-00	N/A	19" rack mount frame 27U
AZA-3600-00-00	N/A	19" rack mount frame 36U
AZA-4200-00-00	N/A	19" rack mount frame 42U

KIT CONTENTS
Front/Rear metal vented doors and front stabiliser

PHYSICAL DIMENSIONS

U	27	36	42
Width (mm)	600	600	600
Height (mm)	1400	1800	2000
Depth (mm)	1000	1000	1000
Colour	Mist White	Mist White	Mist White

Rack-Mount Concentrator and Options

- 8-port model
- Control up to 64 servers from one console
- Patented OSCAR (On-Screen Configuration and Activity
- Reporting) user Interface allows for very easy access and control.
- Programmable scanning, naming, security and broadcast functions.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AEX-8000-00-00	N/A	1U 8 Port Monitor/Keyboard/Mouse Concentrator
ACN-0009-00-00	N/A	7' BSU to Concentrator Monitor / keyboard/ Mouse cable
ACN-0010-00-00	N/A	12' BSU to to Concentrator Monitor / keyboard/ Mouse cable
ACN-0011-00-00	N/A	12' Keyboard/Mouse/Monitor extension Cable Extension

KIT CONTENTS
8 Port Concentrator /3 cable Kit

TECHNICAL SPECIFATIONS	AEX-8000-00-00
OSCAR	On-screen pop-up menu system
Windows NT	Microsoft certified
Password security	Restrict system access through the switch
Broadcast Commands	Send the same keyboard or mouse commands to multiple computers (configurable)
Programmable scanning	Set system view time and selection pattern
SnapShot	Manages communication with the CPU during power-down
Long-line operation	Separate switch and CPUs by up to 12'
On-screen diagnostics	Displays technical assistance information on-screen
Automatic System Restart	Provides unattended reboot without administrative intervention
Power Supply	Auto senses 100-240 VAC internal
Flexible applications	SVGA, VGA, XGA, and PS/2 support Serial mouse capable with ACN-00xx00-00
Video	VGA, SVGA XGA
Regulatory	FCC-A, UL, cUL, TUV/GS, CISPER-A, VCCI, CE Mark, NEMKO
Connections	
Output:	
Console Video	HD15
Console Keyboard	PS/2
Console Mouse	PS/2
Input:	
System Video	HD15
System Keyboard	PS/2
System Mouse	PS/2
PHYSICAL DIMENSIONS	
Height inches (cm)	1.75 (4.45)
Depth inches (cm)	10.8 (27.7)
Width inches (cm)	17.0 (43.2)
Wight lbs (Kg)	9.0 (4.09)
ENVIRONMENTAL LIMITS	
Temperature (^{0}C)	10-40

The 230V Rackmountable Power Distribution Unit

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASP-0001-00-00	N/A	24A Power Distribution Unit, including 10 outlets

KIT CONTENTS
Power Distribution Unit 3 connection cords 1 power cord

TECHNICAL SPECIFICATIONS

AC Input	120/240 V
AC Output	120/240V
Current	24A/16A
Max. Current	30A/20A
Circuit Breaker	30/20/20
EMI/RFI Filter	30A
Transient Protection	6500PA
Receptacle Outlets	10, 14/16
Receptacle type	NEMA/IEC
Power Cord	12/3 - 15'
Power Plug 220V	L5-30P

	EXPRESS5800 120Ld	EXPRESS5800 120Mc2
DESIGN		
Form factor	Tower or 5U Rack	Tower or 6U Rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 2 (SMP)
Type	Pentium® III 600 to 800 MHz	Pentium® III 600 to 800 MHz
Slot type	Slot 1	Slot 1
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	256KB ECC L2 on-die
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	133 MHz
ARCHITECTURE		
Chipset	ServerSet III LE	ServerSet III LE
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	64MB/ 2GB / ECC SDRAM
Memory slots	4 DIMM	4 DIMM
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	All
MEDIA AND STORAGE		
CD ROM drive	40x EIDE	40x EIDE
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives EIDE 5400 RPM		
Hard Disk Drives EIDE 7200 RPM		
Hard Disk Drives SCSI 7200 RPM	U2W: 9.1/18.2GB	U 160/m: 9.1/18.2GB
Hard Disk Drives SCSI 10 kRPM	U2W: 9.1/18.2GB	U 160/m : 9.1/18.2GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board
RAID controller	Option	Option
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	3 / 2	4 / 3
3.5" Media bays (total / free)	1 / 0	1 / 0
3.5" Non-Hot Swap HDD bays	4 x 1.6" ***OR***	-
3.5" Hot swap HDD bays	6 x 1" (choose one type)	7 x 1" or (3 x 1.6" and 4 x 1")
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	4MB/4MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	-/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	1xUW SCSI	Option
System Management	Integrated	Integrated
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	300W
Hot-Plug PSU option	-	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1	1 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	445x220x620mm	533x289x591 mm
Weight	30 kg	30 kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35° C, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1

Standard warranty	3 year on-site	3 year on-site
Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes NTSL certified
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 1400 (option)

SERVERS AT A GLANCE

	EXPRESS5800 120Mc3	EXPRESS5800 HX4600
DESIGN		
Form factor	Tower or 7U Rack	Dual Tower or 14U rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 4 (SMP)
Type	Pentium^{R} III Xeon 733-800MHz	Pentium^{R} III Xeon 550MHz
Slot type	Slot 2	Slot 2
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	512KB or 1MB or 2MB ECC L2
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	100MHz
ARCHITECTURE		
Chipset	ServerSet III LE	Intel 450NX
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	256MB / 8GB / ECC RAM
Memory slots	4 DIMM	16 or 32 DIMM (with add. Memory board)
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	4 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	3 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
MEDIA AND STORAGE		
CD ROM drive	40xEIDE	40x SCSI
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives SCSI 7200 RPM	U 160/m: 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Hard Disk Drives SCSI 10 kRPM	U 160/m : 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x U2W SCSI on board 1x UN SCSI on board
RAID controller	Option	Standard (U2/W tri)
Maximum Internal Storage capacity	127.4GB (7x18.2)	436.8GB (12x36.4)
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	4 / 3	4 / 3
3.5" Media bays (total / free)	1 / 0	2 / 1
3.5" Non-Hot Swap HDD bays	-	-
3.5" Hot swap HDD bays	7 x 1" or (3 x 1.6" and 4 x 1")	8 or 12 x 1" or 1.6"
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	2MB/2MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	Yes/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	Option	1x UN SCSI
System Management	Integrated	Optional board
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	560W
Hot-Plug PSU option	Yes	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1 standard + 1 option	2 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	533x289x591 mm	620x445x678 mm
Weight	30 kg	77 Kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35°, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1
WARRANTY		

Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 2200 (option)

(1) 4-way : 1 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit ; 8-way : 2 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit
(2) 4-way : 1 standard + 1 option ; 8-way : 2 standard + 1 option
(3) Additional Disk Unit option and UPS option are mutually exclusive

Microsoft

Windows NT®

Operating System

Microsoft Windows NT – The Foundation

White Paper

Abstract

This paper explains the primary design goals of Microsoft® Windows NT® – robustness, extensibility and maintainability – and explains how these attributes informed and directed each aspect of the initial system design and its development over the last several years. Windows NT was designed to provide a solid foundation for future development efforts by Microsoft and the larger development community. This paper describes the original design process, provides a high-level overview of the architecture, and concludes with a real-world example of the coding standards implemented and maintained by the Windows NT design team.

Microsoft Corporation • One Microsoft Way • Redmond, WA 98052-6399 • USA

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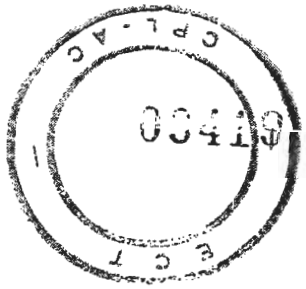
CONTENTS



INTRODUCTION

From its inception, Microsoft® Windows NT® was designed to be a robust, portable operating system that would be maintainable, flexible, and secure over time. This paper describes the design decisions that were made during the initial planning of Windows NT, describes each of the design goals in priority order (as documented in the original design documentation[1]), and describes how these goals were met in the system architecture. Finally, the paper provides an example of a subsystem component specifically designed to meet the goals of robustness and maintainability over time.

The Mission

When the Windows NT development team was formed in 1989, it had a clear mission: *to design and build a personal computer operating system that would meet the current and future operating system needs of the PC platform.* To meet this objective, the design team identified the following market requirements:

- To provide easy portability to other 32-bit architectures.
- To provide scalability and multiprocessing support.
- To support distributed computing, allowing multiple computers to share resources.
- To support the application programming interfaces (APIs) required by POSIX.
- To provide U.S. government Class 2 (C2) security features, and to provide a path to Class B1 and beyond.

The Design Goals

Based on market requirements and Microsoft's development strategy, the original Microsoft NT design team established the a set of prioritized goals. Note that from the outset, the priority design objectives of Windows NT were *robustness* and *extensibility*:

1. ***Robustness***. The operating system must actively protect itself from internal malfunction and external damage (whether accidental or deliberate), and must respond predictably to software and hardware errors. The system must be straightforward in its architecture and coding practices, and interfaces and behavior must be well-specified.
2. ***Extensibility and maintainability***. Windows NT must be designed with the future in mind. It must grow to meet the future needs of original equipment manufacturers (OEMs) and of Microsoft. And the system must be designed for maintainability—it must accommodate changes and additions to the API sets it supports and the APIs should not employ flags or other devices that drastically alter their functionality.
3. ***Portability***. The system architecture must be able to function on a number of platforms with minimal re-coding.

[1] "NT OS/2 Subsystem Design Rationale," June 1, 1989

4. ***Performance***. Algorithms and data structures that lead to a high level of performance and that provide the flexibility needed to achieve our other goals must be incorporated into the design.

5. ***POSIX compliance and government certifiable C2 security***. The POSIX standard calls for operating system vendors to implement UNIX-style interfaces so that applications can be moved easily from one system to another. U.S. government security guidelines specify certain protections such as auditing capabilities, access detection, per-user resource quotas, and resource protection. Inclusion of these features would allow Windows NT to be used in government operations.

Design Alternatives

With its primary goals in mind, the development team investigated several alternatives during the design phase.

The first design layered the POSIX API set over a slightly extended OS/2 API set. (Originally, the operating system was to have an OS/2-style user interface and was to provide the OS/2 API as its primary programming interface. However, due largely to the greater popularity of Microsoft Windows, Microsoft refocused its strategy and developed the Win32 API, a 32-bit programming interface for development of next-generation applications.) As the design progressed, it became clear that it would result in a system that would not be robust, easily maintained, or extensible. A similar attempt during the development of OS/2 led to considerable change in the base system capabilities, which further strengthened the team's conclusion that this was a poor alternative.

The next design implemented both OS/2 and POSIX API sets directly in the Windows NT executive. This was an improvement on the previous design, but the large number of oddly structured and tricky interfaces required by this design threatened the goals of extensibility and maintainability.

The third design implemented OS/2 and POSIX as protected subsystems outside the Windows NT executive. This type of client/server architecture had been successful in the academic community and at other research sites, largely because it decoupled the more volatile services from the operating system kernel—thus preserving the integrity of the operating system while allowing system services to grow and change as necessary. After analysis and an extended mock up and test cycle, it became clear that this design would provide the robustness, extensibility, maintainability, portability, and performance that the new operating system required.

The next section of this document provides an overview of Windows NT architecture, particularly as it relates to the crucial design goals of system robustness and maintainability over time.

THE WINDOWS NT DESIGN

The Windows NT system design consists of a highly functional executive, which runs in privileged processor (or *kernel*) mode and provides system services and internal processes, and a set of nonprivileged servers called *protected subsystems*, which run in nonprivileged (or *user*) mode outside of the executive. Note that the executive provides the only entry point into the system—there are no back door entry points that could compromise security or damage the system in any way.

A protected subsystem executes in user mode as a regular (native) process. The subsystem may have extended privileges as compared to an application, but it is not considered a part of the executive and, therefore, cannot bypass the system security architecture or corrupt the system in any other way. Subsystems communicate with their clients and each other using high-performance local procedure calls, or LPCs.

The NT executive includes a set of system service components—the Object Manager, the Security Reference Monitor, the Process Manager, and so forth—which are exposed through a set of API-like system services. While the executive performs some internal routines, it is primarily responsible for taking an existing process thread from a requesting subsystem or application, *validating that the thread should be processed,* executing it, and then returning control of the thread to the requestor.

Maintainability and Extensibility Over Time

The following efforts ensure that Windows NT meets its goals of maintainability and extensibility:

- The original developers of Windows NT designed the system to be simple and provided extensive code documentation. This, coupled with a common coding standard used throughout the system, has enabled subsequent programmers to work on any piece of the system without having to consult a system expert to learn about hidden rules, side effects, magical programming tricks, or Windows NT folklore. The code is straightforward—as is the documentation.
- By using subsystems to implement major portions of the system, Windows NT isolates and controls dependencies. For example, the only piece of the system affected by a change to the POSIX standard is the POSIX subsystem. The design of the process structure, memory management, synchronization primitives, and so on, are not affected.
- The Windows NT design accommodates change and growth. Subsystems that provide additional functionality can be added to the system without impacting the base system. New subsystems can be added without modifications to the Windows NT executive; for example, new subsystems can be added to allow limited support for operating system environments other than the Microsoft-provided MS DOS, OS/2, Win32, and POSIX environments. Moreover, the executive itself is modular in design—because its components are independent from each other and interact in predictable ways, and because the interfaces between these components are so carefully controlled, it is possible to replace

a component without adversely impacting the system. If the new version implements all of the system services and internal interfaces correctly, the operating system will function as before.

- Perhaps most importantly, all subsystems can be coded to take advantage of the security features provided in Windows NT.

The following illustrates the basic architecture of the operating system through version 3.51 (note that only a few of the subsystems are illustrated).

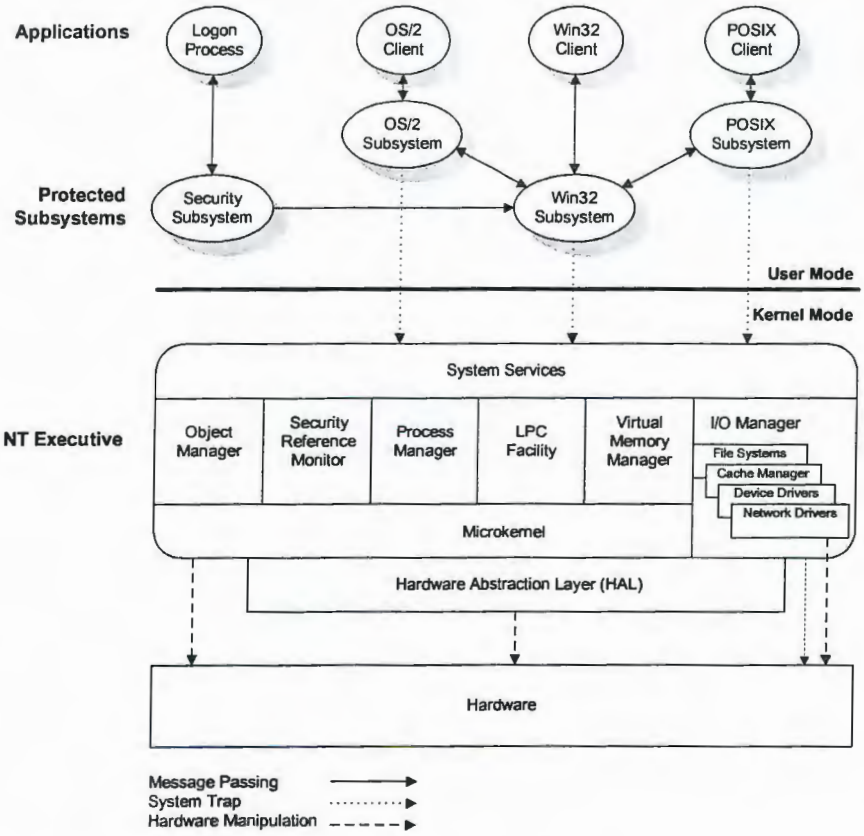


Figure 1. Windows NT Basic Architecture – version 3.51 and earlier

In Windows NT 4.0, much of the Win32 graphical user interface (GUI) subsystem—the Window Manager, Graphics Device Interface (GDI), and related graphics drivers—were moved from a body of code that executed in the csrss.exe subsystem process to a kernel mode device driver (win32k.sys).. The console, shutdown, and hard error handling portions remain in user mode. This change significantly improves system performance while decreasing memory requirements, and has no impact on application developers. Applications now access the GUI implementation subsystems just as they access other system services, such as I/O and memory management. This change only serves to demonstrate the maintainability and flexibility of the Windows NT modular design.

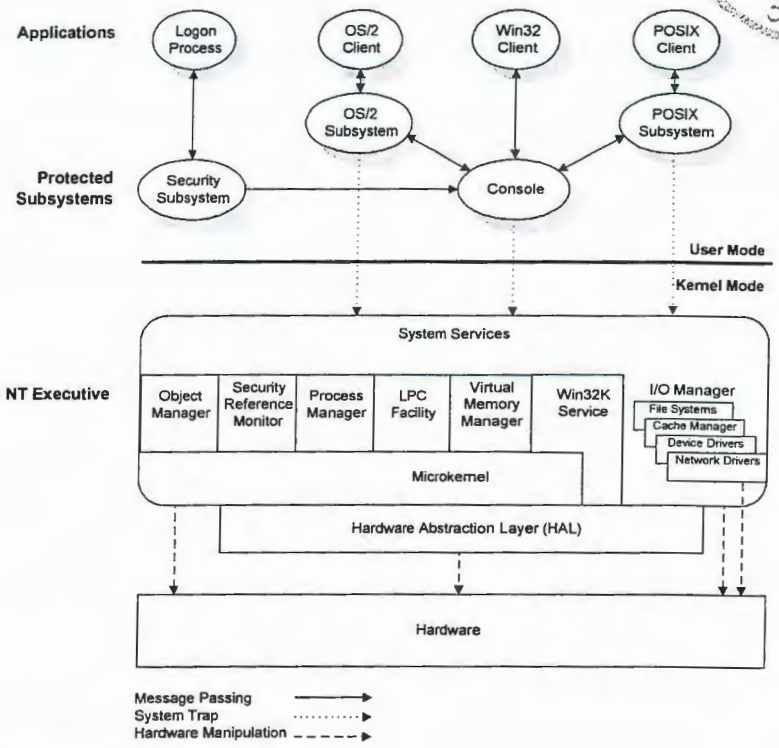


Figure 2. Windows NT Basic Architecture – version 4.0

Built-in Robustness

Windows NT meets its primary goal of robustness as follows:

- The kernel mode portion of the system exports well-defined APIs that, in general, do not have mode parameters or other magic flags. Therefore, the APIs are simple to implement, easy to test, and easy to document.
- A formal design document was produced for all portions of the Windows NT system prior to coding. This effort led to well-documented interfaces for native services and internal functions.
- The partitioning of major components, such as Win32, OS/2, and POSIX, into separate subsystems resulted in a simple, elegant designs for these subsystems. Each subsystem implements only those features needed to provide its API set.
- The prevalent use of frame-based exception handlers (exception handlers associated with a particular procedure or part of a procedure) allows Windows NT and its subsystems to catch programming errors and filter bad or inaccessible parameters in an efficient and reliable manner.

The division of the operating system into kernel-mode system services and subsystems adds a layer of validation to ensure that poorly behaved applications can't crash the operating system.

The next section of this document describes the argument probing and capture requirements to which all system services must adhere. The requirements described here are part of a living document that has existed since the project began in 1989, and serve to illustrate Microsoft's longstanding commitment to robustness and maintainability in the Windows NT code base.

ARGUMENT VALIDATION IN WINDOWS NT

Since its inception, Windows NT development has required that system services be written to be robust and provide protection against malicious attack and inadvertent program bugs. To meet the goal of robustness, it must not be possible to crash or corrupt the system by passing an invalid argument value, a pointer to memory that is not accessible to the caller, or by dynamically altering or deleting the memory occupied by an argument in a simultaneously executing thread.

The next few subsections detail some of the standards and coding practices used in the development of past and future versions of Windows NT.

System Service Requirement

To ensure robust system operation, each system service must ensure that the arguments on which it operates are valid (that is, the values are correct). This requires the service to capture the values and probe the argument addresses at appropriate points. In general, a system service should capture all arguments at the outset. This ensures that the caller or one of its threads cannot dynamically alter the value of the argument after it has been read and verified, or delete the memory in which it is contained.

In some cases, it is not necessary to capture the value of an argument immediately. Such is the case for I/O buffers and name strings. However, all pointers MUST be captured and the addresses to which they point MUST be probed for accessibility.

Fortunately, most arguments do not need explicit capture since they are passed in registers. Arguments that are passed in memory are probed and captured by the system service dispatcher as necessary.

Address Space Layout

The address space layout of Windows NT clearly separates user address space from system address space.

- All addresses above the boundary are system addresses and all addresses below the boundary are user addresses. Furthermore, at the boundary between user address space and system address space, there is a 64K barrier that is inaccessible to both modes. With this address space design, it is possible to determine whether an address is a valid user address simply by comparing boundaries.
- Pages in the system part of the address space are owned by kernel mode and are not accessible to the user unless they are double-mapped into the user portion of the address space. Pages in the user part of the address space are owned by user mode. The executive *never* creates a page that is owned by kernel mode in the user part of the address space.

System Service Operation

System service operation should occur as described in the following paragraphs.

When a system service is called, the trap handler gets control, saves state, and transfers control to the system service dispatcher. The system service dispatcher determines which system service is being called, and obtains the address of the appropriate function and the number of in-memory arguments from a dispatch table.

If the previous processor mode is **user** and there is one or more in-memory arguments, the in-memory argument list is probed and copied to the kernel stack.

- If an access violation occurs during the copy, the system service finishes with a status of "Access Violation."
- If an access violation does not occur, the pointer to the in-memory argument list is changed to point to the copy of the arguments on the kernel stack.

The system service dispatcher sets up a catch-all condition handler and then calls the system service function.

The system service establishes an exception handler. This handler should handle any access violation that may occur as argument pointers are de-referenced to read or write actual argument values.

The system service obtains the previous processor mode.

- If the previous mode was **kernel**, there is no need to probe any arguments. The executive does not call one of its own services and provide bad arguments.
- If the previous mode was **user**, any argument values that are read or written by de-referencing a pointer must be probed for accessibility. To probe a pointer, the service first ensures that the address of the variable is within the user's address space, and then reads or writes the variable as appropriate. The code that actually probes pointer-related arguments does not set up a condition handler. It merely does a boundary check and then reads or writes the indicated location. If the boundary check fails or if the memory is inaccessible, an access violation occurs. (Note that probes are not expensive in terms of system resources.)

The code at the beginning of a system service should be constructed as follows:

```
PreviousMode = KeGetPreviousMode();
if (PreviousMode != KernelMode) {
  try {
    ProbeForWrite(ProcessInformation,
          ProcessInformationLength,
          sizeof(ULONG));
    if (ARGUMENT_PRESENT(ReturnLength)) {
      ProbeForWriteUlong(ReturnLength);
    }
  } except(EXCEPTION_EXECUTE_HANDLER) {
```

```
        return GetExceptionCode();
    }
}
```

This code sequence guarantees that all address parameters that the service is going to write through are valid user-mode addresses. If any of the probes were to fail, an exception would occur and the exception code would be returned as the service status. Since for this service, **ProcessInformation**, and **ReturnLength** are direct arguments to the service, they do not need to be captured manually inside the service. The system service dispatcher captures them on entry to the system.

CONCLUSION

From the outset, Windows NT was designed to be a robust, reliable operating system that could be easily maintained and that could be extended to take advantage of new technologies as they were developed. The system includes a highly functional executive that executes in kernel mode, and provides native system services. The executive provides the sole, secure entry point into the system—there are no back door entry points that could compromise security or damage the system in any way. In addition, the design includes a layer of protected system services that function in user mode between the application layer and the operating system. This modular approach allows additional crucial services to be added—with no change to the executive layer. Each major executive subsystem has been extensively documented to ensure that standard coding practices are used and that all features adhere to the system design and are maintainable over time.

This design has remained virtually unchanged from 1989 until now. It provides the foundation for all versions of Windows NT to date, including the highly distributed version that will be shipped in 1998.

FOR MORE INFORMATION

For more information on the design and architecture of Windows NT, refer to the product documentation. Historical information about the development and early design of Windows NT can be found in *Inside Windows NT* from Microsoft Press.

For the latest information on Windows NT Server, check out our World Wide Web site at http://www.microsoft.com/ntserver the Windows NT Server Forum on the Microsoft Network (GO WORD: MSNTS).

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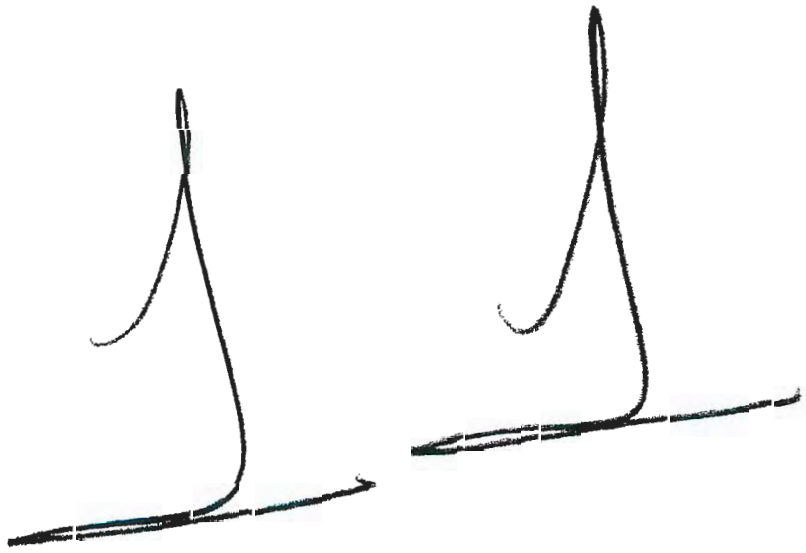

Escala EPC Series Reference Guide

This edition of the Escala EPC Series Reference Guide describes the Escala EPC Series offer enhanced in:

- **30 April 1999**

The Escala Powercluster Technical Guide consists of a single section:

Section 1: System Hardware, Terminals and Printers

- This Section consists of 8 chapters: Hardware Overview, Models Description, Disks/Media/Subsystems and Libraries, Memory Expansion Cards, Interconnections, Communications Adapters, and Modems, Cluster Management/Terminals and Printers, Reference Information, Conformance to Standards


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Chapter 1: Hardware Overview

1. Escala EPC Positioning and Strategy

The Escala EPC is targeted to users who need:

- Server consolidation.
- Large OLTP server.
- E-commerce.
- Large database server (Datacenter).
- Large Decision Support (DSS) Server.
- Supply Chain Management (SCM).
- Customer Relationship Management (CRM).
- Enterprise Resource Planning (ERP) server in three tier architecture.

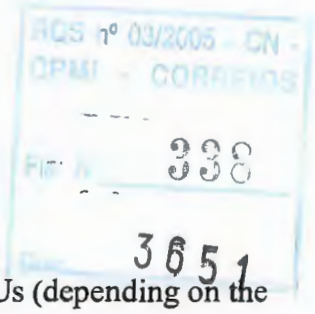
The Escala EPC provides:

- Solutions to improve decision making & enterprise department management (e.g. Supply Chain Management & Customer Relationship Management).
- Power & reliability for high-speed query response times, without system interruption.
- Consolidation solutions to avoid the high administration & maintenance costs of overly distributed systems.
- Scalability & flexibility to adapt to growing business needs and provide investment protection.
- High availability to avoid costly downtimes and data loss.
- Easy management facilities to reduce training costs.
- Unix high-level expertise to optimize implementation of customers' IT projects.
- Affordable prices to optimize IT budget allocation.

Customers' benefits with EPC solutions are the following:

- Lower investments (consolidation).
- Reduced total cost of ownership.
- Better budget allocation monitoring.
- Floor space use optimization.

The strategy is to enforce the Escala EPC offer in the following areas:



Performance & scalability

- Highly powerful, well-balanced architecture.
- 64-bit capable.
- Unlimited power growth allowing to cluster up to 32 nodes with 1 to 24 CPUs (depending on the EPC model) in a high availability environment, and even more nodes in a non-HA environment.

Robustness and availability for production

Downtime reduced to a few minutes per year, with HA, storage and backup solutions plus manageability tools.

Industry-leading solutions portfolio

Broadest choice of partner solutions and services: SAP, BAAN, Oracle, Informix, Netscape and over 15,000 AIX® applications.

Security for vital business assets

Leading set of security tools and solutions with AIX®, Internet/Intranet and end-to-end enterprise security management.

Expertise in services and support

A complete set of service packages, customer benchmarking facilities and highly skilled consulting services.

2. Escala EPC General Features

The Escala EPC provides easy-to-use clusterable SMP (Symmetrical Multi-Processing) nodes, based on Bull's PowerScale™ architecture and on PowerPC™ technology, giving exceptional reliability and availability, scalability and flexibility, parallel computing power and high levels of fault resiliency and redundancy.

Bull Escala EPC products are clusters of UNIX-based Escala computers. The Escala EPC family is based on the PowerPC RISC architecture using symmetric multiprocessing.

2.1. Reliability and Availability

Excellent quality and reliability are inherent in all facets of Bull EPC products. The measures taken help ensure that the products operate when required, perform reliably, efficiently handle infrequent failures in a nondisruptive fashion, and provide timely and competent repair to allow resumption of operations with minimal inconvenience. For example, the Escala EPC servers have embedded service processor and ECC memory.

The AIX operating system and appropriate software tools make the most of the Escala EPC hardware features by providing:

- Error monitoring (including alarm transmission).
- Remote service session management.

Remote maintenance and diagnostics - including console mirroring from a remote site - allows a service technician to dial in through a secure connection and correct a potential malfunction before it occurs or reboot and restore system function as soon as possible after an outage. For even greater reliability, the platform also supports HACMP clustering software, the leading UNIX clustering solution.

Reliability begins with the development of architectures, where RAS innovations are of paramount importance. It flows through design and product development stages, where RAS designs are reviewed, assessed, developed, evaluated, and optimized. It continues through the manufacturing and release processes, where the manufacturing quality is extensively measured and is under continual evaluation. It culminates in service and support, where reliability is consistently monitored for deviation from the criteria, warranty and maintenance have undivided focus, and where significant customer business problems are assigned to a key managerial representative and remedied by an expert team.

2.2. Scalability

Scalability is also a key design consideration. The Escala servers can be easily upgraded. The packaging permits convenient replacement or upgrading of processor, memory and I/O adapters. For example, processors are contained on processor cards that plug into slots on the system board. Upgrading a system is just a matter of plugging in an additional processor card.

The AIX operating system provides reliability and serviceability by means of Logical Volume Manager (LVM), Journaled File System (JFS) and dynamic kernel, all contributing to a reliable and robust operating system implementation.

2.3. Cluster Architecture - Escala EPC Clustering Design

A cluster architecture can be defined as a rather small set (a few tens) of interconnected systems that share some resources (which will be referred to as clustered resources) in a fully transparent manner. Each of these systems could be an independent system, because it has its own processor(s), memory, and I/O channels, as well as its own copy of the operating system.

The operating system for a cluster provides transparent access to clustered resources, and also provides a unified view of the cluster for system management.

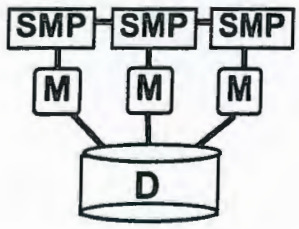
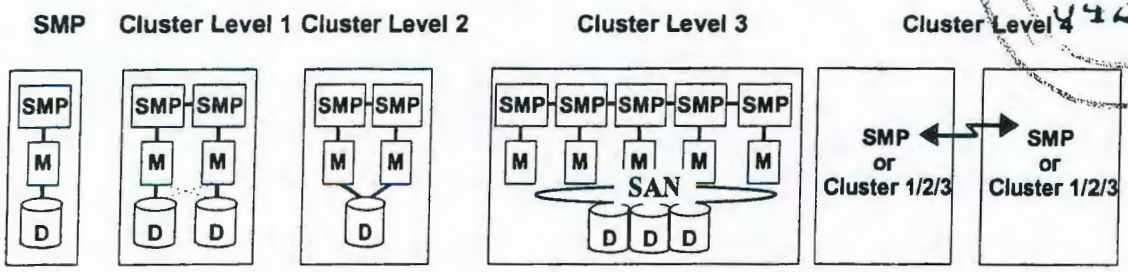


Figure 1: Cluster architecture

Clustering of Symmetric MultiProcessing (SMP) systems with shared disks is a choice acknowledged as the most appropriate to insure both full compatibility, high availability and a steady increase of the performance for UNIX production environment. The first Escala EPC cluster offers started with a shared disk architecture (depicted in figure 1 wherein M stands for Memory and D stands for shared disks). Clustering was an answer to overtop the limitations of SMP technology.

The EPC in its current stage encompasses, in a same cluster unit, cooperative SMP servers with or without shared disks, and individual SMP servers, as depicted in figure 2. With the construct of only individual servers, this cluster architecture includes the definition of server consolidation.



	Targets	Typical nb. of nodes	Typical apps.
SMP	non-critical applications departmental and dedicated server	1	DB/TP DW, WEB
Cluster Lev.1	critical (HA) applications departmental to enterprise dedicated server	2	DB/TP DW, WEB
Cluster Lev.2	critical, "share everything" applications (OPS) departmental to enterprise dedicated server	2 - 8	DB/TP Large DW
Cluster Lev.3	Storage Aera Network for critical and 3-tier applications, large department, enterprise server	2 - 32	ERP, WEB Large DW+data mart
Cluster Lev.4	geograhic cluster (disaster recovery) departmental to enterprise server	2 - 4	DB/TP, ERP Large DW

Figure 2: Cluster Main Topologies

HACMP (High Availability Cluster Multi-Processing for AIX) is the core framework for clustering. It provides mechanisms for controlling the cluster. The main HACMP module "High Availability Subsystem" (HAS) is in charge of recognizing changes within the cluster and starting, coordinating the actions needed, when a failure occurs, for reconfiguring the environment and assuring resources takeover. In addition, HACMP features a module, the "Concurrent Resource Manager" (CRM) which adds concurrent shared access management for the disks.

The Escala EPC implements the full HACMP functionality on rackmounted multiple clustered Escala systems, and achieves both inherent high availability and more performance with the CRM.

The HACMP 4.3 environment supports up to 32 nodes, while the CRM supports up to 8 nodes.

The cluster interconnect is based on Ethernet (10/100 Mb/s, 1 Gb/s) and FDDI. Dual connections are often used to increase availability.

The main benefits of the cluster architecture are:

- Centralized administration (single point of control).
- Scalability.
- Flexibility.
- Parallel performance.
- High Availability features.

The rationale of the Bull approach is to exploit the various architectural options in a common framework. The goal is to benefit from both SMP scalability (with the PowerScale Architecture) within the limits of the technology and cluster configurations for high availability, and higher performance for applications that can benefit from this form of parallelism.

2.4. PowerPC

2.4.1. Architecture

The PowerPC architecture is a derivative of the multi-chip POWER architecture that has been developed specifically for single-chip processor designs. The changes incorporated in the PowerPC architecture from POWER architectures are:

- Simplified instruction set.
- Single precision floating point.
- Modified storage model.
- Multi-processor support.
- Simplified I/O architecture.

The PowerPC architecture is binary compatible with applications written for POWER architecture. Any unimplemented, infrequently used POWER instructions are trapped and emulated.

2.4.2. Technology

PowerPC 604e Processor

The PowerPC 604e is a superscalar processor capable of issuing four instructions simultaneously. As many as seven instructions can finish execution in parallel. The PowerPC 604e has six execution units that can operate in parallel:

- Floating-point unit (FPU)
- Branch processing unit (BPU)
- Condition Register Units
- Load/store unit (LSU)
- Three integer units (IUs)
  - Two single-cycle integer units (SCIUs)
  - One multiple-cycle integer unit (MCIU).

This parallel design, combined with the PowerPC architecture's specification of uniform instructions that allows for rapid execution times, yields high efficiency and throughput. The PowerPC 604e's rename buffers, reservation stations, dynamic branch prediction, and completion unit increase instruction throughput, guarantee in-order completion, and ensure a precise exception model. (Note that the PowerPC architecture specification refers to all exceptions as interrupts.)

The PowerPC 604e has separate memory management units (MMUs), and separate 32-KB on-chip caches for instructions and data. The PowerPC 604e implements two 128-entry, two-way set (64-entry per set), associative Translation Lookaside Buffers (TLBs), one for instructions and one for data, and provides support for demand-pages virtual memory address translation and variable-sized block translation. The TLBs and the cache use least-recently used (LRU) replacement algorithms.

The PowerPC 604e has a 64-bit external data bus and a 32-bit address bus. The PowerPC 604e interface protocol allows multiple masters to compete for system resources through a central external arbiter. Additionally, on-chip snooping logic maintains data cache coherency for multiprocessor application. The PowerPC 604e supports single-beat, and burst data transfers for memory accesses and memory-mapped I/O accesses.
The PowerPC 604e uses an advanced, 3.3-V CMOS process technology and is fully compatible with TTL devices.

PowerPC RS64-II Processors

The PowerPC RS64-II is a 4-way, superscalar microprocessor implementing the 64-bit PowerPC architecture. The internal structure of the processor is optimized for commercial transactions.

- Full 64-bit implementation of PowerPC architecture.
- Architectural extensions for 32-bit OS migration support.
- PowerPC Common Hardware Reference Platform (CHRP) compliant.
- 4-way superscalar.
- On chip 64KB L1 Instruction cache and 64KB Data cache, 128-byte line size.
- On chip L2 cache controller:
  - Up to 8 MB 4-way set associative L2 cache using 4 Mbit SRAM chips.
  - Up to 32 MB 4-way set associative L2 cache using 16 Mbit SRAM chips.
  - 32 Byte Data Buses.
- PowerPC 6XX Bus Architecture:
  - 16 Byte data bus (2:1, 3:1 or 4:1).
- Full multiprocessor support.
- Technology:
  - CMOS 6S2.
  - Standard Cell Library.
- Data Integrity:
  - L1 Data cache = ECC.
  - L1 Instruction cache = Parity and Retry.
  - L2 cache = ECC.
  - Main Storage = ECC.
  - I/O and Bus = Parity.

PowerPC RS64-III Processors

The RS64 III superscalar processors have been well optimized for commercial workloads. Target environments are characterized by heavy demands on system memory, both in the form of very large working sets and latency-sensitive serial dependencies. As a result, the design of the RS64-III processors has focused on large cache sizes and data paths having high bandwidth and low latency.

The RS64 III processor has separate internal 128 KB L1 caches for instructions and data. Both L1 caches have doubled in size over the RS64-II. It contains an L2 cache controller and a dedicated 32-byte interface to a private 4-way set associative L2 cache. The L2 cache controller supports up to 8 MB L2 cache. The L2 interface runs at half processor speed, but transfers data twice per cycle to provide 14.4 GB/s of bandwidth. RS64 III internal data paths are 32 bytes wide. The RS64 III processor also has a separate 16-byte system bus interface.

The RS64-III has a total of five pipeline execution units. There is a Branch Unit, a Load/Store Unit, a Fixed-point Unit, a Complex Fixed-point Unit and a Floating-point Unit. The processor has a 32-byte interface to the dispatch logic. There is a current instruction stream dispatch buffer that is 16 instructions deep. The RS64-III has an eight deep branch buffer. The RS64-III can sustain a decode and execution rate of up to 4 instructions per cycle.

All of the arrays in the RS64-III have either redundancy and ECC or parity and retry to support the high requirements desired for customer reliability, availability and integrity. This enables full fault detection and correction coverage.

Benefits to Escala Performance

The Escala models have the following major attributes:

- The operating system can schedule and synchronize work across the available processors.
- A high-bandwidth bus is provided for access between cache and memory.
- Cache and memory are efficiently managed to provide cache consistency.

An example of how the design of the Escala servers can maximize performance follows:

- The most recently used or projected to use program elements are kept in L1 cache (fastest access).
- Programs and control objects are kept in L2 cache (next fastest).
- Directories to databases are kept in memory (next fastest to L2 cache).
- Actual databases are stored on disk drives.

3. Escala EPC Features Summary

The Bull Escala EPC offer is made of rackable nodes that can be assembled into clusters of UNIX-based Escala computers or racked together for consolidation. The main elements of this offer are nodes, interconnection, cluster or node management, disk subsystems and tapes/libraries subsystems. Whenever possible these elements can be integrated into racks.

The Escala EPC offer comprises ranges of tightly clusterable UNIX servers, scaleable up to 32 nodes in HA mode (and more without HA), which are linked by a coordinated system of standard-based networks and housed in a highly scaleable rack configuration. The clustering framework of the Escala EPC is implemented with HACMP subsystem installed on every node. Graphical console solutions provide cluster management and single point of control.

The Escala EPC family is composed of entry-level (EPC400 EPC430, EPC440 and EPC450), midrange (EPC800) and high-end (EPC1200, EPC1200A and EPC2400) systems.

3.1. Escala EPC Models and Nodes

The Escala EPC nodes are built from basic models. Each model is a basic component of an EPC Series. The need of power and scalability defines the EPC Series to choose for a Customer.

Each component of the Escala EPC is expandable by adding:

- CPU boards in the basic drawer.
- Memory boards (or banks).
- Internal disk/media devices or expansion drawers, disk subsystems (DAS and EMC) and tape library subsystems (DLT Overland).
- Adapter boards or expansion drawers.
- Nodes in the rack.

The following models are available:

3.1.1. ESCALA EPC400

- SMP rack-drawer server.
- 1- to 4-way PowerPC 604e @ 360 MHz.
- 4MB L2 cache per processor.
- Up to 3 GB ECC DRAM memory.
- Up to 218.4 GB of internal disk capacity:
  - 109.2 GB internal disks capacity in the base drawer.
  - 109.2 GB additional internal disk capacity with expansion drawer.
- 12 bays for hot swappable disks:
  - 6 bays in the base drawer.
  - 6 additional bays with expansion drawer.

- 5 bays for media:
  - 3 bays (1 for CD-ROM, 1 for floppy disk and 1 free) in the base drawer.
  - 2 additional media bays with expansion drawer.
- 18 free I/O slots:
  - 8 I/O slots in the base drawer: 5 64 bit PCI + 2 ISA/PCI + 1 ISA.
  - 2x5 additional free PCI slots with expansion drawer and expansion bus.
- Integrated Ethernet 10/100 Mb/s.
- 8117 transactions per minute.

3.1.2. ESCALA EPC430

- 64-bit SMP rack-drawer server.
- 1- to 4-way PowerPC RS64-II processors at 262 MHz.
- 4MB L2 cache per processor.
- Up to 8GB ECC SDRAM memory.
- Up to 218.4 GB of internal disk capacity:
  - 109.2 GB internal disks capacity in the base drawer.
  - 109.2 GB additional internal disk capacity with expansion drawer.
- 12 bays for hot swappable disks:
  - 6 bays in the base drawer.
  - 6 additional bays with expansion drawer. 6 bays in the base drawer.
- 5 bays for media:
  - 3 bays (1 for CD-ROM, 1 for floppy disk and 1 free) in the base drawer.
  - 2 additional media bays with expansion drawer.
- 18 I/O slots:
  - 8 I/O slots in the base drawer: 7 PCI (4*64 bit) + 1 ISA/PCI.
  - 10 additional free PCI slots with expansion drawer.
- Integrated Ethernet 10/100 Mb/s.
- 13700 transactions per minute.

3.1.3. ESCALA EPC440

- 64-bit SMP rack-drawer server.
- 1-to 4-way RS64-II processors at 340 MHz.
- 4MB L2 cache per processor.
- Up to 8GB ECC SDRAM memory.
- Up to 218.4 GB internal disks capacity.
- 12 bays for hot swappable disks.
- 3 bays for media (1 for a CD-ROM drive, 1 for a floppy disk drive and 1 free).
- 8 PCI slots (4*64 bit).
- Integrated Ethernet 10/100 Mb/s.

- 17133 transactions per minute.

04252

3.1.4. ESCALA EPC450

- 64-bit SMP rack-drawer server.
- 1- to 4-way PowerPC RS64-III processors at 400 MHz.
- 4MB L2 cache per processor.
- Up to 8GB ECC SDRAM memory.
- Up to 218.4 GB of internal disk capacity:
  - 109.2 GB internal disks capacity in the base drawer.
  - 109.2 GB additional internal disk capacity with expansion drawer.
- 12 bays for hot swappable disks:
  - 6 bays in the base drawer.
  - 6 additional bays with expansion drawer.
- 5 bays for media:
  - 3 bays (1 for a CD-ROM drive, 1 for a floppy disk drive and 1 free) in the base drawer.
  - 2 additional media bays with expansion drawer.
- 18 I/O slots:
  - 8 I/O slots in the base drawer: 7 PCI (4*64 bit) + 1 ISA/PCI.
  - 10 additional free PCI slots with expansion drawer.
- Integrated Ethernet 10/100 Mb/s.
- More than 19000 transactions per minute.

3.1.5. ESCALA EPC800

(Discontinued: 31/12/1999)

- SMP rack-drawer server.
- 2- to 8-way PowerPC 604e @ 320 MHz.
- 4MB L2 cache per processor.
- Up to 4 GB ECC DRAM memory.
- Up to 72.8 GB of internal disk capacity:
  - 18.2 GB in the base drawer.
  - 54.6 GB additional disk capacity with the expansion disk drawer.
- 6 bays for hot swappable disk:
  - 2 bays in the base drawer.
  - 4 additional with the expansion disk drawer.
- 2 bays for media (1 for a CD-ROM drive, 1 for a floppy disk drive) in the base drawer.
- 3 bays for either disks or media:
  - 1 in the base drawer.
  - 2 additional bays with the expansion drawer.
- Up to 16 MCA slots:
  - 8 MCA in the base drawer with at least one slot used to drive media and disks.
  - 8 additional MCA slots with the expansion bus.
- Integrated Ethernet 10/100 Mb/s.

- 11400 transactions per minute.

3.1.6. ESCALA EPC1200 and EPC1200A

(EPC1200 discontinued as of 30/11/1999)

- 64-bit SMP system.
- 4-, 8-, or 12-way Power PC RS64-II@262 MHz or PowerPC RS64@125 MHz (EPC1200 only).
- 8 MB L2 cache per processor.
- Up to 32 GB memory.
- Up to 4 I/O drawers.
- Up to 873.6 GB internal disk capacity:
  - 218.4 GB per I/O drawer.
- 48 disk bays:
  - 12 bays per I/O drawer.
- 8 media bays:
  - 2 media bay per I/O drawer.
- Up to 56 PCI adapter slots:
  - One slot used for the service processor in the primary I/O drawer.
  - One slot used to drive media and disks in the primary I/O drawer.
  - 12 additional free slots in the primary I/O drawer.
  - 14 slots per additional I/O drawer.
- 34139 transactions per minute.

3.1.7. ESCALA EPC2400

- 64-bit SMP system.
- 6-, 12-, 18- or 24-way Power PC RS64-III processors at 450 MHz.
- 8 MB L2 cache per processor.
- Up to 64 GB memory.
- Up to 4 I/O drawers.
- Up to 873.6 GB internal disk capacity:
  - 218.4 GB per I/O drawer.
- 48 disk bays:
  - 12 bays per I/O drawer.
- 8 media bays:
  - 2 media bay per I/O drawer.
- Up to 56 PCI adapter slots:
  - One slot used for the service processor in the primary I/O drawer.
  - One slot used to drive media and disks in the primary I/O drawer.
  - 12 additional free slots in the primary I/O drawer.
  - 14 slots per additional I/O drawer.
- 135815 transactions per minute.

3.2. Escala EPC Models in Figures

	EPC400	EPC430	EPC440	EPC450	EPC800	EPC1200/1200A	EPC2400
Racks	1	1	1	1	1	2	2
CPUs per node	1 to 4	1 to 4	1 to 4	1 to 4	2 to 8	4 to 12	6 to 24
I/O slots / node (max)	18	18	8	18	16	56	56
Memory / node (max)	3GB	8GB	8GB	8GB	4GB	32GB	64GB
Internal disk / node (max)	218.4GB	218.4GB	218.4GB	218.4GB	72.8GB	873.6GB	873.6GB
Transaction/minute per node (estimated min-max)	3325-8117 (2)	4600-13700 (3)	5700-17133 (3)	5800-19000 (3)	4100-11400 (2)	7250-18666 or 13800-34139 (1)(3)	42000-135815(3)

(1) With PowerPC RS64@125MHz or RS64-II@262MHz respectively.
(2) Sybase.
(3) Oracle.

3.3. Additional Nodes and Models

Different types of nodes can be mixed together in a configuration. Nodes can be added to a model according to the following table:

Models \ Nodes	EPC400	EPC430	EPC440	EPC450	EPC800	EPC1200	EPC1200A	EPC2400
EPC400	Y	Y	Y	Y	N	Y	Y	Y
EPC430	Y	Y	Y	Y	N	Y	Y	Y
EPC440	Y	Y	Y	Y	N	Y	Y	Y
EPC800	Y	Y	Y	Y	Y	Y	Y	Y
EPC1200	Y	Y	Y	Y	N	Y	Y	Y
EPC1200A	Y	Y	Y	Y	N	Y	Y	Y
EPC2400	Y	Y	Y	Y	N	Y	Y	Y

3.4. Racks

There are three types of racks:

- 1.8m high expansion rack for the EPC800 (usually referred as EPC800 rack).
- 1.8m high expansion rack for the EPC400, EPC430, EPC440 and EPC450 (usually referred as EPC400 rack).
- 1.6m high I/O rack for the EPC1200, EPC1200A, EPC2400 and EPC440 (usually referred as EPC1200 rack).

The EPC400 and EPC800 racks are industry-standard 19-inch racks designed to comply with the EIA-310C standard. The EPC1200 rack complies with the 19-inch EIA standard.
A rack is divided in several areas each being of a predefined height expressed in U (1U = 44,45 mm). The EPC400 and EPC800 rack provides 36U of space to install drawers (CPUs, disks, ...), while the EPC1200 rack provides 32U of space.

An EPC400 rack unit allows to install 6 EPC400, EPC430 or EPC450 CPU drawers, or 3 EPC440 CPU drawers. An EPC800 rack unit allows to install up to 4 EPC800 CPU drawers.

The Escala EPC1200, EPC1200A and EPC2400 allow, by node, one Central Electronics Complex (CEC) rack, up to 4 I/O racks, and additional storage racks for external DAS, SSA or DLT subsystems.

A rack unit supports other drawers, depending on the rack dispatching rules in the NOEMIE configurator, to be chosen between:

- DAS drawer.
- SSA drawer.
- Disk/media drawer.

Other devices can be installed in a rack unit, such as interconnects hubs or switches and DLT4000/DLT7000. Optional rack unit(s) can be required to accommodate all drawers/devices.

Additional EPC440 nodes can be mounted in an EPC400 or EPC1200 rack unit.

Drawer / Rack	EPC400 Rack	EPC800 Rack	EPC1200, EPC1200A or EPC2400 "CEC Rack"	EPC1200, EPC1200A or EPC2400 "I/O Rack"
EPC400	Yes	SFR	No	No
EPC430	Yes	No	No	No
EPC440	Yes	No	No	Yes
EPC450	Yes	No	No	No
EPC800	SFR	Yes	No	No
EPC1200, EPC1200A or EPC2400 CEC	No	No	Yes	No
EPC1200, EPC1200A or EPC2400 I/O drawer	No	No	No	Yes

3.5. Interconnection

terconnect communication network is also known as back-end network or private network.
An interconnect is a complete network dedicated to internode communications by application. The interconnect links a group of nodes inside the cluster. This network is dedicated and private to the cluster.

It is possible to have multiple interconnects for different purposes linking different groups of nodes.

An interconnect can be used as a high-performance network for exchanging information related to CMP mode operation (concurrent access). It can also be used to handle data exchanges in Client/Server or three tier architectures. The interconnect protocol supported is TCP-IP. A number of implementations, based on different technologies (Ethernet, Fast Ethernet, Gigabit Ethernet, FDDI), different levels of redundancy (simple or double connections), and optional network devices (hubs, switches) are possible.

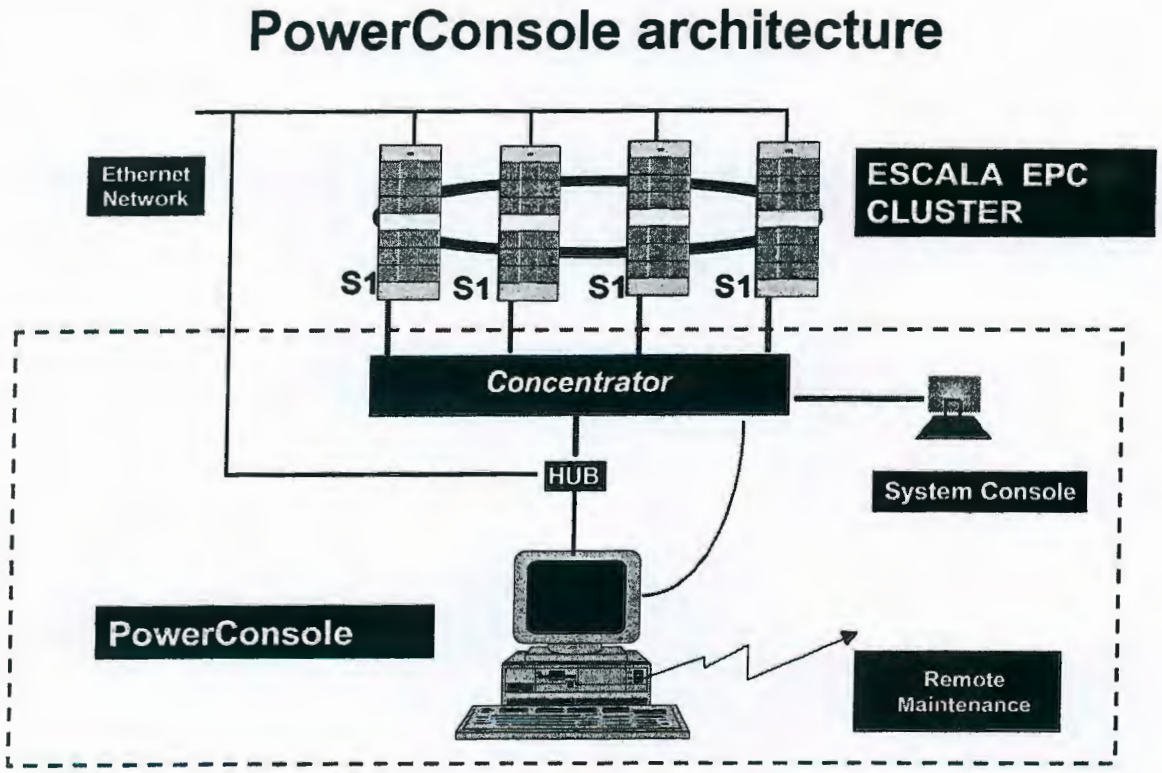
In a consolidation server configuration, it is possible to have no interconnect.

3.6. Cluster/Node Management

Main hardware components used for cluster/node management are the following:

- A PowerConsole, or an ASCII console, or a graphical console.
- A console concentrator.
- A cluster administration hub.

ASCII and graphical consoles are well suited for the management of individual nodes.
The PowerConsole is the ideal tool for cluster management.



PowerConsole

The PowerConsole is a single point of control for the simple administration of all nodes that are part of a Bull EPC cluster environment. The PowerConsole provides:

- Optimum utilization of the complete toolset delivered with AIX®, thanks to assistants and an intuitive graphic interface.
- A set of functions enabling local or remote launching of operations such as reboot, installation, configuration, upgrades, saves, and software distribution.
- A highly performing, active tool designed for the administration of HA nodes, so guaranteeing maximum operational security.
- Monitoring capability, with dynamic display of resource status, whether global for the cluster or within a node, triggering of alarms with adjustable thresholds, and manual or automatic resources

reassignment.

- Easier management of AIX® evolution thanks to the capability for co-existence of two AIX® versions on the same cluster.
- As an option, the ability to administer production applications and the SAN infrastructure, including disk subsystems, thus making the PowerConsole a real control tower of the information system.

The PowerConsole is based on the Escala S100.
If needed, more than one PowerConsole can be attached to a clustered system.

Console Concentrator

The PowerConsole is attached to the clustered system via a console concentrator (3COM CS/2600 terminal server) and an Ethernet link. The cluster administrator can access all the nodes of an Escala EPC from a multi-window system console.

Cluster Administration Hub

In addition, a private network is provided to allow secured and advanced cluster management operations. This private network is accessible through a specific cluster administration Ethernet hub also known as the management network.
For local system operations (maintenance), a system console (BQ306 terminal) is provided.

3.7. Power Distribution and Power Supply

Additional PDBs (Power Distribution Board) or PDUs (Power Distribution Unit) can be used for higher availability and redundant configurations.

3.8. Disk Subsystems

A large choice of disk subsystems is available:

- DAS disk subsystem.
- SSA disk subsystem.
- EMC Symmetrix disk subsystem.

Shared disk access to SCSI-based DAS subsystems is limited to 4 nodes (due to SCSI bus limitations) and to 8 nodes for the other subsystems (fibre channel based DAS subsystems, SSA subsystems, and EMC subsystems).

The concurrent access mode (with CRM) is supported on DAS, SSA and EMC subsystems.

SSA Subsystem

(Discontinued: 30 June 1999)

The SSA subsystem (Serial Storage Architecture) provides high performance storage facilities:

- Loop connections.
- High bandwidth, high performance.
- Disk sharing from multiple nodes (up to 8 nodes).
- Multiple device connectivity, dual access.
- Support of 4.2GB and 9.1GB disks.
- Hot plugging.
- Bypass cards to dynamically rebuild the loop in case of node failure.
- Large scalability.
- Remote connection (with optic fiber extender).

EMC² Symmetrix Subsystem

The Symmetrix 3000 family is the industry's premier open storage solution from EMC².

Main features:

- Up to 32 physical SCSI interface connections
- Up to 16 physical Fibre Channel interface connections
- 4 to 256 physical 3.5-inch disk devices
- Remote diagnostics and AutoCall feature via an integrated service processor
- Non-disruptive component repair
- Non-disruptive microcode upgrades
- Dual-initiator disk director.

Data protection features:

- Mirroring option (RAID 1)
- Dynamic Sparing option.

Software features:

- Information protection:
  - Symmetrix Remote Data Facility (SRDF™)
  - EMC TimeFinder™.
- Information sharing:
  - Symmetrix Enterprise Storage Platform (ESP)
  - EMC InfoMover™.
- Information management:

- Symmetrix Manager - Base Component
- Symmetrix Manager - SRDF / TimeFinder Component
- Symmetrix Manager - SDDR Component
- EMC PowerPath™.

Classification:

- The Symmetrix Models 3000 are classified as Electronic Data Processing Equipment intended to be installed in a data processing center environment (class 2).

DAS Subsystem

DAS subsystems, composed of DAS 1000, 2000, and 5000 series, are disk array subsystems available in rackmount configuration.

The DAS 1x00 and DAS 2x00 Series are based on SCSI, whereas the DAS 5300, DAS 5700, and DAE 5000 are based on the fibre channel standard (FC-AL, Fibre Channel Arbitrated Loop).

The fibre channel based DAS subsystems are connected through a high performance PCI fibre channel (FC-AL) adapter to all the Escala EPCs except the EPC800, which only supports SCSI-based DAS.

All these DAS subsystems provide RAID functionality, except the DAE 5000 that is a JBOD (Just a Bunch of Disks) solution.

DAS subsystems extend disk offers with a scalable storage solution for customers that need both high availability and high capacity for mission critical applications. They provide near fault tolerant storage subsystems with highly competitive performance and price.

A DAS subsystem can either be attached to one node, or be shared by several nodes inside an Escala EPC configuration.

3.9. Libraries

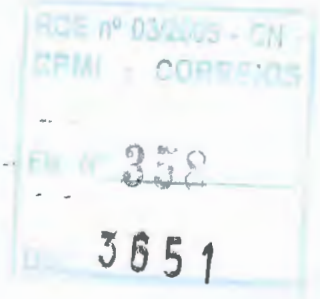
The same libraries are available for the Escala product range.
Using NetBackup™ high availability features a library can be shared by 2 nodes of an Escala EPC configuration.
Concurrent access is not allowed.

3.10. Attachment Facilities

Interconnects, disk subsystems and libraries can be attached to multiple nodes. The different nodes share the same resource: private network, disks and drives respectively.
The shared resource (disk subsystems and libraries) is mainly used for high available configurations.

SSA and EMC subsystems can be attached up to eight nodes belonging to the configuration.

Any type of interconnect can be attached from two to eight nodes belonging to the configuration.
Any type of library can be attached to up to two nodes.



Chapter 2: Models Description


E C T
C P L - A C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1. Escala EPC Servers Comparison Table

Escala EPC Model	EPC400	EPC430	EPC440	EPC450	EPC800 (1)	EPC1200 (2)	EPC1200A	EPC2400
Processor	PPC-604e	PPC-RS64-II	PPC-RS64-II	PPC-RS64-III	PPC-604e	PPC-RS64 or RS64-II	PPC-RS64-II	PPC-RS64-III
Processor Speed (MHz)	360	262	340	400	320	125 or 262	262	450
Number of processors (min/max) per node	1/4	1/4	1/4	1/4	2/8	4/12	4/12	6/24
L1 cache per CPU (KB)	32/32	64/64	64/64	128/128	32/32	64/64	64/64	128/128
L2 cache per CPU (MB)	4	4	4	4	4	4 or 8	8	8
PCI/MCA bus - per node	2 PCI 64-bit	2 PCI 64-bit	4 PCI 64-bit	2 PCI 64-bit	2 MCA	4 to 16 PCI 64-bit	4 to 16 PCI 64-bit	4 to 16 PCI 64-bit
I/O Slots (max) - per node/with expansion drawer	8 / 18	8 / 18	8	8 / 18	8	14 / 56	14 / 56	14 / 56
I/O bus Transfer Rate (MB/sec) per node (1)	2x266	2x264		2x264	1x160	4x500	4x500	4x500
Memory slots - per node	4	4	32	4	4	20	20	16
Memory min - per node	64MB	256MB	256MB	256MB	64MB	512MB	1GB	2GB
Max memory per node (GB)	3	8	8	8	4	32**	32**	64
Hard disk std per node (GB)	9,1	9.1	9.1	9.1	4,2	4.5	9.1	9.1
Max disk in CPU drawer per node (GB)	109.2	109,2	218.4	109,2	18.2	209.3	218.4	218.4
Max disk capacity per node (GB)	218.4	218.4	218.4	218.4	72.8	864.5	873.6	873.6
Ultra2 SCSI Adapter	N	Y	N	Y	N	N	Y	Y
Ultra SCSI Adapter	Y	Y	Y	Y	N	Y	Y	Y
SCSI-2 Fast/Wide Adapter	Y	Y	Y	Y	Y	Y	Y	N
Fast Ethernet, Token-Ring, or FDDI Adapter	Y	Y	Y	Y	Y	Y	Y	Y
Multiport Asynchronous Adapter	Y	Y	Y	Y	Y	Y	Y	Y
X25 Adapter	Y	Y	Y	Y	Y	Y	Y	Y
Fibre Channel Adapt. (FC-AL)	Y	Y	Y	Y	N	Y	Y	Y
Serial & parallel ports	Y	Y	Y	Y	Y	Y	Y	Y
Redundant Power Supply	Y	Y	Y	Y	Optional	Y	Y	Y
Internal 3"1/2 Diskette	Y	Y	Y	Y	Y	Y	Y	Y
Internal CD-ROM	Y	Y	Y	Y	Y	Y	Y	Y
Performance (**estimated**)	1 / 2 / 3 / 4 CPUs	1 / 2 / 3 / 4 CPUs	1 / 2 / 3 / 4 CPUs	1 / 2 / 3 / 4 CPUs	2 / 4 / 8 CPUs	4 / 8 / 12 CPUs	4 / 8 / 12 CPUs	6 / 12 / 18 / 24 CPUs
TPM	3325 / 5625 / 6700 / 8117 (Sybase)	4600 / 7800 / 11000 / 13700 (Oracle)	5000 / 9600 / 13400 / 17133 (Oracle)	5800 / 11000 / 15600 / 19000 (Oracle)	4100 / 7000 / 11400 (Sybase)	7250 / 13200 / 18666 OR 13800 / 24800 / 34139 (Oracle)	13800 / 24800 / 34139 (Oracle)	42000 / 79500 / 111000 / 135815 (Oracle)
SPECint_rate95	127/249/364/480	105/210/315/419	144/287/430/573	165/329/493/655	219/425/775	-	-	-
SPECfp_rate95	73/141/200/249	12/240/350/460	191/370/534/674	-	121/227/420	-	-	-
SPECint'95-SPECfp'95 (single CPU)	14.2-8.2	11.7-14	16-21.2	18.34-xx	12.5-7.1	-	-	-
SPECweb96	-	-	-	4700 / 8600 / 12000 / 14600	-	-	-	

** The hardware memory limit is 40 GB. AIX supports 32 GB of real memory. This limit will be raised in a later version of AIX.

(1) Discontinued: 31/12/1999.

(2) Discontinued: 30/11/1999.

2. Escala EPC400

The Escala EPC400 brings affordable entry into the world of high-end UNIX servers and solution servers.

Based on one single CPU drawer, this entry-level application server allows to expand and optimize configuration with maximum flexibility.

The EPC400 is based on an EPC400 drawer rack mounted in an EPC400 rack. An expansion drawer can be added to the EPC400 drawer to provide additional PCI slots, disks or media.

2.1. The EPC400 Drawer

The EPC400 drawer provides:

- 4 slots for single PowerPC 604e@360MHz CPU boards. Each CPU board contains one processor with 32KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
- From 128 MB to 3GB of memory provided by 4 memory slots for memory DIMMs on riser cards, each with 6 memory slots, for a total of 24 memory slots. Upgrades come in the form of quads: 4x32MB (128MB), 4x64MB (256MB) or 4x128MB (512MB).
- 1 internal dual 64bit PCI bus with a throughput of 2x266MB/s.
- 2 x 3 disk bays (1" high) or 2 x 2 disk bays (1"6 high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operation.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  - 5 64-bit PCI
  - 2 combo (PCI or ISA)
  - 1 ISA.
- Two native Ultra SCSI busses on the motherboard.
- One native 10/100Mb/s Ethernet bus with 3 connectors: 10Mb/s, 100Mb/s and AUI.
- One native SVGA graphics controller with 1MB video memory.
- Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Redundant power supply.

The EPC400 drawer is 4U high.

2.2. The EPC400 Expansion Drawer

The EPC400 expansion drawer provides:

- 2 x 3 disk bays (1" high) for 9.1GB or 18.2 GB hot-swappable disks.
- 2 media bays (CDROM, DAT, VDAT, or QIC).
- 6 additional PCI slots.

6 additional PCI slots can be added to the EPC400 expansion drawer installing the EPC400 Bus Expansion.

The EPC400 expansion drawer occupies 4U.

2.3. Extensions and Options

- Ultra SCSI RAID adapter for internal disks.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communication adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- DLT tape library (Overland) with SCSI interface.

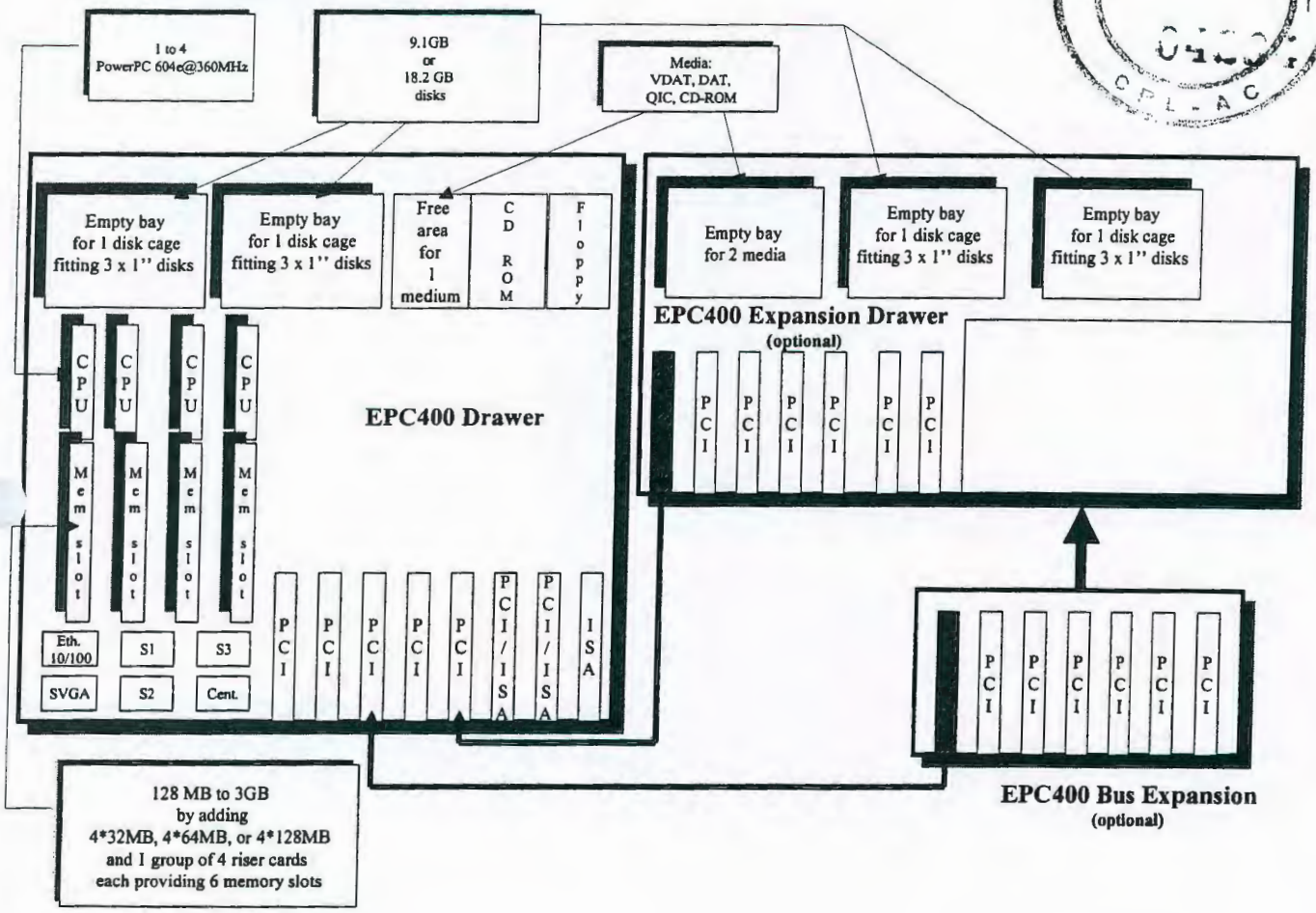
2.4. Maximum Configuration

- 4 CPUs.
- 3 GB of memory.
- 218.4 GB of disks with expansion drawer (109.2GB in the base drawer).
- 18 slots for adapters 15 PCI, 2 PCI/ISA, 1 ISA with the expansion drawer (8 slots: 5 PCI, 2 PCI/ISA, and 1 ISA in the base drawer).

2.5. Operational Requirements

- AIX 4.2 or later.

EPC400 Description



2.6. Power Kits for the EPC400

2.6.1. Power Kit 604e@360MHz CPU - 4MB L2 Cache

The power kit contains the following items:

- 1 CPU module PowerPC 604e@360MHz - 4MB L2 cache.

Operational Requirements

- Any EPC400 (one CPU slot available - 4 CPU slots maximum).
- No mix of PowerPC 604e and PowerPC 620 is allowed on the same node.

2.6.2. Power Kit 620@180MHz CPU - 4MB L2 Cache

This Power Kit is available under controlled commercialization only. It contains the following items:

- 1 CPU module PowerPC 620@180MHz - 4MB L2 cache.

Operational Requirements

- Any EPC400 (one CPU slot available - 4 CPU slots maximum).
- No mix of PowerPC 604e and PowerPC 620 is allowed on the same node.

2.7. Upgrade Kits from the EPC400 to the EPC430

Discontinued: 31/05/2000

This upgrade kit allows to upgrade an EPC400 to an EPC430 reconnecting the existing disks, media, disk adapters and communication adapters. The upgraded EPC400 will have the same memory and CPU capability as an EPC430. The system's serial number remains unchanged.

- From 256MB to 8 GB of memory.
- Up to 4 PowerPC RS64-II@262MHz processors with 4MB of L2 cache.
- 7 PCI slots and 1 PCI/ISA slot in the CPU drawer.
- Expansion drawer with 12 additional slots making a total of 18 slots available.
- 109.2GB disk capacity in the CPU drawer and 218.4GB with an expansion drawer.
- Native 10/100 Mb/s Ethernet.
- Native SVGA with 2MB of video memory.
- Keyboard and mouse port.
- Three asynchronous ports and one Centronics port.
- One Ultra2 SCSI bus for disks.
- One Ultra SCSI bus for Fast Wide SCSI media.

This upgrade kit is composed of:

- At least one basic upgrade kit from EPC400 to EPC430.
- A "swap kit" that allows you to swap each additional single 604e/620 CPU board with an RS64-II-based CPU board.

2.7.1. Basic Upgrade Kit from the EPC400 to the EPC430

The basic kit includes:

- 1 Escala EPC430 basic drawer.
- 1 single CPU board with an RS64-II processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- EPC400 basic drawer.

- 1 single PowerPC 604e or 620 CPU board.
- Memory on the EPC400. The client has to acquire new memory for the upgraded machine.

2.7.2. Swap Kit for Additional Single 604e/620 CPU Boards

This kit contains the following items:

- 1 single CPU board with an RS64-II@262 MHz processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
  1 single PowerPC 620 CPU board.

System Requirements

- Escala EPC400.
- AIX 4.3.2 or later.

2.8. Upgrade Kits from the EPC400 to the EPC450

This upgrade kit allows to upgrade an EPC400 to an EPC450 reconnecting the existing disks, media, disk adapters and communication adapters. The upgraded EPC400 will have the same memory and CPU capability as an EPC450. The system's serial number remains unchanged.

- From 256MB to 8 GB of memory.
- Up to 4 PowerPC RS64-III@400 MHz processors with 4MB of L2 cache.
- 7 PCI slots and 1 PCI/ISA slot in the CPU drawer.
- Expansion drawer with 12 additional slots making a total of 18 slots available.
- 109.2GB disk capacity in the CPU drawer and 218.4GB with an expansion drawer.
- Native 10/100 Mb/s Ethernet.
- Native SVGA with 2MB of video memory.
- Keyboard and mouse port.
- Three asynchronous ports and one Centronics port.
- One Ultra2 SCSI bus for disks.
- One Ultra SCSI bus for Fast Wide SCSI media.

This upgrade kit is composed of:

- At least one basic upgrade kit from EPC400 to EPC450.
- A "swap kit" that allows you to swap each additional single 604e/620 CPU board with an RS64-III-

based CPU board.

2.8.1. Basic Upgrade Kit from the EPC400 to the EPC450

The basic kit includes:

- 1 Escala EPC450 basic drawer.
- 1 single CPU board with an RS64-III processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- EPC400 basic drawer.
- 1 single PowerPC 604e or 620 CPU board.
- Memory on the EPC400. The client has to acquire new memory for the upgraded machine.

2.8.2. Swap Kit for Additional Single 604e/620 CPU Boards

This kit contains the following items:

- 1 single CPU board with an RS64-III@400 MHz processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
- 1 single PowerPC 620 CPU board.

System Requirements

Escala EPC400.

- AIX 4.3.3 or later.

3. Escala EPC430

The EPC430 is based on an EPC430 drawer racked in an EPC400 rack. An expansion drawer can be added to the EPC430 drawer to provide additional PCI slots, disks or media.
Based on one single CPU drawer, this mid-size application server offers configuration flexibility for multi-purpose workloads.

3.1. The EPC430 Drawer

The EPC430 drawer provides:

- 4 slots for single PowerPC RS64-II@262MHz CPU boards. Each CPU board contains one processor with 64KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
- From 256 MB to 8GB of memory provided by 4 slots fitting 4 riser cards, each with 8 memory slots for a total of 32 memory slots. Upgrades come in quads: 4*64MB (256MB), 4*128MB (512MB) or 4*256MB (1GB).
- 1 internal dual 64-bit PCI bus with a throughput of 2x264 MB/s.
- 2 x 3 disk bays (1" high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operations.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  - 4 64-bit PCI
  - 3 32-bit PCI
  - 1 combo (PCI or ISA).
- One native Ultra2 SCSI bus and one native Ultra SCSI bus on the motherboard.
- One native 10/100Mb/s Ethernet bus with one connector.
- One native SVGA graphics controller with 2MB video memory.
- Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Redundant power supply.

The EPC430 drawer occupies 4U.

3.2. The EPC430 Expansion Drawer

The EPC430 expansion drawer provides:

- 2 x 3 disk bays (1" high) for 9.1GB or 18.2 GB hot-swappable disks.
- 2 media bays (CDROM, DAT, VDAT, or QIC).
- 12 additional PCI slots.

The EPC430 expansion drawer occupies 4U.

3.3. Extensions and options

- Ultra SCSI RAID adapter for internal disks.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
- EMC Disk Subsystems with SCSI or FC-AL interface.
- DLT Tape Library (Overland) with SCSI interface.

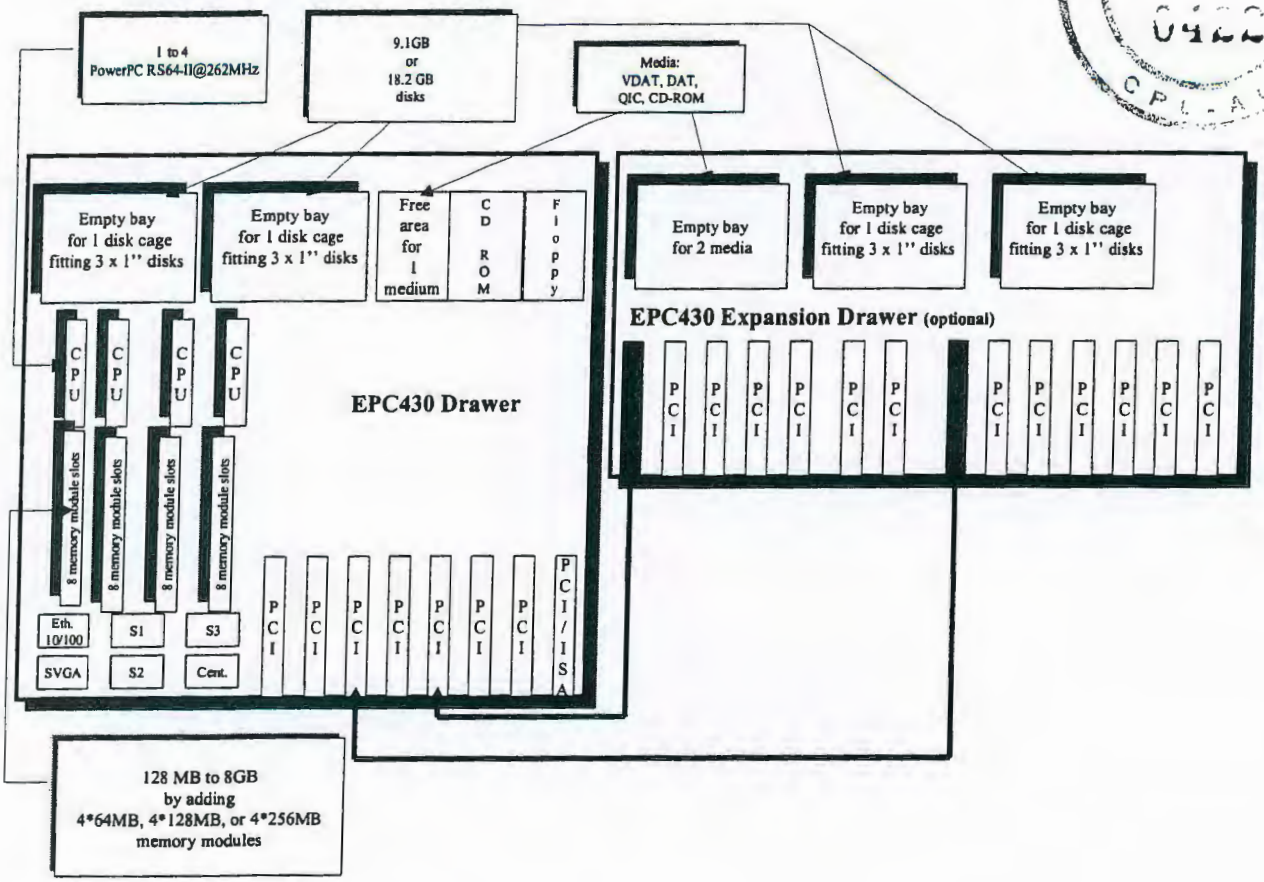
3.4. Maximum Configuration

- 4 CPUs.
- 3 GB of memory.
- 218.4 GB of disks with expansion drawer (109.2GB in the base drawer).
- 18 slots for adapters (17 PCI, 1 PCI/ISA) with the expansion drawer (8 slots: 7 PCI, 1 PCI/ISA).

3.5. Operational Requirements

- AIX 4.3.2 or later.

EPC430 Description



3.6. Power Kits for the EPC430

3.6.1. Power Kit RS64-II@262MHz CPU - 4MB L2 Cache

The Power Kit contains the following items:

- 1 CPU module PowerPC RS64-II@262MHz, 4MB L2 cache.

Operational Requirements

- Any EPC430 with a CPU slot available.

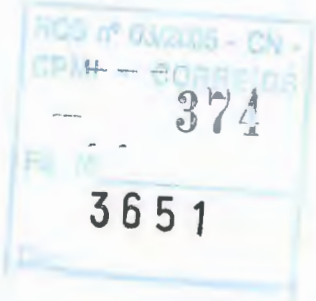
3.7. Upgrade Kit from EPC430 to EPC450

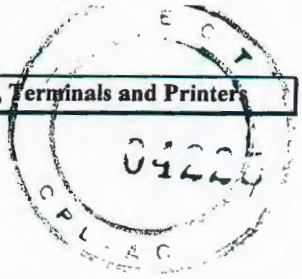
This upgrade kit contains the following items:

- 1 CPU module PowerPC RS64-III@400MHz, 4MB L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 CPU module PowerPC RS64-II@262MHz, 4MB L2 cache.





4. Escala EPC440

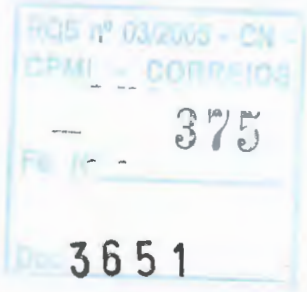
The EPC440 is based on an EPC440 drawer racked in an EPC400 rack. The EPC440 can also be racked in an EPC1200 rack when ordered as an additional node in a configuration.
Based on one single CPU drawer, this general-purpose server is ideally suited to well-balanced workloads.

4.1. The EPC440 Drawer

The EPC440 drawer provides:

- 2 slots for single or dual PowerPC RS64-II@340MHz CPU boards for a total of 4 CPUs. Each CPU board contains one processor with 64KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
- From 256 MB to 8GB of memory provided by 2 slots fitting 2 riser cards, each providing 16 memory slots, for a total of 32 memory slots. Upgrades come in pairs: 2*128MB (256MB) or 2*256MB (512MB) memory modules.
- Four 64-bit PCI busses.
- 12 disk bays (1" high) or 6 disk bays (1"6 high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operations.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  4 32-bit PCI
  2 64-bit@33MHz PCI
  2 64-bit@33/50 MHz PCI.
- Two native Ultra SCSI busses on the motherboard.
- One native 10/100Mb/s Ethernet bus with 3 connectors: 10Mb/s, 100Mb/s, AUI.
- One native SVGA graphics controller with 2MB video memory.
- Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Two power supply units.

The EPC440 drawer occupies 8U.



4.2. Extensions and Options

- Ultra SCSI RAID adapter for up to 6 internal disks
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM,

Asynchronous and X25).

- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- DLT tape library (Overland) with SCSI interface.

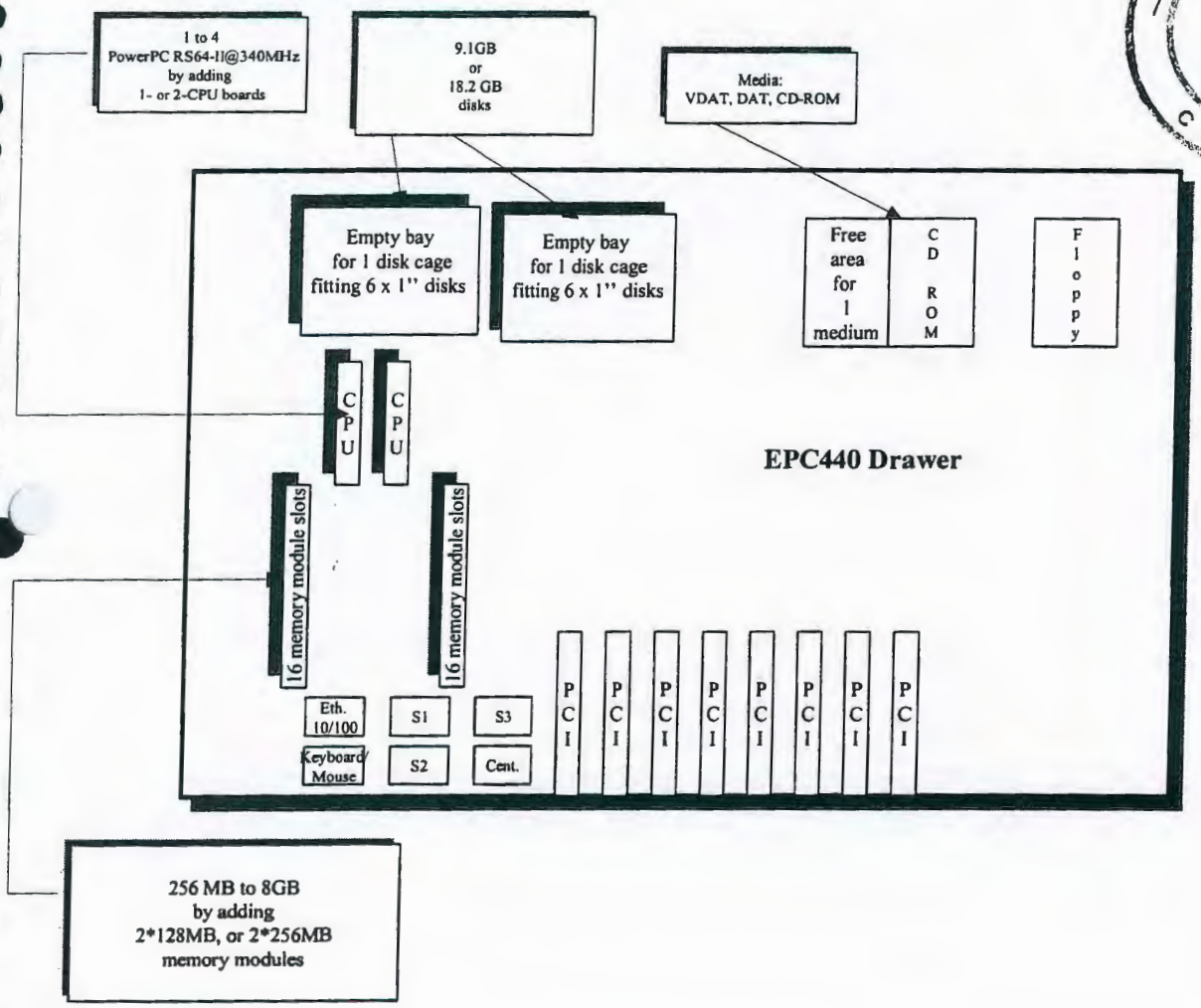
4.3. Maximum Configuration

- 4 CPUs.
- 8 GB of memory.
- 218.4 GB of disk space.
- 8 PCI slots.

..4. Operational Requirements

- AIX 4.3.2 or later.

EPC440 Description



4.5. Power Kits for the EPC440

4.5.1. Power Kit RS64-II@340MHz CPU - 4MB L2 Cache

The Power Kit contains the following items:

- 1 CPU board PowerPC RS64-II@340MHz, 1 way, 4MB L2 cache.

Operational Requirements

- Any EPC440 with a CPU slot available.

4.5.2. Power Kit 2*RS64-II@340MHz CPU - 4MB L2 Cache

The Power Kit contains the following items:

- 1 CPU board PowerPC RS64-II@340MHz, 2-way, 4MB L2 cache per way.

Operational Requirements

- Any EPC440 with a CPU slot available.

5. Escala EPC450

The EPC450 is based on an EPC450 drawer racked in an EPC400 rack. An expansion drawer can be added to the EPC450 drawer to provide additional PCI slots, disks or media.
Based on one single CPU drawer, this mid-size application server offers configuration flexibility for multi-purpose workloads.

5.1. The EPC450 Drawer

The EPC450 drawer provides:

- 4 slots for single PowerPC RS64-III@400MHz CPU boards. Each CPU board contains one processor with 64KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
- rom 256 MB to 8GB of memory provided by 4 slots fitting 4 riser cards, each with 8 memory slots for a total of 32 memory slots. Upgrades come in quads: 4*64MB (256MB), 4*128MB (512MB) or 4*256MB (1GB).
- 1 internal dual 64bit PCI bus with a throughput of 2x264 MB/s.
- 2 x 3 disk bays (1" high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operations.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  - 4 64-bit PCI
  - 3 32-bit PCI
  - 1 combo (PCI or ISA).
- One native Ultra2 SCSI bus and one native Ultra SCSI bus on the motherboard.
- One native 10/100Mb/s Ethernet bus with one connector.
- One native SVGA graphics controller with 2MB video memory.
- Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Redundant power supply.

The EPC450 drawer occupies 4U.

5.2. The EPC450 Expansion Drawer

The EPC450 expansion drawer provides:

- 2 x 3 disk bays (1" high) for 9.1GB or 18.2 GB hot-swappable disks.
- 2 media bays (CDROM, DAT, VDAT, or QIC).
- 12 additional PCI slots.

The EPC450 expansion drawer occupies 4U.

5.3. Extensions and options

- Ultra SCSI RAID adapter for internal disks.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
  EMC Disk Subsystems with SCSI or FC-AL interface.
- DLT Tape Library (Overland) with SCSI interface.

5.4. Maximum Configuration

- 4 CPUs.
- 3 GB of memory.
- 218.4 GB of disks with expansion drawer (109.2GB in the base drawer).
- 18 slots for adapters (17 PCI, 1 PCI/ISA) with the expansion drawer (8 slots: 7 PCI, 1 PCI/ISA).

5.5. Operational Requirements

- AIX 4.3.3 or later.

6. Power Kits for the EPC450

5.6.1. Power Kit RS64-III@400 MHz CPU - 4MB L2 Cache

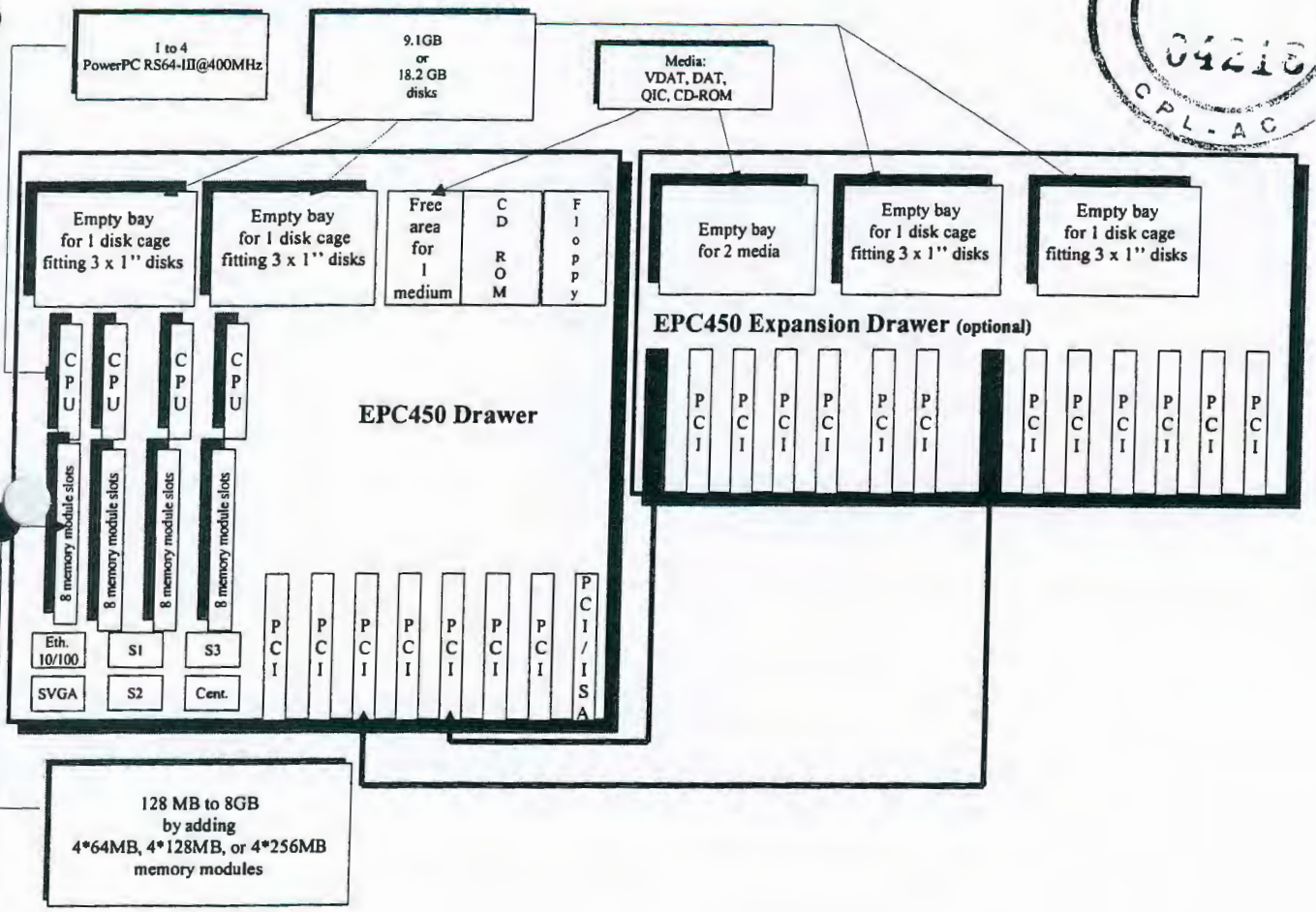
The Power Kit contains the following items:

- 1 CPU board PowerPC RS64-III@400MHz, 4MB L2 cache.

Operational Requirements

- Any EPC450 with a CPU slot available.

EPC450 Description



6. Escala EPC800

Initial Nodes Discontinued: 31/12/1999. Still available as addtionnal nodes

The Escala EPC800 model brings affordable entry into the world of high-end UNIX servers and high-end solution servers. This model offers configuration flexibility for building optimized "à la carte" servers.

The Escala EPC800 is a 19-inch rack-mounted model. It is a configuration based on one Escala [36U] rack including one 604e Escala CPU node drawer [6U].

The EPC800 basic model features two 200 MHz or 320 MHz PowerPC 604e RISC processors (maximum eight processors with 4 dual CPU boards).
Each CPU board contains two processors with 64 KB internal cache and 2MB L2 cache (or 4MB L2 cache with the 320 MHz processor) on each processor for fast data transfer between the processor and memory for balanced system performance.

Each EPC800 basic model also includes one (upgradable to two) high speed 160 MB/sec MCA bus with 8 (up to 16) total and 6 (up to 14) open slots, and comes at minimum with 128 MB of memory (upgradable to 4096MB), 4.2GB internal disk and an internal CD-ROM.

Two bays for internal disk (1" high) are available in the EPC800 basic model.
Two 5.25" bays for internal media/disk are available in the EPC800 basic model.
The 5.25" bays for media/disk can be only used for additional media.

The basic Rack can hold up to 4 drawers and up to six expansion racks can also be linked to the basic model, with a capacity of four drawers each.

6.1. Configuration

The Escala EPC800 basic model configuration provides the following features:

- One 36U rack
- One EPC800 drawer [6U] containing:
  - 1 dual CPU module PowerPC 604e@200MHz - 2MB L2 cache, or 1 dual CPU module PowerPC 604e@320MHz - 4MB L2 cache.
  - 3 additional CPU slots for other dual CPU modules.
  - 128 MB minimum memory.
  - 4 memory slots, each supporting up to 1GB memory board for a total of 4GB memory.
  - One LAN/SCSI SE adapter featuring:
    - One SCSI-2 SE port used to connect the standard internal disk and media devices.
    - One Ethernet IEEE 802.3 port, with a communication rate of 10Mbps. A thick-Ethernet (10Base-5) connector and a twisted pair (10Base-T) connector are standard on the system. This adapter is dedicated to the back-end network. The front-end network must be defined separately with the configuration tool. The front-end network is based on two Ethernet

adapters or two FDDI adapters depending on Customer requirements.

- Three serial RS232 ports reserved for the system console, the remote maintenance and services, and UPS connections.
- One parallel printer port.
- At least a 4.2 GB SCSI-2 internal disk.
- One 1.44MB 3.5-inch Diskette Drive.
- Six open MCA slots, with a total of 8 slots.
- Two bays for SCSI disk device (1" high).
- Two 5.25" bays for SCSI media device.
- One Redundant Power Supply.
- One 8 RS232-C asynchronous adapters.
- One Power Distribution Bus [1U].

Operational Requirements

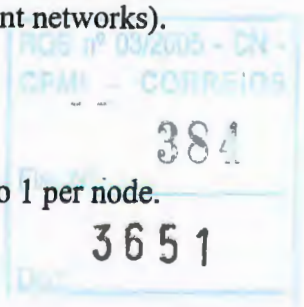
- AIX 4.2 or later.
- One internal 600MB CD-ROM high performance drive.

6.3. Factory Installable Select Options

- 2 MCA buses (instead of 1 MCA bus) featuring 14 free MCA slots (instead of 6 free MCA slots).

6.4. Extensions and Options

- External disk storage and media devices, including:
  - External tape drive drawers.
  - SSA disk subsystem (multiple host allowing to be shared by up to 8 nodes - *discontinued*).
  - DAS1300, DAS2900 RAID drawers (SCSI interface allowing to share a DAS by up to 4 nodes).
  - EMC disk subsystem (SCSI interface allowing to share a CDA by up to 8 nodes depending on disk capacity and performance required).
- System memory expansion up to 4096MB per node.
- Upgrade kit to PowerPC 604e@320MHz.
- Internal disk expansion up to 18.2GB (2x9.1GB) per node.
- One redundant or non-redundant Public Network Adapter per node, with a choice between all types of Ethernet, FDDI, Token Ring and ATM Adapters. Public network availability features need at least 2 network accesses per node (i.e. 2 adapters per node connected to 2 different networks).
- 2 MCA buses per node (instead of 1 MCA bus) on-site option.
  - 14 free MCA slots (instead of 6 free MCA slots).
- Internal media devices (tape drives).
- Disk/media drawer (4 open bays disk 1" or 1"6, 2 open bays media/disk 1"); up to 1 per node.
- LAN, WAN and asynchronous communications adapters.



- Power kit to upgrade the system to up to eight processors per node.
- Redundant fans and power supplies per node.

EPC800 Rack Options

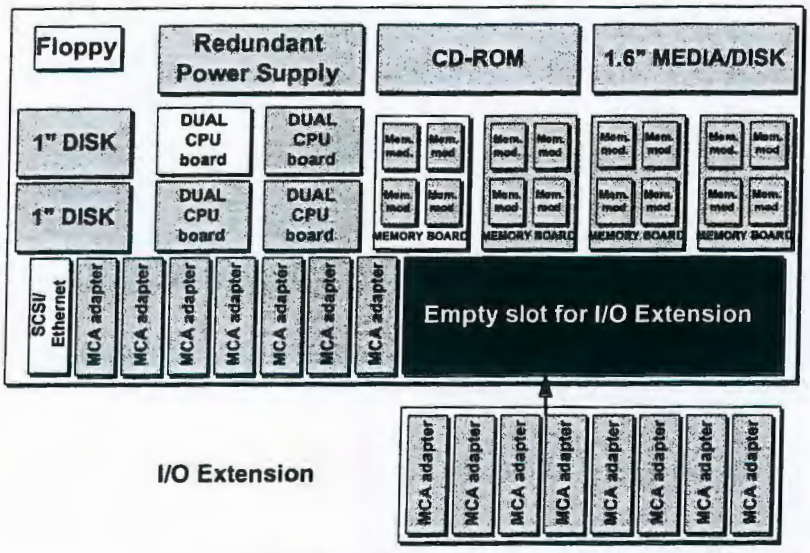
- One redundant Power Distribution Bus per rack.
- One UPS 3KVA per rack.

6.5. Power Distribution Bus

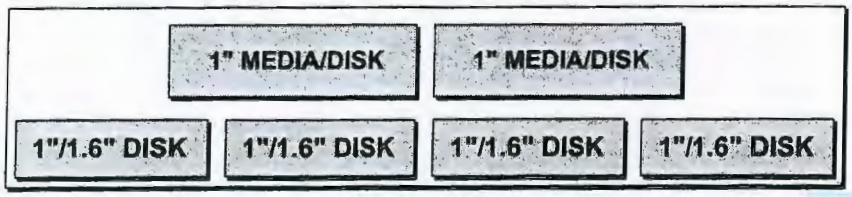
The Power Distribution Bus (PDB) provides up to 8 AC outlets: 6 to the drawers, 1 for a modem, 1 for the CPC in a 19" rack.

The PDB occupies 1 EIA unit of vertical mounting space in the rack.

EPC800 Description



Optional Media/Disk Expansion Drawer for EPC800



Requires 1 SCSI SE adapter

6.6. Power Kits for the EPC800

6.6.1. Power Kit 2*604e@200MHz CPU - 2MB L2 cache

The Power Kit contains the following items:

- 1 Dual CPU module PowerPC 604e@200MHz - 2MB L2 cache.

Operational Requirements

- Any EPC800 (no mix of PowerPC 604e@200MHz and PowerPC 604e@320MHz in the same node).

6.6.2. Power Kit 2*604e@320MHz CPU - 4MB L2 cache

The Power Kit contains the following items:

- 1 Dual CPU module PowerPC 604e@320MHz - 4MB L2 cache.

Operational Requirements

- Any EPC800 (processors must be of the same type).

6.7. Upgrade Kits for the EPC800

6.7.1. Upgrade Kit from PowerPC 604e@200MHz to PowerPC 604e@320MHz

This Upgrade Kit contains the following items:

- Dual CPU module PowerPC 604e@320MHz - 4MB L2 cache.
- Installations instructions.

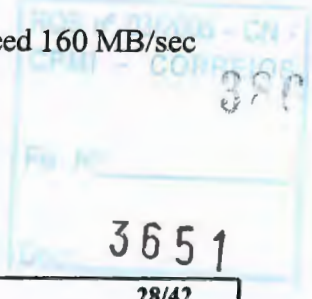
Parts removed becoming property of Bull

- 1 Dual CPU module PowerPC 604e@200MHz - 2MB L2 cache

6.8. Extension Kits for the EPC800

6.8.1. MCA Buses Upgrade

This Extension Kit allows to extend an 8 MCA Slots EPC800 with a second high speed 160 MB/sec MCA Bus, upgrading the number of slots up to 16.



Operational Requirements

- Any 8 MCA Slots EPC800.

7. Escala EPC1200

Discontinued: 30/11/1999.

The Escala EPC1200 brings an attractive and expandable full 64-bit platform into the world of high-end UNIX servers and solution servers.
It is a large database server with huge storage capacity and throughput for I/O-intensive tasks.

The Escala EPC1200 is composed of a Central Electronics Complex (CEC) and one to four I/O drawers. The CEC is packaged inside a dedicated 19-inch 32U Rack called the CEC Rack. The I/O drawers must be racked in a 19-inch I/O Rack.

A service processor provides all the features for maintenance (tests, survey, alarm) and is included in an I/O drawer. This I/O drawer also contains the system disk and will be referred to as the primary I/O drawer. Additional I/O drawers are called secondary I/O drawers.

7.1. The EPC1200 CEC

The CEC contains:

- One, two, or three 4-way processor cards (for a total of 4, 8, or 12 processors).
- From 512 MB to 32 GB of memory provided by 5 slots fitting quad-memory boards of 512 MB (4x128MB), 1GB (4x256MB), 2GB (4x512MB), 4GB (4x1024MB) or 8GB (4x2048MB). (Although the system can house 40GB of memory, 32GB are supported.)
- One Remote I/O (RIO) controller supporting 4 connections at 500MB/s. These are used to connect the I/O drawers.

The EPC1200 supports two 64-bit processors: PowerPC RS64@125MHz and RS64-II@262MHz. Each processor card contains four processors with 64 KB internal cache and 4MB (for the RS64) or 8MB (for the RS64-II) L2 associative cache on each processor.

7.2. The EPC1200 Primary I/O Drawer

- 12 disk bays: 11 for 9.1GB or 18.2 GB hot-pluggable Fast Wide SCSI internal disksand one for a mandatory 4.5 GB or 9.1 GB disk.
- 2 media bays for internal media devices: one is occupied by a CD-ROM drive and one is free for additional media (DAT, VDAT, or CD-ROM).
- One floppy disk drive

14 PCI slots (11 free slots) on 4 PCI busses
- One PCI slot is dedicated to the service processor (PowerPC 603).
- One PCI slot is dedicated to a SCSI controller to drive the drawer's internal disks.
- One PCI slot is dedicated to a SCSI controller to drive the drawer's internal media.

2 RS232 serial ports.
1 parallel port.
1 keyboard port and 1 mouse port.
One dual Ultra2 SCSI PCI adapter.
Dual redundant hot-swappable power supplies for enhanced reliability.

The EPC1200 I/O drawer occupies 7 Units of vertical space.

7.3. The EPC1200 Secondary I/O Drawer

2 areas of 6 disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks. Each area must be driven by a dedicated SCSI bus.
2 media bays for internal media devices (DAT, VDAT, or CD-ROM).
14 PCI slots (5*64 bit and 9*32 bit).

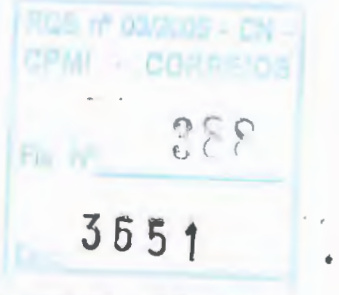
7.4. Options and Extensions

External modem for remote monitoring and maintenance allowing the service processor to call out and alert the Bull Maintenance Center.
Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5700, DAE5000 and for EMC disk subsystem connection (Max distance: 10Km).
Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25)
DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5700) interface.
DAE5000 JBOD enclosures with FC-AL interface.
EMC disk subsystems with SCSI or FC-AL interface.
Overland DLT tape library (DLT4000 or DLT7000) with SCSI interface.

7.5. Maximum Configuration

Internal disk storage:
- 1x9.1GB + (11x18.2GB)=209.3GB with one I/O drawer.
- 209.3GB+(3x218.4GB)=864.5GB with 4 I/O drawers.

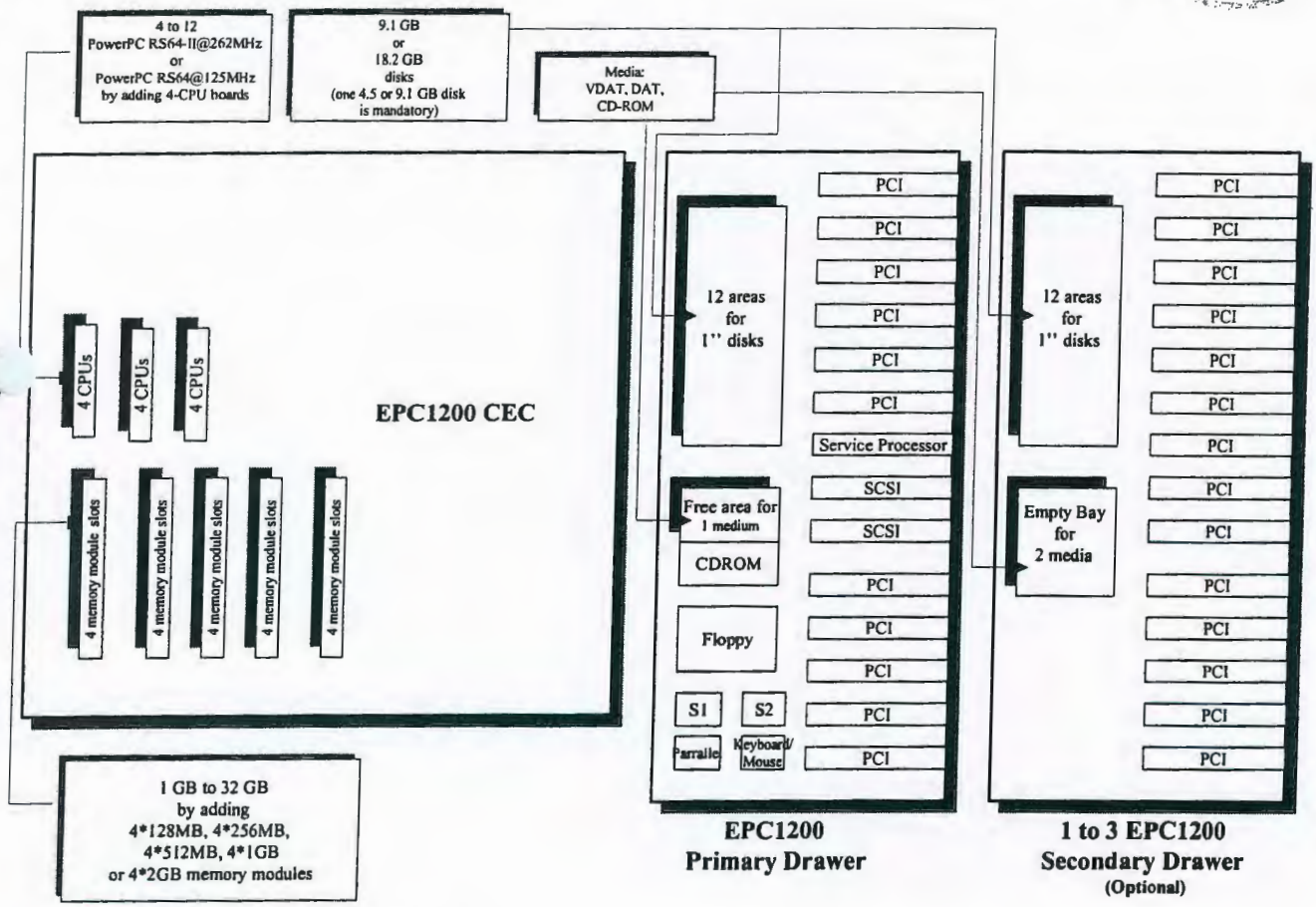
32 GB of memory.
Up to 3 quad-CPU boards (i.e. 12-way).
Up to 14 PCI slots per I/O drawer.
Up to 56 PCI slots with four I/O drawers.



7.6. Operational Requirements

- AIX 4.3 or later.

EPC1200 Description



7.7. Power Kits for the EPC1200

7.7.1. Power Kit Quad-CPU RS64@125MHz - 4MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 quad-PowerPC RS64@125MHz CPU board - 4MB L2 cache per CPU.

Operational Requirements

- Any EPC1200 (a CPU slot available - 4 CPU slots maximum).

Remarks

- There are two different boards to upgrade the EPC1200 from 4 CPU to 8 CPU and to upgrade from 8 CPU to 12 CPU.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7.7.2. Power Kit Quad-CPU RS64-II@262MHz - 8MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 quad-PowerPC RS64-II@262MHz CPU board - 8MB L2 cache per CPU.

Operational Requirements

- Any EPC1200 (a CPU slot available - 4 CPU slots maximum).

Remarks

- There are two different boards to upgrade the EPC1200 from 4 CPU to 8 CPU and to upgrade from 8 CPU to 12 CPU.

7.8. Upgrade Kits for the EPC1200

7.8.1. Upgrade Kit from PowerPC RS64@125MHz to PowerPC RS64-II@262MHz

This Upgrade Kit contains the following items:

- 1 quad-PowerPC RS64-II@262MHz CPU board - 8MB L2 cache.
- Installations instructions.

Parts removed becoming property of Bull

- 1 quad-PowerPC RS64@125MHz CPU board - 4MB L2 cache.

8. Escala EPC1200A

The Escala EPC1200A brings an attractive and expandable full 64-bit platform into the world of high-end UNIX servers and solution servers.
The EPC1200A is a large database server with huge storage capacity and throughput for I/O-intensive tasks.

The Escala EPC1200A is composed of a Central Electronics Complex (CEC) and one to four I/O drawers. The CEC is packaged inside a dedicated 19-inch 32U rack called the CEC rack. The I/O drawer must be racked in a 19-inch I/O rack.

A service processor provides all the features for maintenance (tests, survey, alarm) and is included in an I/O drawer. This I/O drawer also contains the system disk and will be referred to as the primary I/O drawer. Additional I/O drawers are called secondary I/O drawers.

8.1. The EPC1200A CEC

The CEC contains:

- One, two, or three 4-way processor cards (for a total of 4, 8, or 12 processors).
- From 512 MB to 32 GB of memory provided by 5 slots fitting quad-memory boards of 512 MB (4x128MB), 1GB (4x256MB), 2GB (4x512MB), 4GB (4x1024MB) or 8GB (4x2048MB). (Although the system can house 40GB of memory, 32GB are supported.)
- One Remote I/O (RIO) controller supporting 4 connections at 500MB/s. These are used to connect the I/O drawers.

The EPC1200A supports the PowerPC RS64-II@262MHz 64-bit processors.
Each processor card contains four processors with 64KB internal cache and 8MB L2 associative cache on each processor.

8.2. The EPC1200A Primary I/O Drawer

- 2 areas of 6 Disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks; each area must be driven by a dedicated SCSI bus; at least one disk is necessary
- 2 media bays for internal media devices: one is occupied by a CD-ROM drive and one is free for additional media (DAT, VDAT, or CD-ROM).
- One floppy disk drive
- 14 PCI slots (11 or 12 free slots depending on the disk areas configuration) on 4 PCI busses
  - One PCI slot is dedicated to the service processor (PowerPC 603).
  - One or two other PCI slots are dedicated to SCSI controllers, as explained below:
    For configurations using only one area of disk bays (all disks are connected to the same SCSI bus) one dual Ultra2 SCSI controller is used to drive the media devices and the disks. The first bus is used for disks and the second bus for media.
    For configurations using both areas of disk bays, the Ultra2 SCSI controller is used to connect

each area to a different SCSI bus. The first bus is used for the first area and the second bus for the second area. An additional Ultra SCSI controller is required to connect media devices.

- 2 RS232 serial ports.
- 1 parallel port.
- 1 keyboard and 1 mouse port.
- One dual Ultra2 SCSI PCI adapter.
- Dual redundant hot-swappable power supplies for enhanced reliability.

The EPC1200A I/O drawer occupies 10 Units of vertical space.

8.3. The EPC1200A Secondary I/O Drawer

- 2 areas of 6 disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks. Each area must be driven by a dedicated SCSI bus.
- 2 media bays for internal media devices (DAT, VDAT, or CD-ROM).
- 14 PCI slots (5*64 bit and 9*32 bit).

8.4. Options and Extensions

- External modem for remote monitoring and maintenance allowing the service processor to call out and alert the Bull Maintenance Center.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DAS5700, DAE5000 and for EMC disk subsystem connection (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300, DAS5700) interface.
- DAE5000 JBOD enclosures with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- Overland DLT tape library (DLT4000 or DLT7000) with SCSI interface.

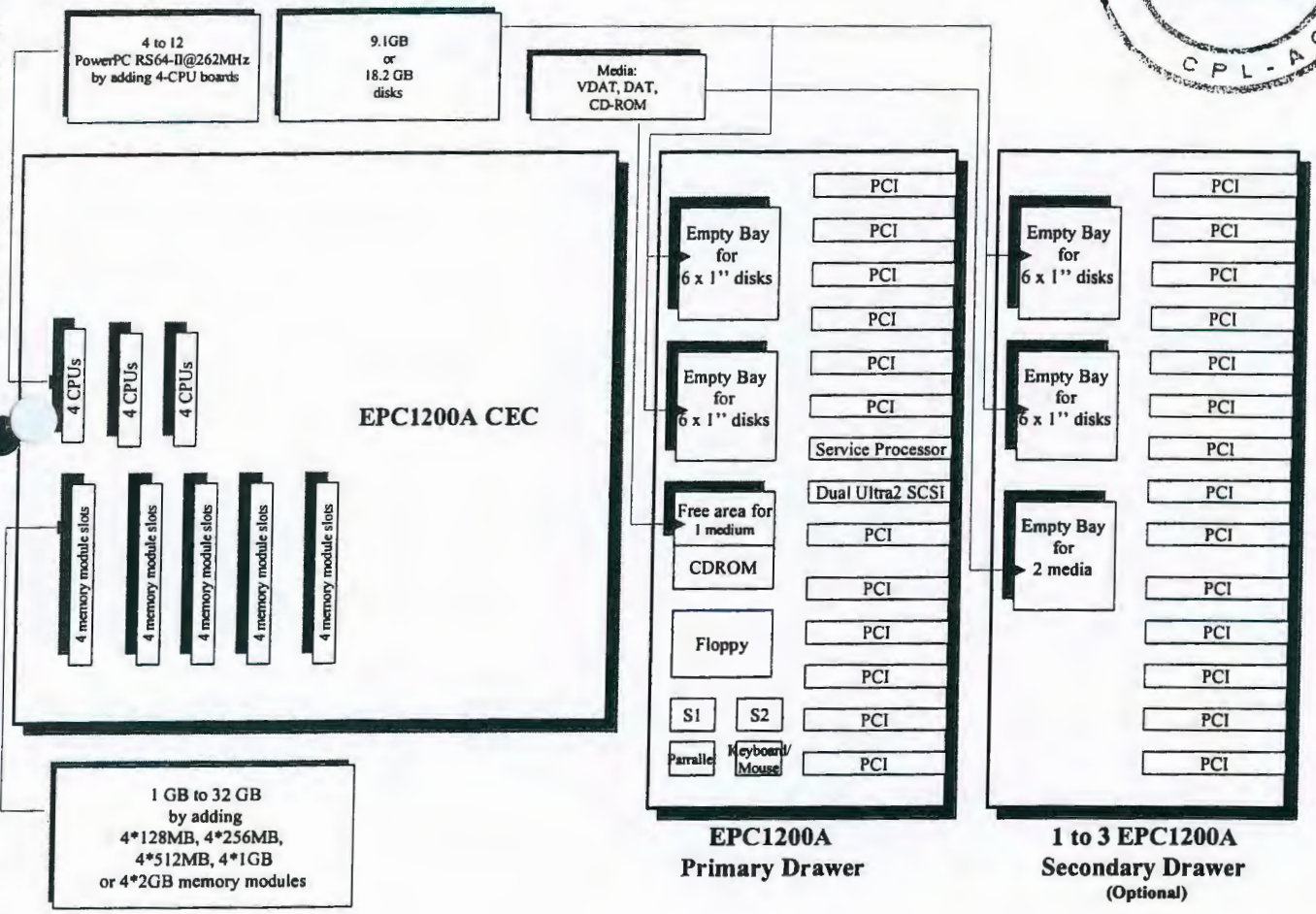
8.5. Maximum Configuration

- Internal disk storage:
  - 12x18.2GB=218.4GB with one I/O drawer.
  - 4x218.4GB=873.6GB with 4 I/O drawers.
- 32 GB of memory.
- Up to 3 quad-CPU boards (i.e. 12-way).
- Up to 14 PCI slots per I/O drawer.
- Up to 56 PCI slots with four I/O drawers.

8.6. Operational Requirements

- AIX 4.3 or later.

EPC1200A Description



8.7. Power Kits for the EPC1200A

8.7.1. Power Kit Quad-CPU RS64-II@262MHz - 8MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 quad-PowerPC RS64-II@262MHz CPU board - 8MB L2 cache per CPU.

Operational Requirements

- Any EPC1200A (a CPU slot available - 4 CPU slots maximum).

Remarks

- There are two different boards to upgrade the EPC1200A from 4 CPU to 8 CPU and to upgrade

from 8 CPU to 12 CPU.

8.8. Upgrade Kits from the EPC1200A to the EPC2400

This upgrade kit allows to upgrade an EPC1200A to an EPC2400 reconnecting the existing I/O drawers including disks, media, disk adapters and communication adapters. The upgraded EPC1200A will have the same memory and CPU capability as an EPC2400.

This upgrade kit is composed of:

- At least one basic upgrade kit from EPC1200A to EPC2400
- A "swap kit" that allows you to swap each additional quad-RS64-II@262MHz CPU board with a six-way RS64-III@450MHz CPU board.

8.8.1. Basic Upgrade Kit from EPC1200A to EPC2400

The basic kit includes:

- 1 Escala EPC2400 CEC.
- 1 six-way RS64-III@450MHz CPU board with 8MB of L2 cache.
- 1 service processor.
- A cabling set for the primary I/O drawer.
- 1 remote I/O hub - dual loop.
- AIX 4.3.3 operating system CD-ROMs.
- Installation instructions.

Parts removed becoming property of Bull

- EPC1200A CEC.
- 1 quad PowerPC RS64-II@262MHz CPU board.
- 1 service processor.
- Replaced cables.
- 1 remote I/O hub - dual loop.
- Memory on the EPC1200A. The client has to acquire new memory for the upgraded machine.

8.8.2. Swap Kit for Additional Quad RS64-II@262MHz CPU Boards

This kit contains the following items:

- 1 six-way RS64-III@450MHz CPU board.
- Installation instructions.

Parts removed becoming property of Bull

- 1 quad-PowerPC RS64-II@262MHz CPU board.

9. Escala EPC2400

The Escala EPC2400 brings an attractive and expandable full 64-bit platform into the world of high-end UNIX servers and solution servers.
The EPC2400 is a high range server ideally tailored for e-center and for consolidation.

The Escala EPC2400 is composed of the Central Electronics Complex (CEC) and one to four I/O drawers. The CEC is packaged inside a dedicated 19-inch 32U rack called the CEC rack. The I/O drawer must be racked in a 19-inch I/O Rack.

A service processor provides all the features for maintenance (tests, survey, alarm) and is included in an I/O drawer. This I/O drawer also contains the system disk and will be referred to as the primary I/O drawer. Additional I/O drawers are called secondary I/O drawers.

.1. The EPC2400 CEC

The CEC contains:

- One, two, three or four 6-way processor cards (for a total of 6, 12, 18 or 24 processors).
- From 2GB to 64GB of memory provided by 5 slots fitting quad-memory boards of 1GB (4x256MB), 2GB (4x512MB), 4GB (4x1024MB), 8GB (4x2048MB) or 16GB (4x16348MB).
- One Remote I/O (RIO) controller supporting 4 connections at 500MB/s. These are used to connect the I/O drawers.
- Redundant power and redundant cooling.

The EPC2400 supports the PowerPC RS64-III@450MHz 64-bit processors.
Each processor card contains six processors with 128KB internal cache and 8MB L2 associative cache on each processor.

2. The EPC2400 Primary I/O Drawer

- 2 areas of 6 Disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks; each area must be driven by a dedicated SCSI bus; at least one disk is necessary.
- 2 media bays for internal media devices: one is occupied by a CD-ROM drive and one is free for additional media (DAT, VDAT, or CD-ROM).
- One floppy disk drive
- 14 PCI slots (11 or 12 free slots depending on the disk areas configuration) on 4 PCI busses
  - One PCI slot is dedicated to the service processor (PowerPC 603).
  - One or two other PCI slots are dedicated to SCSI controllers, as explained below:
    For configurations using only one area of disk bays (all disks are connected to the same SCSI bus) one dual Ultra2 SCSI controller is used to drive the media devices and the disks. The first bus is used for disks and the second bus for media.
    For configurations using both areas of disk bays, the Ultra2 SCSI controller is used to connect each area to a different SCSI bus. The first bus is used for the first area and the second bus for

the second area. An additional Ultra SCSI controller is required to connect media devices.

- 2 RS232 serial ports.
- 1 parallel port.
- 1 keyboard and 1 mouse port.
- One dual Ultra2 SCSI PCI adapter.
- Dual hot-swappable power supplies for enhanced reliability.

The EPC2400 I/O drawer occupies 10 Units of vertical space.

9.3. The EPC2400 Secondary I/O Drawer

- 2 areas of 6 disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks. Each area must be driven by a dedicated SCSI bus.
- media bays for internal media devices (DAT, VDAT, or CD-ROM).
- 14 PCI slots (5*64 bit and 9*32 bit).

9.4. Options and Extensions

- External modem for remote monitoring and maintenance allowing the service processor to call out and alert the Bull Maintenance Center.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5700, DAE5000 and for EMC disk subsystem connection (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5700) interface.
- DAE5000 JBOD enclosures with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- Overland DLT tape library (DLT4000 or DLT7000) with SCSI interface.

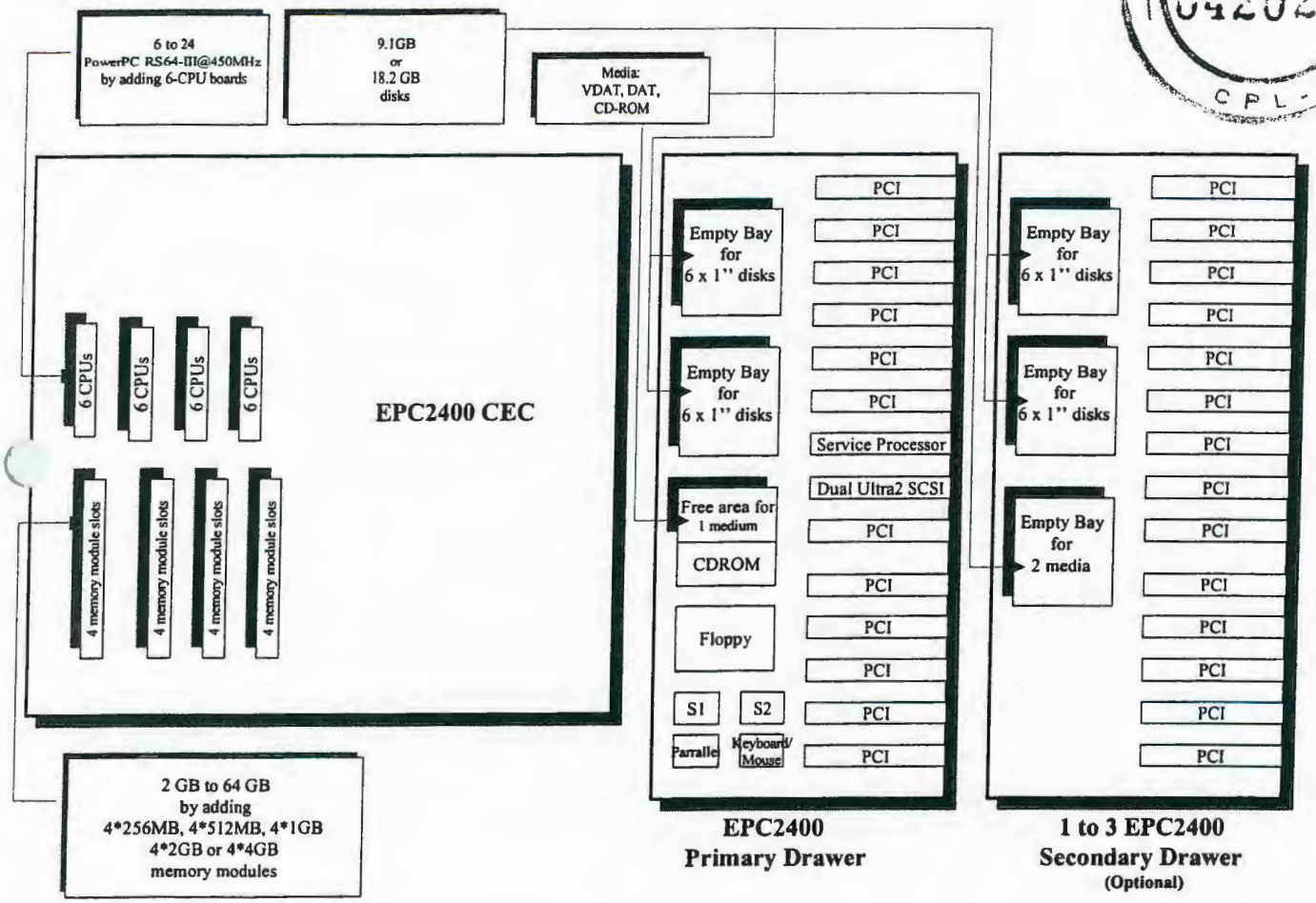
9.5. Maximum Configuration

- Internal disk storage:
  - 12x18.2GB=218.4GB with one I/O drawer.
  - 4x218.4GB=873.6GB with 4 I/O drawers.
- 64 GB of memory.
- Up to 3 quad-CPU boards (i.e. 12-way).
- Up to 14 PCI slots per I/O drawer.
- Up to 56 PCI slots with four I/O drawers.

9.6. Operational Requirements

- AIX 4.3.3 or later.

EPC2400 Description



9.7. Power Kits for the EPC2400

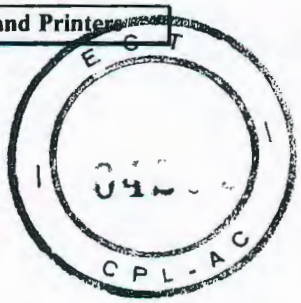
9.7.1. Power Kit Six-CPU RS64-III@450MHz - 8MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 six-CPU board PowerPC RS64-III@450MHz - 8MB L2 cache per CPU.

Operational Requirements

- Any EPC2400 (one CPU slot available - 4 CPU slots maximum).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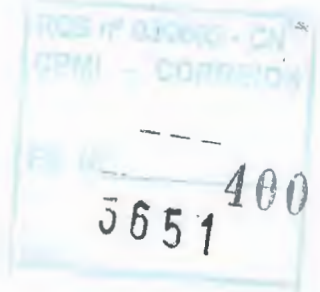
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Chapter 3: Disks, Media, Subsystems and Libraries

This chapter describes the disk devices, associated controllers, media devices (such as tapes and CD-ROM drives) and other subsystems and libraries available on the Escala EPC models.

1. Adapters

1.1. SCSI Adapters for EPC400 EPC430 and EPC450

1.1.1. PCI SCSI-3 LVD/Wide Adapter

The PCI SCSI-3 LVD/Wide Adapter is a single ported Ultra2 (40 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 80 MB per second.

The PCI SCSI-3 LVD /Wide Adapter provides high performance attachment to both internal and external SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 LVD /Wide Adapter has one external VHDCI connector (68p) and one high-density internal connector (68p). The Adapter is capable of addressing up to 15 LVD/SE devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The adapter supports either 8-bit or 16-bit devices.

Characteristics:

- Ultra2 and wide (16-bit wide) SCSI PCI Adapter
- One external 68p VHDCI connector
- One internal 68p HD connector
- Controller conforms to SCSI-SPI2
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 80 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible (version 2.0 and 2.1)
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)
- Automatic switching to LVD or SE mode.

Operational requirements

- Supported on the Escala EPC430 and EPC450 only.
- One free PCI slot.
- AIX version 4.3.2, or later.

1.1.2. PCI SCSI-3 Ultra Wide SE Adapter

The PCI SCSI-3 Ultra Wide SE Adapter is a single ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 MB per second. The PCI SCSI-3 Ultra Wide SE Adapter provides high performance attachment to both internal and external Single Ended SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra Wide SE Adapter has one external connector (68p) and two internal connectors (1 narrow 50p and 1 wide 68p). The Adapter is capable of addressing up to 15 Single Ended devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The adapter supports either 8-bit or 16-bit devices.

Characteristics:

- Ultra and wide (16-bit wide) SCSI PCI Adapter
- One external 68p connector
- Two internal (50p & 68p) connectors
- Controller conforms to ANSI Doc X3T9.2/86-109 Rev 10h
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator).

Operational requirements

- One free PCI slot.
- AIX version 4.2.1, or later.

SYMBOLSYMBOL**1.1.3. PCI SCSI-3 Ultra Wide RAID SE Adapter - DPT**

The PCI SCSI-3 Ultra Wide SE Adapter is a Dual ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 MB per second on each port.
The PCI SCSI-3 Ultra Wide SE Adapter provides high performance attachment to internal Single Ended SCSI disks. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra Wide SE Adapter has two internal Single Ended ports. One of these ports is also available on the external connector. Each port is capable of addressing up to 15 Single Ended devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The external port of this adapter supports 8-bit or 16-bit devices via a 16-bit connector.

The PCI SCSI-3 Ultra Wide SE Adapter supports RAID functionality (RAID 0, RAID 1 and RAID 5 mode) and is designed with 16 MB cache upgradable to 64 MB.
The PCI-SCSI-3 Ultra Wide SE Adapter provides SAF-TE and "Storage Works" capabilities (fault detection and management).
This adapter is used with the internal disks.

Key features:

- Bus mastering, with on-board processor for reduced SCSI and host CPU overhead
- Supports simultaneous operation of Wide and Narrow devices
- Scatter/Gather transfer support
- SCSI-1, SCSI-2, SCSI-3, Fast Wide (W) or Fast-20/Wide (UW) SCSI support with active termination
- Overlapped I/O and tagged command queuing.

Characteristics

- Ultra and wide (16-bit wide) PCI SCSI RAID Adapter
- Two ports (1 internal/external and 1 internal)
- Controller conforms to ANSI Doc X3T9.2/86-109 Rev 10h
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible
  - PCI bus data transfer rates up to 132MB/sec

  Supports Command Tagged Queuing (as SCSI initiator)
- SAF-TE and "Storage Works" capabilities
- RAID functionality
- Hot spare disk and hot-plugging disks
- Array configuration graphic support
- No jumper - Automatic configuration by Software.

Operational requirements

- One free PCI slot.
- AIX version 4.2.1, or later.

Caution: PCI SCSI-3 Ultra-Wide RAID Adapter - DPT can't be used for Native HA.

SYMBOLSYMBOL1.1.4. PCI SCSI-3 Ultra Wide DE Adapter

The PCI SCSI-3 Ultra Wide DE Adapter is a single ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 MB per second. The PCI SCSI-3 Ultra Wide DE Adapter provides high performance attachment to external Differential SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra Wide DE Adapter has one external Differential port. The external port is capable of addressing up to fifteen Differential devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The external port of this adapter supports either 8-bit or 16-bit devices via a 16-bit connector. The external Differential SCSI bus is capable of supporting cable lengths of 25 meters (82 feet).

acteristics:

- Ultra wide (16-bit wide) PCI Adapter
- One external Differential 16-bit bus
- Controller conforms to ANSI Doc X3T9.2/86-109 Rev 10h
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)

Operational requirements

- One free PCI slot.
- AIX version 4.2.1, or later.

SYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOL**1.2. SCSI Adapters for EPC440, EPC1200, EPC1200A and EPC2400**

1.2.1. PCI Dual Channel Ultra2 SCSI Adapter

The PCI Dual Channel Ultra2 SCSI Adapter is a 64 bit adapter and is an excellent solution for high performance SCSI applications. The PCI Dual Channel Ultra2 SCSI Adapter provides 2 SCSI channels (busses). Each SCSI bus can either be internal or external and is designed to support a data rate of up to 80 MB per second, up to twice the maximum data transfer rate of previous Ultra SCSI adapters (40 MB per second).

In order to achieve an Ultra2 SCSI bus data rate of up to 80 MB per second, and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. In order to utilize this Ultra2 80 MB per second performance, all attaching devices or subsystems must also be Ultra2 LVD devices. If any device is not Ultra2 LVD, the adapter will switch its SCSI bus to single-ended (SE) performance and interface at the lower SE SCSI bus data rate of the device.

Two industry standard VHDCI 68 pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A .3 meter converter cable, VHDCI to P, Mini-68 pin to 68 pin, can be used with older external SE subsystems to allow connection to the VHDCI connector on the PCI Dual Channel Ultra2 SCSI Adapter.

Operational Requirements

- Supported on the EPC1200A and EPC2400 only.
- One free PCI slot.
- AIX 4.3.3 or later.

1.2.2. PCI Single-Ended Ultra SCSI Adapter

The PCI Single-Ended Ultra SCSI Adapter is an ideal solution for applications requiring large block data transfers (more than 64K block size) in a multi disk drive environment utilizing SCSI-2 protocol. The PCI Single-Ended Ultra SCSI Adapter has a maximum data transfer rate of 40 MB per second, which is twice the maximum data transfer rate of SCSI-2 Fast Wide adapters (20 MB per second).

The PCI Single-Ended Ultra SCSI Adapter conforms to the SCSI-2 standard and Fast-20 (Ultra) documentation. Industry standard 68 pin connectors are incorporated (SCSI "P" connector definition of X3T9.2/90-048).

Operational Requirements

- One free PCI slot.
- AIX 4.3 or later.

1.2.3. PCI Differential Ultra SCSI Adapter

The PCI Differential Ultra SCSI Adapter is the next generation of SCSI-2 performance with maximum data transfer rates of 40 MB per second. The PCI Differential Ultra SCSI Adapter allows connection to external differential SCSI-2 F/W or Ultra SCSI type devices up to 25 meters away.
The PCI Differential Ultra SCSI Adapter will negotiate with each external device and transfer data at the fastest SCSI data transfer rate capable by the external device.

The adapter conforms to SCSI-2 standard and the Fast-20 (Ultra) documentation. Industry standard 68 pin connectors are incorporated (SCSI "P" connector definition of X3T9.2/90-048).

Operational Requirements

- Supported on the EPC440, EPC1200 and EPC1200A. Discontinued on the EPC2400.
- One free PCI slot.
- AIX 4.3 or later.

1.2.4. PCI Universal Differential Ultra SCSI Adapter

The PCI Universal Differential Ultra SCSI Adapter is the latest technology advancement of a SCSI-2 differential adapter with a maximum data transfer rate of 40 MB per second.

This adapter has the capability to be plugged into the newer +3.3 volt PCI slots as well as the older +5 volt PCI slots. It allows connection to external differential SCSI-2 F/W or Ultra SCSI type devices up to 25 meters away.

The PCI Universal Differential Ultra SCSI Adapter will negotiate with each external device and transfer data at the fastest SCSI data transfer rate capable by the external device.

The adapter conforms to SCSI-2 standard and the Fast-20 (Ultra) documentation. Industry standard 68 connectors are incorporated (SCSI "P" connector definition of X3T9.2/90-048).

Operational Requirements

- Supported on the EPC2400 only.
- One free PCI slot.
- AIX 4.3 or later.

1.2.5. PCI SCSI-2 Fast Wide Single-ended Adapter

The PCI SCSI-2 Fast Wide Single-Ended Adapter provides a single-ended SCSI-2 Fast Wide interface that can burst data to devices on the SCSI bus at 20MB/s. This feature can provide both internal and external device support, connected to the same SCSI bus.

Operational Requirements

- Supported on the EPC1200 only.
- One free PCI slot.
- AIX 4.3 or later.

1.2.6. PCI 3-Channel Ultra SCSI RAID Adapter

The PCI 3-Channel Ultra SCSI RAID Adapter is a non-bootable high performance Ultra SCSI RAID Adapter providing RAID 0,1,or 5 capability and can address up to forty-five 16-bit SCSI-2 physical disk drives on three independent SCSI buses. To increase the data writing performance, a 32 MB fast-write cache is provided as a resident part of this adapter. The 32 MB fast-write cache is a resident feature of the PCI 3-Channel Ultra SCSI RAID Adapter that utilizes non-volatile RAM.

During the unlikely event of an PCI 3-Channel Ultra SCSI RAID Adapter failure, a replacement PCI 3-Channel Ultra SCSI RAID Adapter can be installed and the fast-write cache can be removed from the failing adapter and installed in the new adapter insuring data integrity. The 32 MB fast-write cache can provide a significant improvement in data throughput and response time during certain sequence write operations compared to SCSI RAID adapters without the fast-write cache. The response time and data transfer improvement will vary depending upon the data block sizes, the percentage of sequential writes, machine type/model, and application parameters. The PCI 3-Channel Ultra SCSI RAID adapter has one internal and two external independent Ultra SCSI buses. The internal port can be used to provide an internal RAID solution. Systems with internal 6-pack disks can attach one PCI 3-Channel Ultra SCSI RAID Adapter per internal 6-pack.

Operational Requirements

- Supported on the EPC440 only.
- One free PCI slot .
- AIX 4.3 or later.

1.3. SCSI Adapters for EPC800

1.3.1. WSA - SCSI-2 F/W SE Adapter

The WSA/SCSI-2 SE Adapter is based on the same electronic design than the LAN/SCSI-2 Adapter (Ethernet part removed)

The WSA/SCSI SE Adapter feature:

- One SCSI-2 SE port used for the connection of the standard internal disk and media devices.
- New POS register to identify the board (0200 instead of 8F9D)
- PCB size reduced
- External SCSI connector only (68-position 16 bits)
- Single Ended connection
- Adapter SCSI ID from 0 to 7 (default 7)
- Performance improvement of about 20%.

Attachment

- The adapter fits into a single MCA slot.

SYMBOL1.3.2. WSA - SCSI-2 F/W DE Adapter

The WSA/SCSI-2 DE Adapter is based on the same electronic design than the LAN/SCSI-2 Adapter (Ethernet part removed)

The WSA/SCSI DE Adapter feature:

- One SCSI-2 DE port used for the connection of the standard internal disk and media devices.
- New POS register to identify the board (0200 instead of 8F9D)
- PCB size reduced
- External SCSI connector only (68-position 16 bits)
- Differential Ended connection
- Adapter SCSI ID from 0 to 7 (default 7)
- Performance improvement of about 20%.

Attachment

- The adapter fits into a single MCA slot.

1.3.3. LSA - SCSI-2 F/W SE Adapter

The LSA SCSI-2 Fast Wide SE Adapter features:

- One SCSI-2 Fast Wide SE port used for the connection of the standard internal disk and media devices.
- One Ethernet IEEE 802.3 port, with a communication rate of 10Mbps. A thick (10Base5) connector and a twisted pair (10BaseT) connector are standard on the system.

SCSI-2 Fast Wide SE Port Description

The LSA SCSI-2 Fast Wide SE Adapter provides one 16-bit Single-Ended external bus featuring with data rate of up to 20 MB/sec.

Main Characteristics:

- Fast and wide MCA Adapter
- One external Single-Ended 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to Single-Ended SCSI Disks, Media Drives and Storage Subsystems.

Main features of the external Single-Ended bus are:

- Supports either 8-bit or 16-bit single-ended devices
- The number of physical devices attached to the bus is limited by SCSI bus cabling restrictions (up to 4-meter length)
- External cabling can be up to 2.4-meter when attaching SCSI-2 SE Deskside Cabinets/Drawers

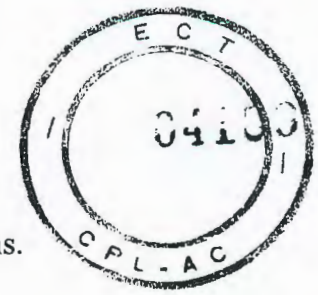
SYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOL**1.3.4. LSA - SCSI-2 F/W DE Adapter**

The LAN/SCSI Fast Wide DE Adapter features:

- One SCSI-2 Fast Wide DE port used for the connection of the standard internal disk and media devices.
- One Ethernet IEEE 802.3 port with a communication rate of 10Mbps. A thick (10Base5) connector and a twisted pair (10BaseT) connector are standard on the system.

SCSI-2 Fast Wide DE Port Description

The LSA SCSI-2 Fast Wide DE Adapter providing one 16-bit Differential external bus featuring with data rate of up to 20 MB/sec.



Main Characteristics:

- Fast and wide MCA Adapter
- One external Differential 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to external Differential SCSI Disks and Storage Subsystems.

Main features of the external Differential bus are:

- Supports 16-bit differential devices
- Maximum cable length is 25 meter.

1.3.5. SCSI-2 Fast Wide SE/SE Adapter

Discontinued: 31/03/2000.

The SCSI-2 Fast Wide SE/SE Adapter provides one 8- or 16-bit internal Single-Ended bus and one 16-bit Single-Ended external bus featuring both data rate of up to 20 MB/sec.

Main Characteristics:

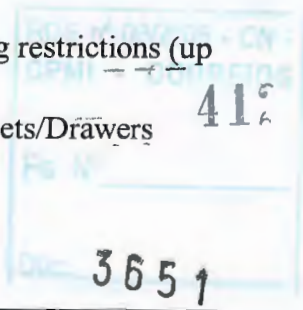
- Dual ported fast and wide (16-bit wide) short MCA Adapter
- One internal 8 or 16-bit Single-Ended bus
- One external Single-Ended 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to Single-Ended SCSI Disks, Media Drives and Storage Subsystems.

Main features of the internal Single-Ended bus are:

- Supports either 8-bit or 16-bit devices
- Only one of these two connectors can be used at a time
- 8-bit bus and 16-bit bus can not be connected and used at the same time
- Each SE bus is able to support up to seven devices

Main features of the external Single-Ended bus are:

- Supports either 8-bit or 16-bit single-ended devices
- A maximum of four external SE bridge boxes devices can be connected
- The number of physical devices attached to each bus is limited by SCSI bus cabling restrictions (up to 4-meter length)
- External cabling can be up to 2.4-meter when attaching SCSI-2 SE Deskside Cabinets/Drawers



Operational requirements

One free MCA slot.

1.3.6. SCSI-2 Fast Wide SE/DE Adapter

The SCSI-2 Fast Wide SE/DE Adapter providing one 8 or 16-bit internal Single-Ended bus and one 16-bit Differential external bus featuring both data rate of up to 20 MB/sec.

Main Characteristics:

- Dual ported fast and wide (16-bit wide) MCA Adapter
- One internal 8 or 16-bit Single-Ended bus
- One external Differential 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to internal Single-Ended SCSI Disks and Media Drives and to external Differential SCSI Disks and Storage Subsystems.

Main features of the internal Single-Ended bus are:

- Supports either 8-bit or 16-bit devices
- Only one of these two connectors can be used at one time
- 8-bit bus and 16-bit bus can not be connected and used at the same time
- Each SE bus is able to support up to seven devices.

Main features of the external Differential bus are:

- Supports 16-bit differential devices
- A maximum of seven external bridge boxes devices can be connected
- A maximum of two SCSI-2 DE Deskside Cabinets can be connected
- Maximum cable length is 25 meters (including internal length).

Additional DPX/20, Serial or SCSI Subsystems and High Availability connections are also available with the differential system-to-system and Y-cable features.

Operational requirements

- One free MCA slot.

1.4. SSA Adapters for EPC400

(Discontinued: 30 June 1999)
Note: Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

1.4.1. PCI SSA 4-port Multi-Initiator/RAID EL Adapter

The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA).
The SSA 4-Port Multi-Initiator/RAID EL Adapter enables attachment of SSA technology disks and subsystems.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA 4-Port Multi-Initiator/RAID EL Adapter allows connection of up to two hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Eight-initiator non-RAID, or two-initiator RAID configurations support
- RAID 5 support
- Optional 4MB Fast-Write Cache Card available for one-initiator RAID or one-initiator non-RAID SSA configurations
- Address and data parity support

- Streaming data transfer at 40MB/sec or 80MB/sec
- Two-way, high-availability configurations using HACMP Version 4.1.1 or Version 4.2.2 in modes 1, 2, and 3 on AIX 4.1.5 and higher.
- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- Interoperability of PCI and Micro Channel SSA Multi-Initiator/RAID EL Adapters.

Limitations

- Will not operate in SSA configurations supporting high-performance 4-Port SSA Adapter or Enhanced 4-Port SSA Serial Adapter on Micro Channel.
- No IPL/Boot support from SSA disk drives
- RAID arrays must have all array members in same SSA loop
- PCI system interface only.

Operational requirements

- One free PCI slot.

Fast-Write Cache Option Card

The SSA Fast-Write Cache Option Card is a 4MB fast-write optional feature that plugs into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache. The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes and application parameters.

1.5. SSA Adapters for EPC800

(Discontinued: 30 June 1999)

1.5.1. SSA Enhanced 4-Port Adapter

- High-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA).
- Enables attachment of SSA technology disks and subsystems.
- Provides a cost-effective solution for packaging large numbers of disk drives.
- Allows to cluster up to eight nodes, to access large databases stored in SSA Disk Subsystem.

The SSA Enhanced 4-Port Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per a[illegible]ter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA Enhanced 4-Port Adapter allows connection of up to eight hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing m[illegible]l, status, and sense bytes.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Conform to SSA, Level 1
- 8-byte bus master
- Address and data parity support
- Streaming data transfer at 40MB/sec or 80MB/sec
- Eight-way, high-availability configurations using HACMP Version 4.1 in modes 1, 2, and 3 on AIX 4.1.4
- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives per adapter

- Micro Channel Type 5 form factor card.

Operational requirements

- One free MCA slot.

SYMBOL**1.5.2. Micro Channel SSA 4-port Multi-Initiator/RAID EL Adapter**

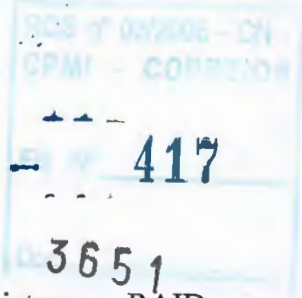
The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA). It enables attachment of SSA technology disks and subsystems.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

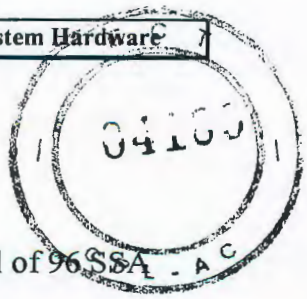
The SSA 4-Port Multi-Initiator/RAID EL Adapter allows connection of up to two hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.



Main Characteristics:

- Four SSA ports configurable as two external loops
- Eight-initiator non-RAID, or two-initiator RAID configurations support
- RAID 5 support
- Optional 4MB Fast-Write Cache Card available for one-initiator RAID or one-initiator non-RAID SSA configurations
- Address and data parity support
- Streaming data transfer at 40MB/sec or 80MB/sec
- Two-way, high-availability configurations using HACMP Version 4.1.1 or Version 4.2.2 in modes 1, 2, and 3 on AIX 4.1.5 and later



- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- Interoperability of PCI and Micro Channel SSA Multi-Initiator/RAID EL Adapters.

Limitations

- Will not operate in SSA configurations supporting high-performance 4-Port SSA Adapter or Enhanced 4-Port SSA Serial Adapter on Micro Channel.
- RAID arrays must have all array members in same SSA loop
- Micro Channel system interface only.

Operational requirements

- One free MCA slot.

Fast-Write Cache Option Card

The SSA Fast-Write Cache Option Card is a 4MB fast-write optional feature that plugs into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache. The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes and application parameters.

1.6. SSA Adapters for EPC1200 and EPC1200A

(Discontinued: 30 June 1999)

1.6.1. PCI SSA 4-port Multi-Initiator/RAID EL Adapter

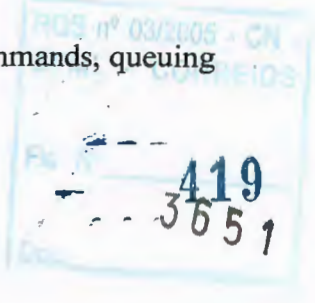
The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA). The SSA 4-Port Multi-Initiator/RAID EL Adapter enables attachment of SSA technology disks and subsystems.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA 4-Port Multi-Initiator/RAID EL Adapter allows connection of up to two hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.



Main Characteristics:

- Four SSA ports configurable as two external loops
- Eight-initiator non-RAID, or two-initiator RAID configurations support
- RAID 5 support
- Optional 4MB Fast-Write Cache Card available for one-initiator RAID or one-initiator non-RAID SSA configurations
- Address and data parity support
- Streaming data transfer at 40MB/sec or 80MB/sec
- Two-way, high-availability configurations using HACMP Version 4.1.1 and Version 4.2.2 in modes 1, 2, and 3 on AIX 4.1.5 and higher
- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations

- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- Interoperability of PCI and Micro Channel SSA Multi-Initiator/RAID EL Adapters

Limitations

- Will not operate in SSA configurations supporting high-performance 4-Port SSA Adapter or Enhanced 4-Port SSA Serial Adapter on Micro Channel.
- No IPL/Boot support from SSA disk drives
- RAID arrays must have all array members in same SSA loop
- PCI system interface only.

Operational requirements

One free PCI slot.

Fast-Write Cache Option Card

The SSA Fast-Write Cache Option Card is a 4MB fast-write optional feature that plugs into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache. The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes and application parameters.

1.7. PCI 64 bits Fibre Channel Adapters (DCCG147-0000, DCCG148-0000) for the EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

The PCI 64 bits Fibre Channel Host Bus Adapters deliver exceptional performance through the use of Emulex's new Dragonfly ASIC, a 266 MIPs on-board processor, and state of the art dual ported buffer memory. These adapters include sophisticated capabilities such as full-duplex data transfers, full fabric support, parity protection and large data buffers.

The LP8000 delivers point-to-point, arbitrated loop and switch fabric connections as well as both Class 2 and 3 frame formats. Support for both copper and fiber optic cabling is provided through embedded interfaces.

Host Support

The PCI Fibre Channel Host Adapter provides simultaneous and concurrent multiple protocols (IP and SCSI) support.

Specifications

- Simultaneous full duplex fibre channel 1.0625 GB/s transfers
- 64-bit PCI data and addressing
- On-board high speed 266 MIPs RISC processor
- Large on-board buffers
- Application Programming Interface (API)
- All fibre channel topologies: point-to-point, arbitrated loop and switch topologies
- Full fabric support using F Port and FL Port connections (FL port in a future product release)
- Full support for both FC service Class 2 and 3
- Supports both network and storage protocols simultaneously (IP and FCP)
- 2 physical interfaces: embedded copper or embedded optical fiber.

Architecture

- Emulex developed ASIC technology up to 33 MHz PCI bus master DMA
- 512 KB FLASH memory
- 1 MB code RAM
- 256 KB buffer RAM.

Benefits

- Industry's best I/O performance
- Single interface for network and storage applications
- Designed to support mission critical enterprise SAN applications.

Standards

- ANSI Fibre Channel FC-PH
  ANSI Fibre Channel FC-AL
- ANSI Fibre Channel FC-PLDA
- ANSI Fibre Channel FC-FLA
- PCI Local Bus Revision 2.2
- Fibre Channel Class 2, 3

Copper

Data Rate:	1.0625 GB/s
Cable Type:	Dual Twinax
Connector Type:	DB9
Distance:	98' (30 meters)

Optical

Data Rates: 1.0625 GB/s
Optics: short wave laser
50/125 µm multimode fiber
Connector Type: dual SC

Physical Dimensions

Short PCI form factor 6.88 inch X 4.20 inch.

Power Requirements

Volts: +5 VDC
Power: 10 watts

Environmental Conditions

Operating Temperature: 32° to 113° F (0° to 45° C)
Storage Temperature: 14° to 131° F (-10° to 55° C)
Relative Humidity: 5% to 95% non-condensing

Agency Approvals

- Class 1 Laser Product per DHHS 21CFR (J) and EN60825
- UL Recognized to UL 1950
- CUR Recognized to CSA22.2, No. 950
- TUV Certified to EN60950
- FCC Rules, Part 15, Class B (Embedded copper Fibre Channel adapter is Class A)
- ICES-003, Class B (Embedded copper Fibre Channel adapter is Class A)
- MC Directive 89/336/EEC (CE Mark)
  - EN55022, Class B*
  - EN50082-1
- Australian EMC Framework (C-Tick Mark)
  - AS/NZS 3548, Class B (Embedded copper Fibre Channel adapter is Class A)
- VCCI, Class B (Embedded copper Fibre Channel adapter is Class A).

Operating System requirement

AIX 4.3.2 or later.

Machines/number of adapters

Escala	EPC400	EPC430	EPC440	EPC450	EPC1200/A	EPC2400
Nb adapters	4	4	4	4	8	8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1.8. PCI Fibre Channel Adapter for EPC400, EPC430, EPC440, EPC1200, and EPC1200A

Discontinued: 30/11/1999.

The Fibre Channel PCI Host Bus Adapter utilizes a state of the art dual ported on-board memory architecture to provide high-performance I/O solutions for applications like client/server, database I/O, multimedia, imaging and clustering which require sustained high throughput coupled with low latency characteristics.

Architecture

The Fibre Channel PCI Host Adapter is designed using custom ASIC technology from Emulex. This integrated design, including both chip level technology and Emulex developed firmware, reduces host requirements, while simplifying the driver interface.

Emulex developed ASIC technology up to 33 MHz PCI bus master DMA

- 512 KB FLASH memory
- 512 KB - 512 KB context RAM
- 512 KB - 512 KB buffer RAM

Host Support

The PCI Fibre Channel Host Adapter provides simultaneous and concurrent multiple protocols (IP and SCSI) support.

Specifications

- Supports Fibre Channel rate of 1 Gbits/sec
- Support point-to-point and arbitrated loop Fibre Channel topologies
- Supports both network and storage protocols simultaneously (IP and FCP)
- Direct interface to copper cables through standard 80-pin GLM
- Built-in protocol engine with an integrated RISC processor.

Benefits

- Industry's best I/O performance
- Single interface for network and storage applications
- Eliminate distributed application bottlenecks.

Standards

- ANSI Fibre Channel FC-PH Revision 4.3
- ANSI Fibre Channel FC-AL Revision 4.5
- FCSI 301 Rev 1.0 Gigabaud Link Module
- PCI Local Bus Revision 2.0/2.1
- Fibre Channel Class 3.

Hardware Interface

80-pin GLM (Gigabit Link Modules) connector for copper interface.

Copper GLMs

Data Rate	1062.5 Mbits/s
Cable Type	Dual Twinax or Quad Axial
Connector Type	DB9
Distance	30 meters

Distance Supported

Up to 30m with copper cables.
Up to 175m with 62.5/125µm multimode fiber.
Up to 500m with 50/125µm multimode fiber.
Up to 10km with optical link extenders.

MIAs, Hubs and Link Extenders

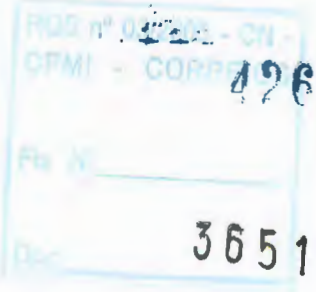
- Hubs to provide up to nine copper ports (DB9 Female) with re-generated signals. The hubs can be chained. (External hubs or rack-mount hubs are available.)
- MIAs to convert copper (DB9 Male) to multimode fiber (DSC) and to provide distant connections. The MIA is directly connected to the copper interface (DBB9 Female) of the equipment.
- Link Extenders to offer a distant connection up to 10km from a copper interface (DB9) to a single mode fiber (9/125µm - optical ST)

Agency Approvals

- Class 1 Laser Product per DHHS 21 CFR (J) and EN60825
- UL Recognized to UL1950
- CUR Recognized to CSA22.2, No. 950
- TUV Certified to EN60950
- FCC Rules, Part 15, Class A
- DOC Rules, Class A
- EMC Directive 89/336/EEC (CE Mark)
  - EN55022, DISPR22/85, Class A
  - EN50082-1.

Operating System requirement

- AIX 4.3 or later.



2. Disk Drives

2.1. Disk Drives Comparison Table

	4.2 GB	4.5 GB	9.1 GB	9.1 GB	9.1 GB	9.1 GB	9,1 GB	9,1 GB	18.2 GB	18.2 GB	18.2 GB
Form Factor	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½
Size (Low Profile, Half Height or Full Height)	1"	1"	1"	1"	1.6"	1.6"	1"	1"	1"	1"	1"
Average Seek Time (ms)	7.5	7.5	6.9	6.7	8.2	8.2	5.1	5.2	7.2 *	5.2	6.9
Average Latency (ms)	4.17	4.17	4.17	4.17	4.17	4.17	2,99	2,99	4.17	2,99	4.17
Rotational Speed (RPM)	7200	7200	7200	7200	7200	7200	10000	10000	7200	10000	7200
Data Transfer Rate:											
Media (MB/sec - max)	15	15	28.3	22	10	15	44.3	36	32	36	28.3
Supported on System											
EPC400	Y		Y		Y						Y
EPC430	Y (1)		Y (1)		Y (1)			Y		Y	Y (1)
EPC440				Y			Y		Y		
EPC450	Y (1)		Y (1)		Y (1)			Y		Y	Y (1)
EPC800	Y		Y		Y						
EPC1200		Y		Y		Y			Y		
EPC1200A		Y		Y		Y	Y		Y		
EPC2400				Y			Y		Y		
Interface	SCSI-2	SCSI-2	SCSI-2	SCSI-2	SCSI-2	SCSI-2	Ultra2 SCSI	Ultra2 SCSI	Ultra SCSI	Ultra2 SCSI	SCSI-2
SE High Speed	Y	Y	Y	Y	Y	Y	LVD/SE	LVD/SE	Y	LVD/SE	Y
DE High Speed	N	N	N	N	N	N	N	N	N	N	N
Internal	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
External	-	-	-	-	-	-	-	-	-	-	-

* Based on 4 reads to 1 write.

(1) Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

(2) Read/Write.

2.2. 4.2 GB Ultra SCSI Disks for EPC400

(Discontinued: 30/10/1999)
Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "Hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	7.5
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15 (max)

2.3. 4.2 GB SCSI-2 High Speed Disks EPC800

Internal (SE High Speed) - "CRU"

Form factor	3"1/2
Size	1"
Average seek time (ms)	7.5
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15 (max)

2.4. 4.5 GB Ultra SCSI High Speed Disks for EPC1200 and EPC1200A

Internal (SCSI-2 or Ultra SCSI) - "hot-swappable disk"

ɔrm factor	3"1/2
Size	1"
Average seek time (ms)	7.5
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15 (max)

2.5. 9.1 GB Ultra SCSI Disks for EPC400

Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1.6"
Average seek time (ms)	8.2
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	10 (max)

2.6. 9.1 GB Ultra SCSI Disks for EPC400

Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.9
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	28.3 (max)

2.7. 9.1 GB SCSI-2 High Speed Disks for EPC800

Internal (SE High Speed)

Form factor	3"1/2
Size	1.6"
Average seek time (ms)	8.2
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	10 (max)

2.8. 9.1 GB SCSI-2 High Speed Disks for EPC800

Internal (SE High Speed)

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.9
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	28.3 (max)

2.9. 9.1 GB Ultra SCSI Disks for EPC1200 and EPC1200A

Internal (SCSI-2 or Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1.6"
Average seek time (ms)	8.2
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15.5 (max)

2.10. 9.1 GB Ultra SCSI Disks for EPC440, EPC1200, EPC1200A and EPC2400

Internal (SCSI-2 or Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.7
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	22 (max)

2.11. 9.1 GB Ultra2 SCSI LVD/SE Disks for Escala EPC440, EPC1200A and EPC2400

Internal (Ultra2 SCSI - LVD/SE) hot swappable disk

Form factor	3"1/2
Size	1"
Average seek time (ms)	5.1
Average Latency (ms)	2.99
Rotational speed (RPM)	10,000
Data Transfer Rate Media (MB/s)	44.3 (max)

2.12. 9.1 GB Ultra2 SCSI LVD/SE Disks for Escala EPC430 and EPC450

Internal (Ultra2 SCSI - LVD/SE) hot swappable disk

Form factor	3"1/2
Size	1"
Average seek time (ms)	5.2
Average Latency (ms)	2.99
Rotational speed (RPM)	10,000
Data Transfer Rate Media (MB/s)	36 (max)

2.13. 18.2 GB Ultra Wide SCSI Disks for EPC400

Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.9
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	28.3 (max)

2.14. 18.2 GB Ultra SCSI Disks for EPC440, EPC1200, EPC1200A and EPC2400

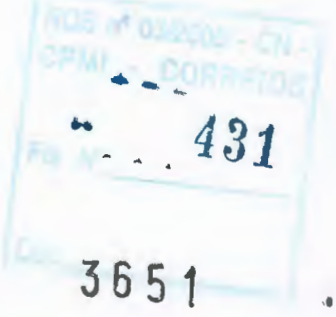
Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	4"
Size	1"
Average seek time (ms)	7.2 (based on 4 reads to 1 write)
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	32 (max)

2.15. 18.2 GB Ultra2 SCSI LVD/SE Disks for Escala EPC430 and EPC450

AUTONUMLGLAUTONUMLGLAUTONUMLGLAUTONUMLGLInternal (Ultra2 SCSI - LVD/SE) hot swappable disk

Form factor	3"1/2
Size	1"
Average seek time (ms)	5.2
Average Latency (ms)	2.99
Rotational speed (RPM)	10,000
Data Transfer Rate Media (MB/s)	36 (max)



3. Media

3.1. Media Usage Summary Table

S: Standard **O:** Internal Option **E:** External Option

	Current Offer	EPC400	EPC430	EPC440	EPC450	EPC800	EPC1200 & EPC1200A	EPC2400	Save/ Restore	Media Interchange
3"1/2 Floppy	1.44MB	S	S	S	S	S	S	S	Y	Y
1/4" Tape	16/32 GB	O/E	O/E (1)	N	O/E (1)	O/E	N	N	Y	Y
1/4" Tape	25/50 GB	O	O	N	O	E	N	N	Y	Y
8mm VDAT	7/14 GB	O	O	O	O	O	O	O	Y	Y
8mm VDAT	20/40 GB	E	E	E	E	E	O	O	Y	Y
mm DAT	12/24 GB	O	O	O	O	O	O	O	Y	Y
LT4000	20/40 GB	E	E	E	E	E	N	N	Y	Y
DLT7000	35/70 GB	E	E	E	E	E	E	E	Y	Y
1/2" Tape	STK	E	E (1)	N	E (1)	E	N	N	Y	Y
CD-ROM	600 MB	S	S	S	S	S/O	S	S	N	N

(1) Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

3.2. Diskette Drives

3.2.1. 3.5-Inch 1.44MB Diskette Drive

A 1.44 MB 3-1/2 inch diskette drive is standard on all ESCALA system units. It supports also the 720 KB format.

Attachment

The drive attaches to the system using an internal cable to the diskette controller in the system unit.

3.3. Tape Drives

3.3.1. QIC 16/32 GB MLR1 1/4-Inch Cartridge Tape Drive (MTUG032)

(Discontinued: 30/10/1999)
Note: Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

The QIC 16/32 GB MLR1 (Multi Channel Linear Recording 1) 1/4 inch Cartridge Tape Drive operates in a streaming mode and provides data interchange and save/restore capabilities with preformatted data cartridges.
The cartridge loading in QIC 16/32 GB MLR1 Tape Drive is motorized.

The drive supports the following standards:

Format	Maximum Capacity	Operation	Bull Express Reference	Imation Reference
QIC 5010	16/32 GB	R/W - ECC	43473	16.0 GB
QIC 5010	13/26 GB	R/W - ECC	47023	13.0 GB
QIC-2 GB	2.5/5 GB	R/W - ECC	3236	MAGNUS 2.5
QIC 1000	1.2 GB	R/W - ECC	3217	MAGNUS 1.2
QIC 525	525 MB	R/W - ECC	3215	DC 6525
QIC 150	150 MB	R/W	3209	DC 6150

The QIC 24 format is not available anymore.

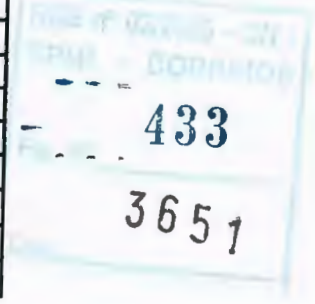
* SCSI Bus transfer rate: 18 MB/s
User average Data Transfer rate, streaming mode: 1.5 MB/s native and 3 MB/s compressed (assuming an average Data Compression ratio of 2:1).
Warning: Capacity and transfer rate using the HW Data Compression embedded into the drive depends on the pattern of the transferred data.
Need of a special "Dry Process" cleaning cartridge - Bull Express Reference: 05678 - for 50 cleaning.

3.3.2. QIC 25/50 GB MLR3 1/4-Inch Cartridge Tape Drive (MTUG036)

The QIC 25/50 GB MLR3 (Multi Channel Linear Recording 3) 1/4 inch Cartridge Tape Drive operates in a streaming mode and provides data interchange and save/restore capabilities with preformatted data cartridges.
The cartridge loading in QIC 25/50 GB MLR3 Tape Drive is motorized.

The drive supports the following standards:

Format	Maximum Capacity	Operation	Bull Express Reference	Imation Reference
MLR3-25GB	25/50 GB	R/W ECC	43498	MLR3 25 GB
QIC 5010	16/32 GB	R/W - ECC	43473	16.0 GB
QIC-4 GB	4/8 GB	R only - ECC	43474	MAGNUS 4.0
QIC-2 GB	2.5/5 GB	R only - ECC	3236	MAGNUS 2.5
QIC 1000	1.2 GB	Not Supported		
QIC 525	525 MB	Not Supported		
QIC 150	150 MB	Not Supported		
QIC 24	60 MB	Not Supported		



User average Data Transfer rate, streaming mode with MLR3 25 GB cartridges: 2.0 MB/s native and 4 MB/s compressed (assuming an average Data Compression ratio of 2:1).
Warning: Capacity and Transfer rate using the HW Data Compression embedded into the drive depends on the pattern of the transferred data.
Need of a special "Dry Process" cleaning cartridge - Bull Express Reference: 05678 - for 50 cleaning.

3.3.3. 5/10 GB 8 mm Tape Drive (or VDAT 5/10 GB) (MTUG037)

(Discontinued)

The 5 GB 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 500 KB per second.

The 5 GB 8 mm tape drive features data compression hardware using an adaptation of IBM's IDRC algorithm This provides an effective capacity of up to 10 GB of data per cartridge and an increased effective data rate of 1 MB per second, assuming an average data compression 2:1 and depending on the type of data transferred.

3.3.4. 7/14 GB 8 mm Tape Drive (or VDAT 7/14 GB) "Eliant" (MTUG029)

The 7 GB 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 1 MB per second.

The 7 GB 8 mm tape drive features data compression hardware using an adaptation of IBM's IDRC algorithm. This provides an effective capacity of up to 14 GB of data per cartridge and an increased effective data rate of 2 MB per second, assuming an average data compression 2:1 and depending on the type of data transferred.

Caution: The 8200 format is "**Read only**".
When using this format the cartridge **MUST** be write protected.

3.3.5. Internal/External 20/40 GB 16-bit 8 mm Tape Drive (or VDAT 20/40 GB)

The 20 GB 16-bit 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 3 MB per second.

The 20 GB 16-bit 8mm Tape Drive features a Liquid Crystal Display (LCD) to provide operating and error messages.

The 20 GB 16-bit 8 mm tape drive features data compression hardware using an adaptation of IBM's IDRC algorithm. This provides an effective capacity of up to 40 GB of data per cartridge and an increased effective data rate of 6 MB per second, assuming an average data compression 2:1 and depending on the type of data transferred.

The 20 GB 16-bit 8mm tape drive reads the 8mm tape cartridges in capacities of 2.3GB, 5GB, 7GB and 20GB in native mode or 10GB, 14GB and 40GB in compressed mode.
The 20GB 16-bit 8mm tape drive writes the 8mm tape cartridges in capacities of 20GB in native mode and 40GB in compressed mode when using Advanced Metal Evaporated (AME) media.

Characteristics:

- Capacity: 20GB native mode, 40GB (typical) compression mode
- Form Factor: 5.25-inch half-high
- Media: 8mm Advanced Metal Evaporated media on Write/Read 20GB format, 8mm Metal Particle (MP) media on Read 2.3GB, 5GB, 7GB format
- Technology: Helical scan, rotating head, Liquid Crystal Display (LCD) for messages
- Operation: Streaming
- Data Transfer Rate: 3MB/s native mode, 6MB/s (typical) compression mode
- Interface: SCSI-2 (single-ended) asynchronous/synchronous
- Physical Specifications: 250mm (Width), 275mm (Depth), 55mm (Height), 5Kg (Weight)

EMC Conformance Classification:

- USA: FCC Class B
- Japan: VCCI-2
- Europe: CISPR 22 Class B

Product Safety/Country Testing/Certification:

- USA: UL
- Canada: CNL (CSA or cUL)
- Germany/Europe: CE Mark (Safety, TUV, EN60 950).

Warning: The 8mm Metal Particle media (2.3GB, 5GB and 7GB) is "Read only".

Limitations:
If this tape drive is used for reading Metal Particle media (2.3GB, 5GB or 7GB), the drive must be cleaned with a cleaning cartridge prior to using an Advanced Metal Evaporated media (20GB).
Cleaning Tape: Ref 315250 (Bull Express) for 18 cleanings.

3.3.6. 12/24 GB 4 mm Tape Drive (MTUG028)

The 4mm tape drive features IPL capability and up to 24GB of storage capacity with compression in a 3.5" full high enclosure that attaches via the SCSI interface.

The main characteristics of the 4mm tape drive are:

- Non-data grade media rejection (will not write on audio grade media)
- DDS, DDS2 and DDS3-data compression format
- SCSI2 command support with SCSI-2 SE interface
- Synchronous and asynchronous SCSI data transfers, streaming operation
- Average file search speed:
  - 40 second (125m tape)
- 12GB capacity per cartridge, 24GB with data compression (typical)

- Data transfer rate:
  - Max. Sustained Native: 1 MB/s
  - Max Burst Asynchronous: 3 MB/s
  - Max. Burst Synchronous: 10 MB/s
- Data Buffer 2 MB
- Rewind Speed 1m/s.

	Cartridge Types			
	DDS-1 (60m)	DDS-1 (90m)	DDS-2 (120m)	DDS-3 (125m)
Characteristics	Read and write in DDS-1	Read and write in DDS-1	Read and write in DDS-2	Read and write in DDS-3
Data capacity *	1.3GB/2.6GB	2GB/4GB	4GB/8GB	12GB/24GB
Bull Express Reference cartridge	3226	3227	3228	3230

SYMBOL * in Not Compressed/Compressed mode

3.3.7. DLT 4000 Tape Drive

The DLT 4000 tape drive is a high-performance, high capacity, streaming 1/2" cartridge tape product designed for use on midrange and high-end systems.

The main characteristics of the DLT 4000 tape Drive are:

- External Table Top - 5"1/4 form factor - 1/2" tape drive
- 20GB capacity per cartridge, 40GB typical with 2:1 data compression ratio
- Differential interface (up to 25m connection)
- Tape cartridge available
  - CompacTape IV (up to 20GB native formatted data)
  - CompacTape III (2.6, 6.0 and 10GB native formatted data depending on selection)
- SCSI-2 differential interface - wide connection
- Data transfer rate: 1.5MB/second native, 3.0MB/s in compression mode (with 2:1 ratio)
- Dual channel read/write
- Maximum block size of 16MB
- Read/write data cache of 2MB
- Tape mark directory to maximize throughput and to minimize data access tie
- Timing characteristics:
  - Tape speed: 110 inches/sec on read/write - 150 inches/sec on search
  - Average rewind time: 45 sec
  - Average access time: 45 sec
  - Load to BOT : 48 sec for tape already used
  - Unload from BOT: 17 sec.

Warning: The CompacTape III (2.6GB, 6GB and 10GB) can be only "on read".

The CompacTape IV (20GB) can be "on read" or "on write".
The CompacTape (40GB) cannot be "on read".

3.3.8. DLT 7000 Tape Drive

The DLT 7000 Tape Drive is a high-performance, high capacity, streaming 1/2" cartridge tape product designed for use on midrange and high-end systems.

The main characteristics of the DLT 7000 Tape Drive are:

- External Table Top - 5"1/4 form factor - 1/2" tape drive
- 35 GB capacity per cartridge, 70 GB typical with 2:1 data compression ratio
- Differential interface (up to 25m connection)
- Tape cartridge available
  - CompacTape IV (20GB and 35GB native formatted data)
  - CompacTape III (2.6, 6.0 and 10GB native formatted data depending on selection)
- SCSI-2 differential interface - wide connection
- Data transfer rate: 5.0 MB/second native, 10 MB/s in compression mode (with 2:1 ratio)
- Quad channel read/write
- Maximum block size of 16 MB
- Read/write data cache of 8 MB
- Tape mark directory to maximize throughput and to minimize data access tie
- Timing characteristics:
  - Tape speed: 160 inches/sec on read/write - 175 inches/sec on search and on rewind
  - Average rewind time: 60 sec
  - Average access time: 60 sec
  - Load to BOT : 47 sec for tape already used
  - Unload from BOT: 17 sec.

Warning: The CompacTape III (2.6GB, 6GB and 10GB) and the CompacTape IV (20GB) can be only "on read". The CompacTape IV (40GB) can be "on read" or "on write".

3.4. CD-ROM Drives

3.4.1. 14-32 Speed Tray-Loading CD-ROM Drive for EPC400 and EPC800

The 14-32 Speed Tray-Loading CD-ROM is a 600MB SCSI-2 CD-ROM drive that provides from 14 up to 32x speed performance with the convenience of loading a CD without a caddy.

The speed is on Constant Angular Velocity. The speed is depending on the location of the "read head".

Main characteristics are:

Form factor:	5"¼ in Half High
Height:	42 mm
External Interface:	SCSI-2 8-bit Single Ended
Interface Speed:	10 Mb/sec max. burst
Access Time:	90 ms average
Data Rate:	from 2300 Kb/sec to 5400 Kb/s average

3.4.2. Twenty Speed Tray-Loading CD-ROM Drive for EPC440, EPC1200 and EPC1200A

The Twenty Speed Tray-Loading CD-ROM is a 600MB SCSI-2 CD-ROM drive that provides more speed performance.

Main characteristics are:

Form factor:	5"¼ in Half High
Height:	43 mm
External Interface:	SCSI-2 8-bit Single Ended
Interface Speed:	10 Mb/sec max. burst
Buffer memory:	512KB
Access Time:	95 ms average
Data Rate:	3000 Kb/sec maximum

Multisession capable (Reads CDR and CDRW media)
Loading tray supports 12-cm and 8-cm disks

4. Escala EPC Expansion Racks

The Escala EPC400 and EPC800 Expansion Rack Unit is a 1.8m high expansion rack. The rack is an industry-standard 19-inch rack designed to comply with the EIA-310C standard. It contains 36 EIA units of vertical mounting space.

A power distribution bus, which provides 8 AC power outlets (6 to the drawers, 1 for a modem, 1 for the CPC), occupies one EIA unit. The rack has an immediate power-off switch.

The Escala EPC1200 Expansion Rack Unit is a 1.6m high expansion rack. The rack is an industry-standard 19-inch rack designed to comply with the EIA-310C standard. It contains 32 EIA units of vertical mounting space.

Available drawers with their own U height:

EPC400-N Drawer	4U
EPC430-N Drawer	4U
EPC440 Drawer	8U
EPC450-N Drawer	4U
EPC800-N Drawer	6U
EPC1200A I/O Drawer	10U
EPC1200 I/O Drawer	7U
EPC2400 Drawer	10U
EPC400 Expansion PCI Drawer	4U
EXB440/480 Drawer	12U
Disk/Media Drawer	5U
DAS5700 DPE enclosure rackmount (*)	8U
DAS5700 DAE enclosure rackmount	4U
DAS5300 iDAE enclosure rackmount (*)	5U
DAS5300 DAE enclosure rackmount	4U
DAE5000 DAE enclosure rackmount	4U
DAS3200/DAS3500 Drawer	12U
DAS2900 Drawer	8U
DAS1300 Drawer	6U
STK9914 Drawer	5U
SSA Drawer	4U
DLT4000/7000 Drawer	4U
Console Concentrator with Cluster Administration Hub drawer	4U
FDDI Hub kit Drawer	8U
FDDI Switch Kit Drawer	6U
Fibre Channel (FC-AL) Hub Drawer	1U
UPS 3KVA Drawer	4U
Additional Power Distribution Board Drawer	2U

(*) Including 1U space for one or two SPS.

5. Disk Subsystems

5.1. Escala External Additional Disk/Media Drawer for EPC800

The Escala External Additional Disk/media Drawer is the Escala Mini Tower Disk Cabinet designed in a Drawer; it provides additional disk storage to Escala EPC800 model.

The Escala External Additional Disk/media Drawer features:

4 bays for 1-inch disks (2.1GB, 4.2GB, 9.1GB) or 1.6-inch disks (9.1GB)
2 bays for 1-inch media / disks

The Escala External Additional Disk/media Drawer can contain maximum of six SCSI-2 SE 2.1/4.2/9.1GB internal drives for a maximum total disk storage per cabinet of 54.6GB.
One Escala External Additional Disk/media Drawer comes without disk.

Two Media bays are available for the attachment of the following combinations of media devices:

One 7/14 GB internal 8-mm Tape Drive
One 12/24 GB internal 4-mm Tape Drive
One 13/26 GB internal 1/4-inch Cartridge Tape Drive

If the Media bays are used, the maximum disk capacity is: 4x9.1 = 36.4GB

Attachment

An Escala EPC800 is required to support External Additional Disk/media Drawers.
Maximum four Escala External Additional Disk/media Drawer can be attached (Noemie allows one Additional Disk/Media Drawer per node).

5.2. Common features of the fibre DAE/DAS5000 Series

5.2.1. Highlights

The 5000 Series constitutes a powerful, highly scalable, family of fibre channel storage solutions. It provides JBOD or RAID capabilities, terabytes of disk storage capacity, high transfer rates, flexible configurations, and high availability. These storage systems are ideal solutions for today's sophisticated enterprise.

The main customer benefits are:

- high performance
- scalability and flexibility
- low foot print with capability to mix servers and storage in the same packaging (rack only)
- capability to build high availability solutions with AIX servers
- easy to use management tools

This line of disk subsystems is based on a common modular architecture, reusing the same components across the complete range. These basic building blocks are:

disks	dual-ported fibre channel disks.
DAE enclosure	a 10 disk module, which can be chained to provide the required capacity.
iDAE	Intelligent DAE, a DAE module with one or two RAID Storage Processors (SP) designed for mid-range disk
DPE	a high end single or dual RAID Storage Processors with up to 10 disks.

5.2.2. Disks

5.2.2.1. Overview

The disk drives integrated in the 5000 Series are fibre channel, dual-ported drives. The disk size is 9 GB, 18GB and 36 GB (DAS 5000 Series only).

5.2.2.2.Disk formatting

The disk formatting depends on the disk subsystem in which they are integrated: it is either 520 bytes per sector (for RAID subsystems), or 512 bytes per sectors (JBOD). Thus, it is not possible to move disks from a JBOD subsystem to RAID subsystem. Reformatting is required. (And could be proposed in SFR). Changing disks formatting is not possible with the tools shipped with the disk subsystems, and can not be performed at customer site.

5.2.2.3.Technical specifications

	9 GB – 10 K rpm	18 GB – 10K rpm	36 GB – 10K rpm (1)
Capacity (RAID formatting)	8.839 GB	17.554 GB	35.458 GB
Capacity (JBOD formatting)	9.1 GB	18.2 GB	36 GB
Form factor	3.5"	3.5"	3.5"
Height	1.0"	1.0"	40.6 mm
Rotational speed	10 000 rpm	10 000 rpm	10 000 rpm
Interface	Fibre Channel	Fibre Channel	Fibre Channel
Data buffer	1 MB	1 MB	1 MB
# of segments	up to 16	up to 16	
Transfer rates			
Buffer to/from media	17.2 – 25.3 MB/s	17.2 – 25.6 MB/s	18 – 28 MB/s
SP or HBA to/from buffer (2)	100 MB/s (max)	100 MB/s (max)	100 MB/s (max)
Access time			
average seek	5.2 ms read	5.7 ms read	5.7 ms read
	6.0 ms write	6.5 ms write	6.5 ms write
Rotational latency	2.99 ms	2.99 ms	2.99 ms
Connector	40-pin, FC-SCA-2	40-pin, FC-SCA-2	40-pin, FC-SCA-2
Monitoring protocol	SES/SFF-8067	SES/SFF-8067	

(1) DAS 5000 Series only.

MTBF

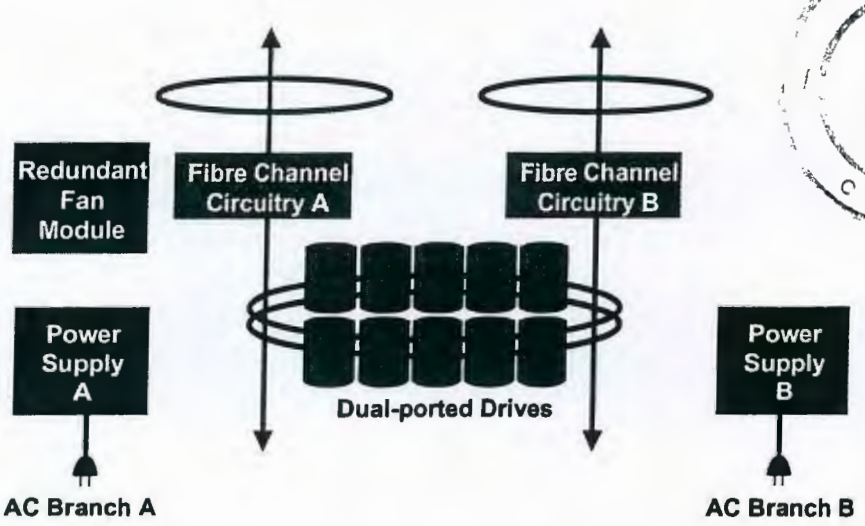
9 GB, 10K rpm 1,000,000 h
18 GB, 10K rpm 1,000,000 h
36 GB, 10K rpm 1,000,000 h

'MBOLSYMBOL**5.2.3. AUTONUMLGLDAE enclosure**

5.2.3.1. Overview

The **DAE** (Disk-Array Enclosure) is a 10-slot enclosure without RAID capabilities (no SPs), playing the role of the capacity building block. This enclosure is the base of the modular. Several enclosures can be chained to create larger configurations.

The figure below summarizes the hardware architecture of a DAE enclosure. A DAE contains at least one Fibre Channel loop. The hardware to implement the second FC-AL loop is optional. Individual hardware components are discussed later in this document.



The DAE components include:

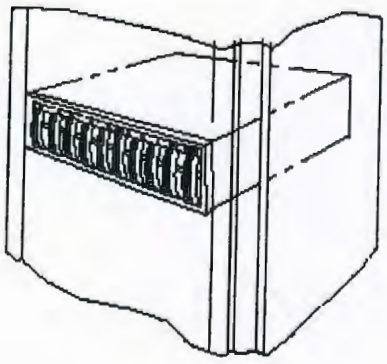
- One or two LCCs (Link Controller Cards, shown as "fibre channel circuitry" in the figure above) to implement one or two FC-AL loops.
- Up to 10 fibre channel dual ported disk modules.
- One or two power supplies each with its own power cord.
- One redundant fan module to cool the disks.

All these components can be replaced under power.

5.2.3.2. Rack packaging:

The DAE enclosure is available as a rackmount (4U) unit.

Rackmount



5.2.3.3. Host connectivity and management

The DAE offers one Fibre Channel DB/9 copper connectors per LCC for the connection to servers, hubs, converters, and other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

The DAE is unmanaged equipment.

5.2.3.4. Architecture: SP, LCC, disks, memory

5.2.3.4.1. LCC (Link Control Cards)

DAE enclosures can be equipped with one or two LCCs. The LCC receives and electrically terminates the incoming FC-AL signal from the host or other kind up "up stream" devices. The LCC passes the input signal to its disk drives and then conducts the output signal, via cables, to an LCC of the next DAE in the loop (if any). In addition, each LCC monitors the environmental status of the enclosure.

When enclosures are equipped with two LCCs, two distinct internal fibre channel loops can be implemented, and in the event of an LCC failure, access remains possible through the other LCC.

Each LCC contains two connectors. One is reserved for the connection to another DAE. The other can be used to connect another DAE or other type of devices, like servers, iDAE enclosures or DPE enclosures. Technically, the number of DAE enclosures that can be chained is limited to 12, resulting in a 120 disks configuration, compatible with the limitations of the Fibre Channel loop.
The distance between chained DAE enclosures is limited to 10m with copper cables.

5.2.3.4.2. Power Supplies

DAE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if one is present. Each supply is equipped with its own power cord, making the connection to two different power sources possible.

5.2.3.4.3. Cooling Fans

DAE enclosures are equipped with a drive fan pack that cools the disk modules. The fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increase to compensate. If needed (for example to change a failed power supply), a fan pack can be removed for exchange operation while the storage system continues to operate. The exchange operation, however, must not exceed two minutes, otherwise disks will shut down.

5.2.3.4.4. Disk drives

The DAE enclosures use the same disks than the other enclosures of the 5000 Series. Only the formatting differs. The minimum number of disks per DAE enclosure depends on the number of LCCs. The maximum is always 10 disks:

	Minimum	Maximum
1 LCC	2	10
2 LCC	4	10

5.2.3.5. Summary of high availability features

- Dual port disks
- Dual loops / LCCs
- Dual Power supply with independent power cords
- Redundant fans
- No electronics in the chassis or back plane
- All active components are hot pluggable.

5.2.3.6. Performance figures

The performance of the DAE enclosure are the performance of the individual disks which are in the enclosure.

5.2.3.7. Technical specifications

Interface to host

Fibre Channel interfaces of 100 MB/s (1 LCC) or 200 MB/s (2 LCCs).
9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA).

Dimensions (approximate)

DAE rackmount:

- Height - 6.07 in. (15.4 cm), 3.5 EIA units (occupies 4 units of rack space)
- Width - 17.5 in. (44.5 cm) (Standard NEMA 19-inch rack)
- Depth - 24 in. (60.9 cm)
- Weight - 78 lb. (35.4 kg) max.

Power requirements

- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies).

Rack:

- Current Draw: At 100 v ac input – 10-slot DAE: 4A
- Power consumption: 10-slot DAE: 400VA.

Operating environment

Temperature:	50 - 104 degrees F (10 - 40 degrees C)
Temperature Gradient:	10 degrees C/hr
Relative Humidity:	20% - 80% (non-condensing)
Elevation:	10,000 ft (3048m) @ 37°C.
Operating Shock:	3 G @ 11 ms, ½ sine pulse
Operating Vibration:	.25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC Class A, EN55022 Class A, CE Mark, VCCI Class 1
  Safety: UL 1950, CSA C22.2-950, EN 60950.

MTBF

Drive Fan pack:	667 000 h
DAE LCC:	781 000 h
DAE power supply	162 000 h
DAE midplane:	4 761 000 h

SYMBOLSYMBOLSYMBOLSYMBOL

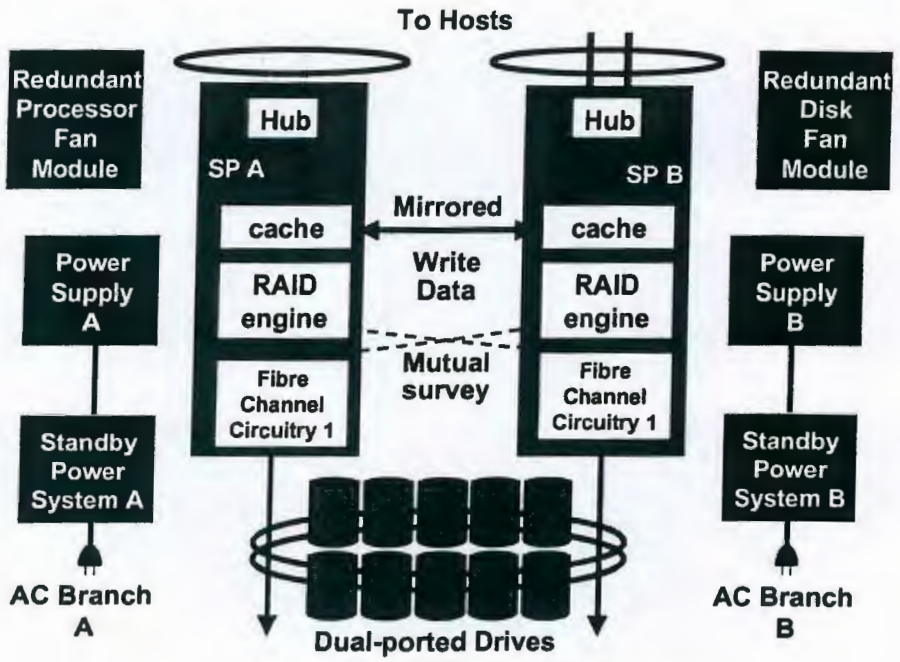
5.2.4. iDAE enclosure

5.2.4.1. Overview

The **iDAE** (Intelligent DAE) is a 10-slots enclosure DAE with RAID functionality provided by one or two SPs (Storage Processors), which replace the LCC cards of the basic DAE. It has been designed to build mid range disk subsystems, with up to 30 disks. It is a "full Fibre Channel" RAID subsystem, using Fibre Channel for both host connect (i.e. font-end) and internal disks connection (i.e. back-end).

Entry price configurations can be defined with the minimum of hardware redundancy, to enable cost attractive solutions. Upgrade to a fully redundant high availability configuration is a simple matter of adding redundant hardware components (described below). All these components are designed for non-disruptive removal and insertion, and can be replaced under power.

The figure below summarizes the hardware architecture of an iDAE enclosure. An iDAE contains at least one SP. The second SP is optional. Individual hardware components are discussed later in this document.



The iDAE components include:

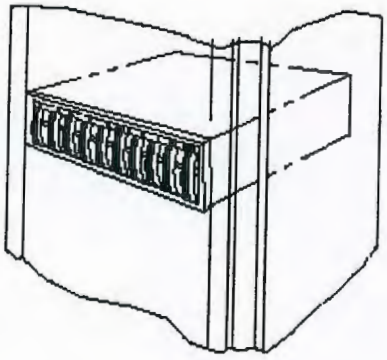
- One or two SPs (Storage Processors), with Fibre Channel circuitry, to manage the internal loops of the RAID subsystem.
- Up to 10 fibre channel dual ported disks.
- One or two power supplies each with its own power cord.
- One redundant fan module to cool the disks and another to cool the SPs.
- To implement write caching, one or two SPSs (Standby Power Supplies – also called BBUs, i.e. Battery Backup Units).

All these components can be replaced under power.

5.2.4.2. Rack packaging:

The iDAE enclosure is available as a rackmount (4U) unit.

Rackmount



Note: for rackmount systems, the SPS is placed in a tray directly beneath the iDAE (one or two SPS units fit in a 1 U space, one beside the other)

5.2.4.3. Host connectivity and management

The iDAE offers two Fibre Channel DB/9 copper connectors per Storage processors for the connection to servers, hubs, converters, and other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

The two ports correspond to a single fibre channel loop. The typical usage is the direct connection of two servers on a single SP. The use of the two connectors to chain multiple devices (servers, SPs or other disk subsystems, ...) is not recommended.

The iDAE can be managed in-band, (i.e. through the host fibre channel interfaces), from any server connected to the iDAE, using the Navisphere software. This mode of management is manageable as long as the server can access to a LUN.

A RS232 with RJ11 connector is also available. It allows iDAE management with Navisphere when, in consequence of administrator errors (or of highly improbable failures), there is no more LUN reachable. RJ11/DB9M, plus DB9F/DB25M converters and a RS232 6m DB25F/DB25F cable are shipped with each iDAE.

5.2.4.4. Architecture: SP, LCC, disks, memory

5.2.4.4.1. SPs (Storage Processors) and host interface

The SP provides the following features to the disk subsystem:

- RAID processing
- host interface management
- backend management
- memory
- built-in hub for external connection
- Fibre Channel circuitry for backend.

Each SP has 3 fibre channel connectors.

Port A and port B connectors correspond to a built-in hub, offering a 100 MB/s logical connection. Using these connectors, 2 devices (like HBA within servers) can be connected to the same SP, witho any external devices. They share the 100 MB/s of bandwidth. Above two devices, an external hub mu be used.

The host interface offers DB9 / copper connections up to 30m. MIAs are supported, to enable longer distances using multimode optical fibers.
The host interface implements the FCP-SCSI-3 protocol. Command tag queuing is implemented.

The third connector is a DB9 expansion connector (EXP) which enables the connection to an additional DAE enclosure. It is not possible to chain more than 2 DAEs. When iDAE is equipped with two SPs, two distinct internal fibre channel loops are available, and the chained DAEs must be equipped with dual LCCs. In the event of a failure, disk access remains possible through the other SP. The distance between iDAE and DAE or between chained DAE enclosures is limited to 10m with copper cables.

5.2.4.4.2. Power Supplies (and PDUs)

iDAE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if present. Each power supply is equipped with its own power cord, making the connection to two different power sources possible.

5.2.4.4.3. Standby Power Supply (SPS)

The SPS protects the iDAE against external power supply failures, and enables to properly stop a disk subsystem in case of power outage.

SPS are optional, but at least one SPS must be installed to use the write cache. Optionally, a second SPS can be installed to provide higher availability.

The SPS is also named BBU (Battery Backup Units).

5.2.4.4.4. Cooling Fans

iDAE enclosures are equipped with a drive fan pack that cools the disks and the SPs. The fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increases to compensate. If needed, a fan pack can be removed for exchange operation while the storage system continues to operate (the exchange operation, however, must not exceed two minutes, otherwise disks and SPs shut down).

5.2.4.4.5. Disk drives

The iDAE enclosures use the same disk than the other enclosures of the 5000 Series. The minimum number of disks per iDAE enclosure depends on the number of SP. The maximum is always 10 disks:

	Minimum	Maximum
1 SP	3	10
2 SP	5	10

Disks are formatted with 620 bytes per sectors.

5.2.4.4.6. Memory

Each SP can have 64 or 128 MB of memory.

The Flare (micro code running on the SP) requires 15 to 18 MB. The remaining 110 MB of memory can be used as a read cache, or write cache, or a mixture of both, to improve the subsystem performance.

To ensure data consistency in case of failure, **the write cache is always mirrored**, and the following hardware configuration must be used:

- Two SPs per iDAE
- Two power supplies and two LCCs in the iDAE and in each DAE
- Disk slots 0 through 4 of the iDAE enclosure must be populated.
- One SPS with a fully charged battery (two SPSs provide higher availability)
- Identical cache memory in both SPs (64 or 128 MB per SP).

It is not possible to use write caching without mirroring across SPs, and without the hardware configuration described above. For example, it is not possible to configure a write cache on an iDAE with a single SP.

The usable cache size is computed as described in the next table:

	1 SP	2 SP
Raw memory per SP (64 MB or 128 MB)	M	M
Write cache	0	W < M
Read cache	M	2 x (M – W)
Total	M	W + 2 x (M – W)

M is the amount of available raw memory per SP
W is the value configured for the write cache size.

Because of the mirroring, the usable write cache is not multiplied by the number of SPs.

5.2.4.5. Summary of high availability features

- dual port disks
- dual loops / LCCs
- dual Power supply with independent power cords
- redundant fans.
- no electronics in the chassis or back plain
- all active components are hot pluggable
- RAID protection
- redundant SP
- mirrored write cache.

5.2.4.6. Supported Fibre Channel topologies

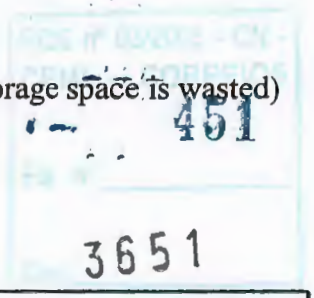
The Fibre channel host interfaces of the iDAE supports the following topologies:

- Private loops (using the internal hub of the SPs or external hubs)

5.2.4.7. RAID features

The RAID features of the iDAE are:

- supports of RAID 0, RAID 1, RAID 1/0, RAID 3, RAID 5 and "individual disk" modes
  LUN type: Possible number of disks in the LUN:
  RAID 0: 3 to 16 disks
  RAID 1: 2 disks
  RAID 1/0: 4 to 16 disks (must be an even number)
  RAID5: 3 to 16 disks
  each disk module in a LUN must have the same capacity (otherwise, disk storage space is wasted)
- any combination of RAID levels can exist in the same subsystem
- up to 32 LUNs configurable (either individual disks or RAID volumes)



- 2 global hot spares, with rebuild priority adjustment (configurable threshold for the minimum number of IO reserved for server use during rebuild). The capacity of a hot spare disk must be at least as great as the capacity of the largest disk module that it might replace.

Caution:
The RAID groups, LUN expansion defragmentation features announced by Clariion on NT are not yet supported on AIX.

5.2.4.8. Performance figures

- 8400 IO/s from SP cache, with dual SP
- 120 MB/s with dual SP

These values are measured from SP cache to servers. They represent the processing power of the SP, and the maximum performance that could be obtained with optimal configuration. In real configurations, performance is lower, and mainly depends on the number of disks: few disks means low throughput and low read/write IO rates.

5.2.4.9. Technical specifications

Interface to host
Fibre Channel interfaces of 100 MB/s (1 SP) or 200 MB/s (2 SPs).
9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA).

Fibre Channel related standards:
- FC-PH, Rev 4.4
- FC-AL Rev 4.5
- Private Loop Direct Attach PLDA Rev 1.10
- SCSI Enclosure Services (SES) Rev 8a

Dimensions (approximate)

iDAE rackmount:
- Height - 6.07 in. (15.4 cm), 3.5 EIA units (occupies 4 units of rack space)
- Width - 17.5 in. (44.5 cm) (Standard NEMA 19-inch rack)
- Depth - 24 in. (60.9 cm)
- Weight - 80 lb. (36 kg) max.

Power requirements
- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies)

Rack:
- Current Draw: At 100 v ac input: 4A

- Power consumption: 400VA (fully configured)

Operating environment

Temperature:	50 - 104 degrees F (10 - 40 degrees C)
Temperature Gradient:	10 degrees C/hr
Relative Humidity:	20% - 80% (non-condensing)
Elevation:	10,000 ft (3048m)
Operating Shock:	3 G @ 11 ms, ½ sine pulse
Operating Vibration:	.25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC part 15 Class A and B, EN55022 Class A and B, CE Mark, VCCI Class 1 and 2
- Safety: UL 1950, CSA C22.2-950, EN 60950

MTBF

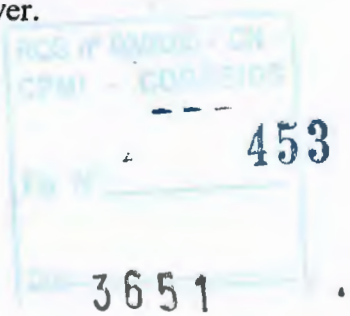
SP:	125 000 h
Drive Fan pack:	667 000 h
SP FAN pack:	162 000 h
iDAE power supply	4 761 000 h
iDAE midplane:	4 761 000 h
SPS:	100 000 h

5.2.5. DPE enclosure

5.2.5.1. Overview

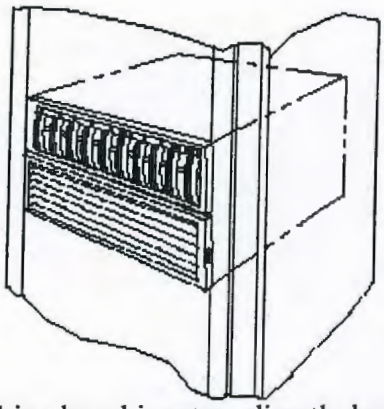
The **DPE** (Disk-Array Processor Enclosure) is a 10-slots enclosure with RAID functionality provided by one or two SPs (Storage Processors). It has been designed to build high-end disk subsystems, with up to 120 disks. It is a "full Fibre Channel" RAID subsystem, using Fibre Channel for both host connect (i.e. front-end) and internal disks connection (i.e. back-end).

Configurations can be defined with the minimum of hardware redundancy, to enable cost attractive solutions with high end SPs. Upgrade to a fully redundant high availability configuration is a simple matter of adding redundant hardware components (described below). All these components are designed for non-disruptive removal and insertion, and can be replaced under power.



5.2.5.2. Rack packaging

The DPE enclosure is available as a 7U rackmount unit (shown below).



Note: for rackmount systems, the SPS is placed in a tray directly beneath the DPE (one or two SPS units fit in a 1 U space, one beside the other)

5.2.5.3. Host connectivity and management

The DPE offers two Fibre Channel DB/9 copper connectors per Storage processors for the connection to servers, hubs, switches, converters, and other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

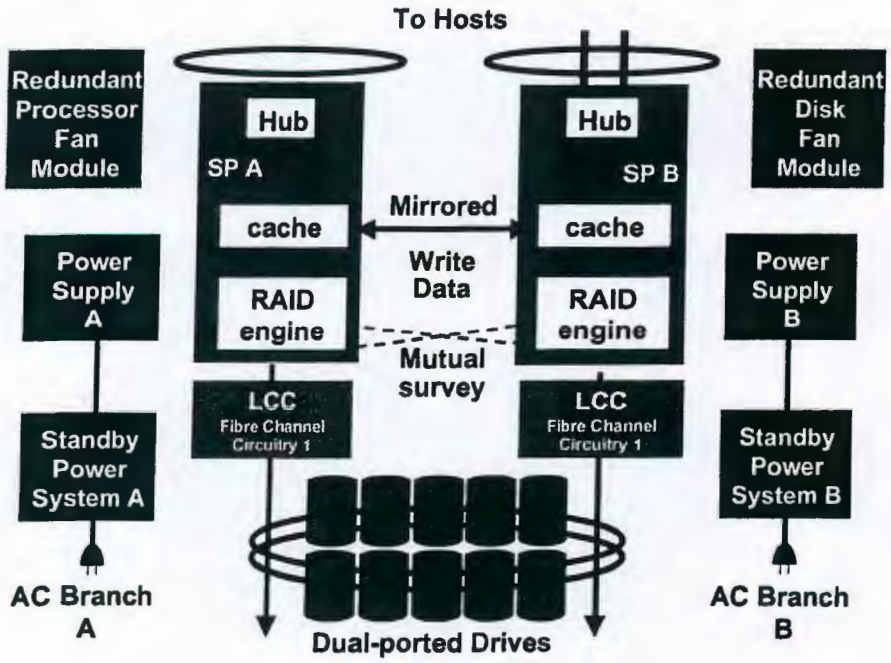
The two ports correspond to a single fibre channel loop. When connecting to a switch, a single connector must be used. In other circumstances, both connectors are usable. The typical usage is the direct connection of two servers on a single SP. The use of the two connectors to chain multiple devices (servers, SPs or other disk subsystems, ...) is not recommended.

The DPE can be managed in-band, (i.e. through the host fibre channel interfaces), from any server connected to the DPE, using the Navisphere software. This mode of management is manageable as long as the server can access to a LUN.

A RS232 with DB9 connector is also available. It allows DPE management with Navisphere when, in consequence of administrator errors (or of highly improbable failures), there is no more LUN reachable. A DB9/DB25M converter and a RS232 6m DB25F/DB25F cable are shipped with each DPE.

5.2.5.4. Architecture: SP, LCC, disks, memory

The figure below summarizes the hardware architecture of a DPE enclosure. A DPE contains at least one SP and one LCC. The hardware to implement the second FC-AL loop is optional. Individual hardware components are discussed later in this document.



The DPE components include:

- One or two SPs (Storage Processors)
- One or two LCCs (Link Controller Cards, shown as "fibre channel circuitry" in the figure above) to implement one or two FC-AL loops
- Up to 10 fibre channel dual ported disk modules
- One or two power supplies each with its own power cord
- One redundant fan module to cool the disks and another to cool the SPs
- To implement write caching, one or two SPSs (Standby Power Supplies – also called BBUs, i.e. Battery Backup Units).

5.2.5.4.1. SPs (Storage Processors) and host interface

The SP provides the following features to the disk subsystem:

- RAID processing
- host interface management
- backend management
- memory
- built-in hub for external connection.

Each SP has 2 fibre channel connectors. Port A and port B connectors correspond to a built-in hub, offering a 100 MB/s logical connection. Using these connectors, 2 devices (like HBA within servers) can be connected to the same SP, without any external devices. They share the 100 MB/s of bandwidth. Above two devices, an external hub or switch must be used.

The host interface offers DB9 / copper connections up to 30m. MIAs are supported, to enable longer distances using multimode optical fibers.
The host interface implements the FCP-SCSI-3 protocol. Command tag queuing is implemented, with up to 256 tags.

5.2.5.4.2. LCC (Link Control Cards)

DPE enclosures can be equipped with one or two LCCs (depending on the number of SP). The LCC receives and electrically terminates the incoming FC-AL signal from the host or other kind up "up stream" devices. The LCC passes the input signal to its disk drives and then conducts the output signal, via cables, to an LCC of the next DAE in the loop (if any). In addition, each LCC monitors the environmental status of the enclosure.

There is a one-to-one relation between SPs and LCCs. Either the DPE enclosure has one SP and one LCC, or the DPE has 2 SPs and 2 LCCs. When enclosures are equipped with two LCCs, two distinct internal fibre channel loops can be implemented, and all the DAE enclosures chained in the backend must have 2 LCCs each. In the event of a failure, disk access remains possible through the other SP/LCC.

The connector of the LCC of the DPE enclosure is reserved for the connection to another DAE. Technically, up to 11 DAE enclosures can be chained to create a RAID subsystem with 120 disks capacity (10 in PDE plus 11x10 in DAE enclosures). Interconnection is made with copper cables. The distance between DPE and DAE or between chained DAE enclosures is limited to 10m with copper cables.

5.2.5.4.3. Power Supplies (and PDUs)

DPE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if is present. Each supply is equipped with its own power cord, making the connection to two different power sources possible.

5.2.5.4.4. Standby Power Supply (SPS)

The SPS protects the DPE against external power supply failures, an enable to properly stop a disk subsystem in case of power outage.

SPS are optional, but at least one SPS must be installed to use the write cache. Optionally, a second SPS can be installed to provide higher availability.

The SPS is also named BBU (Battery Backup Units).

5.2.5.4.5. Cooling Fans

DPE enclosures are equipped with a drive fan pack that cools the disk modules. DPE enclosures also include an SP fan pack that cools the SPs. Any type of fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increase to compensate. If needed, a fan pack can be removed for exchange operation while the storage system continues to operate (the exchange operation, however, must not exceed two minutes, otherwise disks and SPs shut down).

5.2.5.4.6. Disk drives

The DPE enclosures use the same disk than the other enclosures of the 5000 Series. The minimum number of disks per DPE enclosure depends on the number of LLCs and SP. The maximum is always 10 disks:

	Minimum	Maximum
1 SP / 1 LCC	3	10
2 SP / 2 LCC	10	10

Disk are formatted with 520 bytes per sectors.

5.2.5.4.7. Memory

Each SP can have 64, 128, 256 or 512 MB of memory.

A few amount is reserved to store the LIC (Licensed Internal Code) running on SPs. The exact size depends on version, and is around 12 MB. The rest of the cache is availa for read cache, or write, or a mixture of both, to improve performances of the subsystem. To ensure data consistency in case of failure, **the write cache is always mirrored**, and the following hardware configuration must be used:

- Two SPs per DPE
- Two power supplies and two LCCs in the DPE and in each DAE
- Disk slots 0 through 8 of the DPE enclosure must be populated.
- One SPS with a fully charged battery (two SPSs provide higher availability)
- Identical cache memory in both SPs (64, 128, 256 or 512MB per SP).

It is not possible to use write caching without mirroring across SPs, and without the hardware configuration described above. For example, it is not possible to configure a write cache on a DPE with a single SP.

The usable cache size is computed as described in the next table:

	1 SP	2 SP
Raw memory per SP (64 MB, 128 MB, 256 MB or 512 MB)	M	M
Write cache	0	W < M
Read cache	M	2 x (M – W)
Total	M	W + 2 x (M – W)

M is the amount of available raw memory per SP
W is the value configured for the write cache size.

Because of the mirroring, the usable write cache is not multiplied by the number of SPs.

5.2.5.5. Summary of high availability features

- dual port disks
- dual loops / LCCs
- dual Power supply with independent power cords
- redundant fans.
- no electronics in the chassis or back plain
- all active components are hot pluggable
- RAID protection
- redundant SP
- mirrored write cache.

5.2.5.6. Supported Fibre Channel topologies

Fibre channel host interfaces of the DPE supports the following topologies:

- Fabric, with point to point connection to the switch
- Private loops (using the internal hub of the SPs or external hubs)

5.2.5.7. RAID features

The RAID features of the DPE are:

- Supports of RAID 0, RAID 1, RAID 1/0, RAID 3, RAID 5 and "individual disk" modes
  LUN type: Possible number of disks in the LUN:
  RAID 0: 3 to 16 disks
  RAID 1: 2 disks
  RAID 1/0: 4 to 16 disks (must be an even number)
  RAID5: 3 to 16 disks
  each disk module in a LUN must have the same capacity (otherwise, disk storage space is wasted)
- Any combination of RAID levels can exist in the same subsystem

- Up to 32 LUNs configurable (either individual disks or RAID volumes)

- 2 global hot spares, with rebuild priority adjustment (configurable threshold for the minimum number of IO reserved for server use during rebuild). The capacity of a hot spare disk must be at least as great as the capacity of the largest disk module that it might replace.

5.2.5.8. Performance figures

- 22000 IO/s from SP cache, with dual SP
- 120 MB/s with dual SP.

These values are measured from SP cache to servers. They represent the processing power of the SP, and the maximum performances that could be obtained with optimal configuration. In real configurations, performances are lower, and mainly depends on the number of disks: few disks means low throughput and low read/write IO rates.

5.2.5.9. Technical specifications

Interface to host

- SPs (Storage Processors): Provide two Fibre Channel interfaces of 100 MB/s each, with a total of 200 MB/s.
- 9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA)).
- Two ports per SP.

Dimensions (approximate)

DPE rackmount enclosure (10 slots):

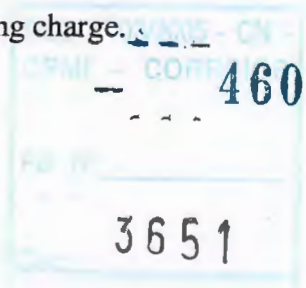
- Height - 11.25 in. (28.6 cm), 6.5 EIA units (occupies 7 units of rack space)
- Width - 17.5 in. (44.5 cm) (Standard NEMA 19-inch rack)
- Depth - 27.2 in. (69.2cm)
- Weight - 115 lb. (52 kg) max. With 2 SPSs: 163 lb. (74 kg) max.

Power requirements

- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies).

Rackmount (10 disks):

- Current Draw: At 100 v ac input: 8A max; SPS 1A max per unit during charge
- Power consumption DPE: 800VA max 400VA; SPS 100VA max per unit during charge.



Operating environment

Temperature:	50 - 104 degrees F (10 - 40 degrees C)
Temperature Gradient:	10 degrees C/hr
Relative Humidity:	20% - 80% (non-condensing)
Elevation:	10,000 ft (3048m) @ 37°C
Operating Shock:	3 G @ 11 ms, ½ sine pulse

Operating Vibration: .25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC Class A, EN55022 Class A, CE Mark, VCCI Class I
- Safety: UL 1950, CSA C22.2-950, EN 60950

MTBF

SP:	125 000 h
Drive Fan pack:	667 000 h
SP FAN pack:	667 000 h
DPE power supply	162 000 h
DPE power supply	162 000 h
DPE LCC:	750 000 h
DPE midplane:	3 200 000 h
SPS:	100 000 h

5.2.6. Companion Software

5.2.6.1. Navisphere for AIX

DPE-and iDAE based storage systems are shipped with the Navisphere manager for AIX application. It provides a graphical facility for configuring, managing and monitoring the RAID subsystems. It is based on the standard AIX WebSM (Web-Based System Manager) framework. A graphical console, or display, or an X-terminal, must be available at the customer site, or must be ordered to use WEB. Navisphere use the fibre channel connections to manage the subsystems. It may optionally use a serial line.

If a Web server is installed on the AIX server, any web browser able to execute Java applets can be used to access to WebSM applications, including Navisphere.

Another mode of operations requires only a Navisphere agent on the AIX server. The manager is located on another server, and cooperates with the agent using TCP/IP protocols through Ethernet or other kind of LAN or WAN networks. This mode of operation require specific licenses to be installed on the same server than the Navisphere manager for AIX. They can be ordered with the Noemie software configurator.

5.2.6.2. ATF

RAID subsystems equipped with two SPs can take advantage of the optional ATF (Application Transparent Failover) software for AIX. ATF lets applications continue to run after an SP, adapter or cable or interconnection failure. Without human intervention, ATF can reconfigure the RAID subsystem (e.g. bind the LUNs to the surviving SP), retrieve IOs in the mirrored write cache and complete them, and finally, on the server it self, route the I/O through a secondary path to the surviving (provided that the server is equipped with two fibre channel adapters).

5.3. DAE5000 (Full Fibre JBOD Disk Array Subsystems)

5.3.1. Highlights

The DAE5000 Series constitutes a powerful, JBOD fibre channel storage solutions. It is based on a DAE enclosure and contains up to 10 disks.

The direct access from servers to the Fibre Channel disks offers very high transfer rates, enabling to operate near full Fibre Channel speed (around 95 MB/s), with a single DAE5000.

The DAE5000 is ideal to increase the storage capacity of AIX servers, without investing in more expensive RAID subsystems. Use of AIX software RAID 1 brings protection against disk failures. Protection against HBA, connection or DAE failures can be obtained using 2 DAE5000 per server.

The DAE5000 is also proposed as an entry range shared storage solution for dual node clusters, using AIX mirroring and redundant DAE5000 for complete data protection.

5.3.2. Configurability and Packaging

The DAE5000 is based on DAE enclosures with a single LCC. A DAE5000 can host from 2 to 10 disks. Two DAE5000 can be connected per server.

There is no hardware option available for DAE5000.

DAE drawers are shipped for the connection to Escala EPC servers.

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.3.3. SAN features

Each DAE5000 is connected to a dedicated fibre channel adapter on the AIX server, or to a hub for sharing by 2 servers. Interconnection of DAE5000 is not proposed, due to the high level of performances obtained with the 10 disks enclosure, and the risk of saturation of the fibre channel loop.

The connection to hubs or servers is made with copper cables. Connection to switches has not been qualified.

For configuration problems, please refer to the SAN Help Desk.

5.4. DAS5300 (Full Fibre RAID Disk Subsystems)

5.4.1. Highlights

The DAS5300 constitutes an entry-level RAID subsystem, offering up to 30 disks slot and 1080 GB of capacity (with 36 GB disks). It is based on iDAE and DAE enclosures. The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP).

The basic packaging, containing 1 SP, and a single power supply, can be upgraded with optional hardware to offer a fully redundant disk subsystem. Several packaging and capacity options allow to build the most suited configuration, while preserving the evolutivity up to 30 disks.

The DAS5300 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes.

5.4.2. Configurability and Packaging

5.4.2.1. Rack packaging

The configurability is summarized in the next table.

	basic configuration 1 SP	**high availability configuration 2 SP**
base drawer(s)	1 iDAE – 10 slots 5 U drawer including a 1U tray for one or two additional SPS	1 iDAE – 10 slots 5 U drawer including one 1 U tray to fit one or two SPS
additional DAE – 4 U / 10 disks drawer	0..2 single LCC/PS DAEs	0..2 dual LCC/PS DAEs
minimum number of disks	3	5
minimum number of disks per additional DAE	2	4
maximum number of disks	30	30
memory (MB)	64 or 128	64 or 128 same value on both SPs
write cache	not supported	yes
power supply	1 PS - No dual PS option	2
SPS	0	1 additional SPS optional for higher availability
ATF	not applicable	yes

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.4.3. SAN features

One or multiple servers can be connected to a DAS5300, using the connectors of the SP (2 connector per SP). External hubs can be used to increase the connectivity. Connection to switches is not supported. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5300 can be connected to a single HBA on a server using external hubs.

For configuration problems, please refer to the SAN Help Desk.

5.5. DAS5700 (Full Fibre RAID Disk Subsystems)

5.5.1. Highlights

The DAS5700 is the high end of the 5000 Series. It is a highly flexible disk subsystem, with high performance levels, up to 60 or 70 disks slots (depending on the packaging option) and more than 2 TB of capacity (with 36 GB disks). Higher capacities (up to 120 disks, 4 TB) can be proposed in SFR.

The DAS5700 is based on DPE and DAE enclosures. The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP). With the DPE design, optimized for OLTP and RAID 5 processing, and the high number of disk, it is able to sustain a very high IO rate, supporting heavy transactional applications.

The basic packaging, containing 1 SP, and a single power supply, can be upgraded with optional hardware to offer a fully redundant disk subsystem. Several packaging and capacity options allow to build the most suited configuration, while preserving the evolutivity up to 120 disks.

The DAS5700 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes. It is well suited for environments requiring high volumes of storage, and high levels of IO performances.

Note: the performances are directly tied to the number of disk within the subsystem. Up to 30 disks, DAS5700 and DAS5300 have comparable performance results.

5.5.2. Configurability and Packaging

5.5.2.1. Rack packaging

The configurability is summarized in the next table.

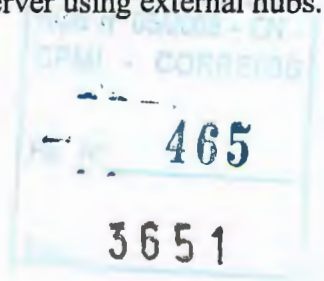
	basic configuration 1 SP	high availability configuration 2 SP
base drawer(s)	1 DPE – 10 slots 8 U drawer including a 1U tray for one or two additional SPS	1 DPE – 10 slots 8 U drawer including one 1 U tray to fit one or two SPS
additional DAE – 4 U / 10 disks drawer	0..6 in the EPC 400 rack 0..5 in the EPC 1200 rack single LCC/PS DAEs	0..6 in the EPC 400 rack 0..5 in the EPC 1200 rack dual LCC/PS DAEs
minimum number of disks	3	10
minimum number of disks per additional DAE	2	4
maximum number of disks	70 for the EPC 400 rack 60 for the EPC1200 rack	70 for the EPC 400 rack 60 for the EPC1200 rack
memory (MB)	64, 128, 256, 512	64, 128, 256, 512 same value on both SPs
write cache	not supported	yes
power supply	1 PS - No dual PS option	2
SPS	0	1 additional SPS optional for higher availability
ATF	not applicable	yes

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.5.3. SAN features

One or multiple servers can be connected to a DAS5700, using the connectors of the SP (2 connector per SP). External hubs or switches can be used to increase the connectivity. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5700 can be connected to a single HBA on a server using external hubs.

For configuration problems, please refer to the SAN Help Desk.



5.6. DAS5720 (Full Fibre RAID Disk Array Subsystems)

Discontinued: December 1999.

5.6.1. Highlights

The DAS5720 is a bundled product based on a dual SP DPE enclosure and a single DAE. It is configured to offer a very attractive price for high availability configurations, with medium storage resource requirement (20 disks). The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP).

The DAS5720 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes.

5.6.2. Configurability and Packaging

5.6.2.1. Rack packaging

The rack packaging is the default option shipped with EPC servers. Nevertheless, AIX deskside servers like E and T Series can be connected to a DAS5720 packaged in a rack.

The configurability is summarized in the next table.

	high availability configuration 2 SP
base drawer(s)	1 DPE – 10 slots 8 U drawer including one 1 U tray to fit one or two SPS
additional DAE – 4 U / 10 disks drawer	0..1 dual LCC/PS DAEs
minimum number of disks	9
minimum number of disks per additional DAE	4
maximum number of disks	20
memory (MB)	64, not upgradable
write cache	yes
power supply	2
SPS	1 additional SPS optional for higher availability
ATF	yes

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.6.3. SAN features

One or multiple servers can be connected to a DAS5720, using the connectors of the SP (2 connector per SP). External hubs or switches can be used to increase the connectivity. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5720 can be connected to a single HBA on a server using external hubs.

For configuration problems, please refer to the SAN Help Desk.

5.7. DAS 1000, 2000 and 3000 Series Disk Array Subsystems

(Note: DAS3500 discontinued as of 30 June 1999.
DAS3200 discontinued as of 30 September 1999.)

Highlights

The DAS 1000, 2000 and 3000 Series, are standalone SCSI-2 based disk array subsystems available in both rackmounted and deskside configurations (DAS3500 subsystems use SCSI disks but provides FC-AL fibre channel attachment to servers). The DAS 1000, 2000 and 3000 Series extend Bull's ESCALA disk offering with a scaleable, "worry free" storage solution, for customers who need both high availability and high capacity for mission critical applications.

The DAS 2000 and 3000 Series consist of model DAS2900 and DAS3200/DAS3500, near fault tolerant storage subsystems with highly competitive performance and price. DAS2x00 and DAS3x00 are recommended for high availability software applications requiring large capacity disk storage. The new DAS2900 and DAS3200/DAS3500 models, based on Power PC technology provide 50% more performance. The DAS 1000 Series consists of model DAS1300, a redundant subsystem providing half of the DAS2900 maximum capacity.

The DAS3200/DAS3500 provide 50% more disk capacity than the DAS2900.

The **DAS1300, DAS2900** and **DAS3200/DAS3500** are new generation subsystems that provide availability, and high performance with caching options.

	DAS1300	DAS2900	DAS3200/DAS3500
Disk modules	10	20	30
Embedded memory per SP Cache and buffers	Yes (optional) 32, or 64 MB	Yes (optional) 32 or 64 MB	Yes (optional) 32 or 64 MB
RAID levels	0, 1, 3, 5, 1/0	0, 1, 3, 5, 1/0	0, 1, 3, 5, 1/0
Global spare	Yes	Yes	Yes
HW Redundancy	Yes	Yes (near fault tolerant)	Yes (near fault tolerant)

Major features of the 1000, 2000 and 3000 Series models include:

- High availability design
- RAID technology based storage subsystems
- Write cache memory for high performance needs
- Scalable host connectivity with the Fibre Channel connectivity on DAS3500
- Scaleable storage subsystems (capacity and performance)
- Small footprint
- Low cost of ownership

The major components of the 1000, 2000 and 3000 Series are:

- Storage-Control Processor (SP) with optional single or mirrored cache memory
  Disks modules (3.5" SCSI-2, high performance, single ended drives)
- Disk array cabinet (10 drives chassis for DAS1300, 20 drives chassis for DAS2900, and 30 drives chassis for DAS3200/DAS3500)
- Redundant power subsystem
- Redundant cooling subsystem
- Battery Backup Unit for cache security

The Storage Control Processor (SP)

The Storage Control Processors (SP) are the main components of the DAS1300, DAS2900 and DAS3200/DAS3500. One or two SPs can be configured in a disk array cabinet. The DAS1300 Storage Processor design is based on a 25MHz AMD 29000 RISC processor, 4MB of instruction and data memory, three or six SCSI-2 interface controllers, power regulator, and RS232 interface. The new DAS2900 and DAS3200/DAS3500 Storage Processor is based on Power PC technology, with a basic 8 MB memory.

The Storage Control Processor serves a number of functions including the RAID 0, 1, 1/0, 3, and 5 modes of operation, as well as individual disk operation. The SP continuously monitors the status of the other major components concurrently with the temperature within the storage subsystem and notifies the host in the event of a failure.

The DAS 1000, 2000 and 3000 Series are optimized to provide high I/O throughput in server environments. They can support two Storage Control Processors (dual active) within the same cabinet. Dual active SPs induce higher overall I/O performance by minimizing bus contention and paralleling data access.

The two SPs can be interfaced directly to a host resident SCSI-2 adapter (or Fibre Channel Adapter for the DAS3500) or daisy chained on the SCSI bus. Each SP is configured as a unique SCSI ID and can support up to 32 logical units (LUNs) each. A LUN would be equivalent to a RAID stripe. The disk drives within the array can be logically connected to any of the Storage-Control Processors. However, dynamically shared access to a drive group is not supported.

In the event of an SP failure, access to data is insured due to the dual-ported subsystem architecture with active dual initiator.

The SP can house a modular memory for write cache option.

The 3.5" SCSI-2 Disk Modules

All DAS models support high performance 4.2GB (7200RPM), 8.8GB (7200RPM) and 17.8GB disk drives. Up to 30 Winchester disk units can be configured in the 3000 Series, up to 20 disk units in the 2000 Series, up to 10 disk units in the DAS 1000 Series. The disks within the storage system can be configured as either individual disks, RAID 0 groups, RAID 1 or RAID 1/0 pairs, RAID 3 or RAID 5 groups. Any or all of these modes of operation can be configured concurrently. This allows the tuning of the DAS 1000, 2000 and 3000 Series to adapt to specific attributes of a given application.

A small amount of disk capacity will be used to save the write cache when a power failure occurs.

Each disk drive is housed in a hot pluggable disk module. Each module consists of a disk drive, a drive carrier, and a regulator PCB. In redundant RAID configurations, when a disk failure occurs, any module can be removed from a logical group without halting operation of the array. When drive replacement is done, data is automatically rebuilt on the new disk.

On redundant RAID configurations global sparing is another area where the DAS 1000, 2000 and 3000 Series offers significant benefit. Global sparing allows the user to designate one or more spares which will satisfy the requirements of any redundant logical group within the subsystem. By initiating a rebuild on the global spare, the disk array essentially heals itself; thereby re-establishing disk level redundancy, minimizing the impact of degraded mode operation, and minimizing exposure to double failures within a single group.

Manufacturers specify disk capacities in GB. One gigabyte (GB) is 1,000,000,000 bytes (ten to the ninth). Under AIX, volume sizes are given in MB (two to the twentieth) with the convention: one MB is 1024 x 1024 bytes. A 5-percent difference in size appears between both measurements of the same space. For example a 4.2 GB disk (4.2 x 10**9 bytes) will be viewed as a 4,091 MB volume at AIX level.

The DAS 3000 Series Cabinet

(Note: DAS3500 discontinued as of 30 June 1999.
DAS3200 discontinued as of 30 September 1999.)

It is a 14-inch high rackmounted chassis and is available in deskside or rackmounted configurations. It includes space for 5 to 30 replace-under-power (hot plug) disk drives, two Storage Control Processors, one mid-plane, three DC power supplies, and one cooling assembly to support the array's operation and replace-under-power features. DAS3200/DAS3500 cabinets manage room for a Battery Backup Unit for write cache security.

Hot plug technology results in dynamic expansion ability. Users can expand capacity or add any other component while the system remains on line and operating.

There is no difference between the cabinet models.

The DAS3500 subsystems is connected to the host either via a copper connection (limited to 30 meters) or via an optic fiber connection using an Media Interface Adapter (MIA) depending on the distance between the Host and the DAS3500.
The distance is up to 10Km by using Link Extender box and suited optic fiber connection (9µ).

The DAS 2000 Series Cabinet

It is a 14-inch high rackmounted chassis and is available in deskside or rackmounted configurations. It includes space for 5 to 20 replace-under-power (hot plug) disk drives, two SP, one mid-plane, three DC power supplies, and one cooling assembly to support the array's operation and replace-under-power features. DAS2900 cabinets manage room for a Battery Backup Unit for write cache security.
Hot plug technology results in dynamic expansion ability. Users can expand capacity or add any other component while the system remains on line and operating.
There is no difference between the cabinet models.

The DAS 1000 Series Cabinet

In the DAS 1000 Series cabinet 3 to 10 hot-plug disk modules and two Power Modules can be housed. All other features of the 2000 Series cabinet are supported.

The Power Subsystem

It includes power supplies (VSCs) (three for the DAS 2000 and 3000 Series or up to two for the DAS 1000 Series), AC input and AC circuit breaker. The subsystem supports n+1 DC power supply configuration to allow for automatic failover in the event of a single supply failure. Each DC power supply is contained in a replace-under-power module and can be replaced without disrupting subsystem operation. Power fault design ensures data integrity even in the event of power loss during a write operation.
The third Power Module is automatically configured with every DAS 2000 and 3000 Series.

The Cooling Subsystem

Like the power subsystem, the DAS 1000, 2000 and 3000 Series incorporate an n+1 cooling design. Two fan pack modules are contained in a single cooling subsystem (one for the DAS 1000 Series), and each fan pack module consist of 3 fans and a fan monitoring PCB. One fan in the system can fail without impacting operation of the disk array. The entire cooling subsystem can be detached from the array cabinet and replaced while the system continues to operate.

The SCSI Host Connection

The main component of the connection to the ESCALA host is the standard dedicated SCSI-2 SE/DE adapter excepted for the DAS3500 (Fibre Channel). It is a 20MB/s Fast Wide differential MCA/PCI-to-SCSI-2 Adapter. The connection uses also a SCSI-2 bus cable, and an asynchronous RS232 cable for the DAS1300, DAS2900 and DAS3200.

The DAS3500 uses a Fibre Channel connection (FC-AL) to connect the SP to the Host. The DAS3500 provides 2 internal 3-ports hubs (one for each Storage Processor) to chain the SP of one DAS3500 or between two DAS3500.

The Host Connection can use also an external hub to chain or to share SP of DAS3500. This solution is a more secure solution than the internal hub and it's recommended for HA solutions.

The local connections can use copper cables up to 30 meters. The distant connections (DAS3500 or host) have to use a mix of copper cables and fiber cables (up to 500 meters) with MIAs modules on the hubs or on the SPs. For Customers who want to get more than 500 meters between DAS3500 and the Hosts, the Fibre Link Extender module has to be use with fiber cables (9/125µm).

Limits: 3 DAS3500 per FC-AL loop.

Disk Drives Specifications

Nominal Disk Capacity (GB)	4.2	8.8	17.8
Actual Disk Capacity (10*6 B)	4372	8800	17800
Interface	SCSI-2	SCSI-2	SCSI-2
Form Factor	3.5"	3.5"	3.5"
Seek Time (Average R/W) (ms)	8.4 /9.9	8.5 /10.5	8.5 /10.5
Spindle speed (RPM)	7202.7	7202.7	7202.7
Latency (ms)	4.17	4.17	4.17
Transfer Rate			
-buffer to/from media (MB/sec)	9.59 to 12.58	10 to 15	10 to 15
-buffer to/from host (MB/sec)	up to 20		
Buffer Size (kB)	512	1024	1024

Disk drives are common to the DAS 1000, 2000 and 3000 Series.

Mirrored Caching Option

On DAS1300, DAS2900 and DAS3200/DAS3500 models, with dual SP, a cache memory is available. Mainly dedicated to write access caching, it can be also configured as a read cache or as a read and write cache.
The write cache drops the response time for every write access and thus alleviate the write penalty tied to RAID5. A small amount of read cache (2 to 4 MB) will benefit sequential access.

The DAS 1000, 2000 and 3000 Series write cache is fully protected against power failures by a Battery Backup Unit (BBU), against memory components by an ECC (Error Correcting Code) and against SP failures by mirroring. The mirrored copy of data and associated address is saved on the second SP.

The DAS1300 can have 6, 14, 30, or 62 MB of cache memory. A 2 MB memory space is reserved by the SP for internal use. DAS2900 and DAS3200/DAS3500 can have 28 or 60 MB of cache memory. A 4 MB memory space is reserved by the SP for internal use. The actual memory capacity is twice the user size due to mirroring protection.

Single board Caching Option

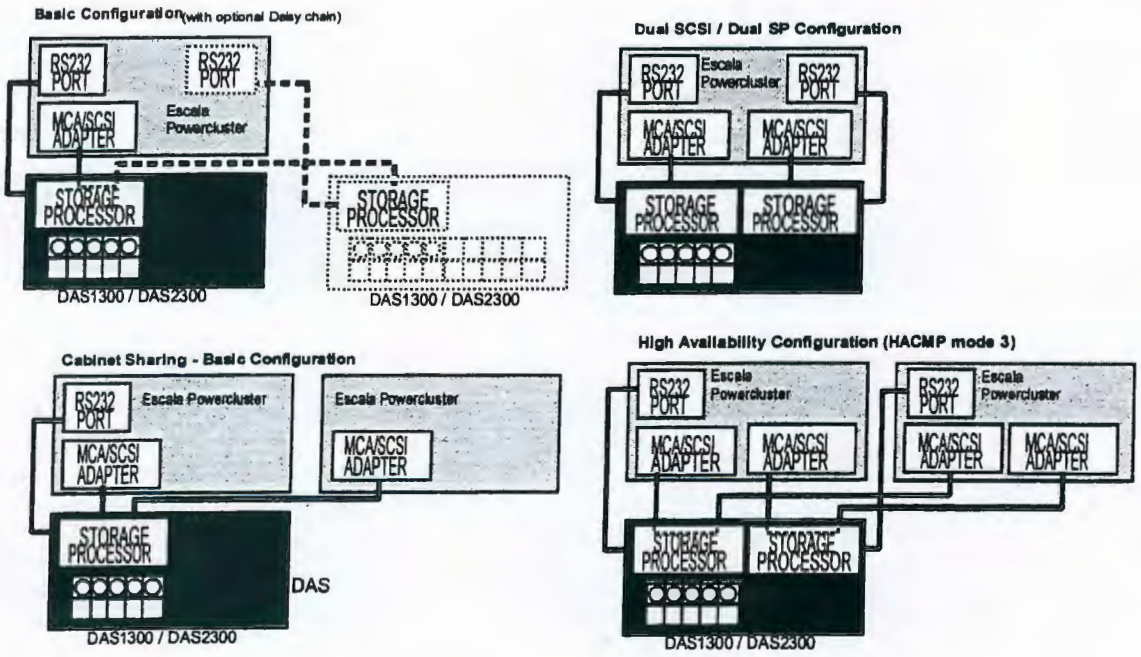
On the DAS1300, DAS2900 and DAS3200/DAS3500 models, with only **one SP**, a cache memory option is now available. This option offers a competitive price for basic configurations.
The DAS 1000, 2000 and 3000 Series single board cache is protected against power failures by a Battery Backup Unit (BBU), and against memory component failure by an ECC (Error correcting Code). No mirrored copy of data is provided.

The DAS1300 can have 6, 14, or 30 MB of cache memory. A 2 MB memory space is reserved by the SP for internal use. DAS2900 and DAS3200/DAS3500 can have 28 MB of cache memory. A 4 MB memory space is reserved by the SP for internal use.

Prerequisites & Configurability

The DAS 1000, 2000 and 3000 Series are available as a standard offering on DPX/20 (150 Series or higher) and on ESCALA platforms.
AIX 4.1, or later, is required.

The following configurations are possible for the DAS1300, DAS2900 and DAS3200/DAS3500:



Performance in these configurations is dictated by a number of factors, including host CPU utilization, SCSI bus traffic, individual disk usage, write cache option.

The basic configuration includes a single DPX/20 or ESCALA host interfaced to the DAS through a standard MCA-to-Differential/SCSI-2 host adapter. In this configuration, a single Storage-Control Processor (SP) is used to access up to 10 (DAS1300), 20 (DAS2900) or 30 (DAS3200/DAS3500) drives in the array chassis. A second array can be daisy chained to the first (up to 534GB: 30x17.8GB for the 3000 Series). The cache memory is available as an option.

The dual Storage Control Processor (SP) configuration offers a higher performance and availability alternative to the basic configuration through the addition of second SP. The mirrored cache memory is available as an option. The SPs can be configured to any of the disks within the subsystem, *however, shared access to a single drive is not supported.* A second DAS 1000, 2000 and 3000 Series array can be daisy chained to the first. In the dual SP configuration, system level redundancy is provided at the drive, power supply and cooling levels. Redundancy at the Storage Control Processor level is also provided: *failover requires operator interaction with the host system.*

The dual SCSI adapter or Fibre Channel adapter/dual SP configuration extends the capabilities of the dual SP configuration by extending a separate SCSI or Fibre bus to the second SP. As with the previous configurations, the optional cache is available and a second array can be daisy chain to the first system. Failover of the storage processors, or SCSI-2 adapters, or Fibre Channel adapters can be initiated *through operator interaction with the host system.*

The cabinet sharing configurations: in this configuration, the SCSI-2/Fibre Channel-to-SP connections are on separate SCSI/Fibre buses, thereby allowing both host systems to share the DAS array as a highly integrated, high availability storage solution.

Limitations to the DAS 1000, 2000 and 3000 Series Cabinet Sharing Configuration:

- Dynamically shared access by two systems to a single drive requires host software (HANFS or HACMP).
- HANFS and HACMP configurations are supported on redundant configurations.

Configuration rules and hints for DAS1300, DAS2900 and DAS3200/DAS3500

Basic Cabinet

One SP is included in the basic cabinet, with 3 power modules for DAS2900 or DAS3200/DAS3500, only 1 for DAS1300.

Number of Disk Drives Allowed

DAS3200/DAS3500:	5 to 30
DAS2900:	5 to 20
DAS1300 without cache:	3 to 10
DAS1300 with cache:	5 to 10
All models with cache and hot-spare disk	6 to 10, 20 or 30

A location exclusion exists between the hot-spare disks and the 5-disk group dedicated to cache saving.

RAID Group Binding Rules

RAID0: 3 to 16 drives per group (3 to 10 for DAS1300)
RAID1: always 2 drives per group
RAID1/0: 4 to 20 drives per group (4 to 10 for DAS1300)
RAID3: always 5 drives per group
RAID5: 3 to 16 drives per group (3 to 10 for DAS1300)

In a DAS1300, or in a DAS 2000 Series with more than 5 drives per group, a very small risk of single point of failure exits at internal SCSI bus level.
When configured in RAID1 RAID3 or RAID5 an amount of capacity of one disk is used for redundant data storage.

Number of Power Modules

For the DAS1300:
The second power supply is an option, power redundancy is only assumed with it. Add the second power supply with 2SPs or with the cache option. NOEMIE will set the option as default. You may remove it to get a lower price, but availability will become poor.
For the DAS2900 and DAS3200/DAS3500:
The third power supply will be delivered with every subsystem.

Number of Storage Processors (SP)

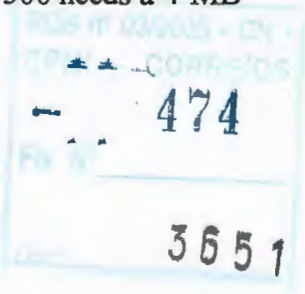
The second SP is recommended for higher availability (associated or not with the second SCSI connection) and for performance over 10 drives.
For high availability, it is mandatory to have the mirrored cache option.
For DAS2900, the single SP configuration is able to manage up to 15 disks without internal I/O saturation (short random I/Os).

Mirrored Cache

The mirrored cache option needs the dual SP configuration, 5 disk drives or more, and the Battery Backup Unit. The memory modules are provided by pairs. Memory size is 32 or 64 MB per SP. A 2-MB space will be reserved for internal use on DAS1300. DAS2900 or DAS3200/DAS3500 needs a 4-MB reserved space.

Single Board Cache

The single board cache option is available in single SP configuration, 5 disk drives or more, and the Battery Backup Unit. The memory size is limited to 32 MB for every model. A 2-MB space will be reserved for internal use on DAS1300. DAS2900 or DAS3200/DAS3500 needs a 4-MB reserved space.



Microcode

The DAS 1000, 2000 and 3000 Series Storage System Manager (DASMGR) software, is an integrated set of utilities that allow users to configure the array, monitor the status of the major storage system components, and download updates of the arrays internal microcode. For DPX/20, DASMGR is available under a specific MI that includes also user's documentation, and media. For Escala, DASMGR is delivered with AIX 4.1.
The Storage processors are controlled by on board internal software. This microcode is included in the base configuration of the subsystem. Enhanced functions are distributed through updates of this software. It is customer installable through the DASMGR utility.
In addition we can take advantage of a new graphic array management tool simplifying day-to-day operational tasks. Called ArrayGUIde, this tool is basically available and requires a graphical color display on the host or somewhere on a LAN connected to the host.

Performance

Performance takes advantage of the capability of mixing RAID architectures to fit application needs. The appropriate RAID level must be chosen according to the file size and the type of access. The write cache drops the write response time for all RAID levels, sweeps out the RAID 5 penalty and boosts the read after write access.

The raw performance of the DAS1300 reaches in RAID 5 for one 5-disk LUN:

- 350 I/Os per second (100 % of READ, random access of 512 bytes, without cache)
- 120 I/Os per second (100% of WRITE, random access of 512 bytes, with an 8MB cache).
- a 13ms response time for 20 I/O per second (read without cache)
- a 7.3 ms response time for 20 I/O per second (write with an 8MB mirrored cache)
- a 5 ms response time for 20 I/O per second (write with an 8MB single cache).

The raw performance of the DAS2900 is much higher for large configurations (more than 12 drives).

- 1200 I/Os per second (100 % of READ, random access of 4 Kbytes, cache hit = 0, access time = 32 ms, 20-disk 4-LUN RAID5, Dual SP Dual SCSI configuration).
- 4 ms less than DAS1300 in access time for 4 Kbytes I/Os in the same conditions.
- 500 I/Os per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Dual SP Dual SCSI configuration).
- 340 I/Os per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Single SP Single SCSI configuration).
- a 7 ms response time for 20 I/O per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Single SP Single SCSI configuration).

These values are worst cases, measured within a full size working space, the access time includes a higher seek time than the one usual applications get.

5.8. EMC² Enhanced Symmetrix Subsystems (Symmetrix 3000)

Symmetrix enables to consolidate storage from multiple heterogeneous UNIX, Windows NT and AS/400 hosts. Optional Symmetrix Enterprise Storage Platform (ESP) software also allows mainframe information to be resident and accessible on the same Symmetrix 3000 system.

Symmetrix 3000 Enterprise Storage systems protect the largest relational databases and most demanding applications with the highest degree of data protection. The enterprise is fully protected against planned or unplanned disruption to information availability and accessibility. Protection choices include disk Mirroring (RAID 1), Symmetrix Remote Data Facility (SRDF™) remote mirroring software, hardware redundancy, and non-disruptive microcode and component replacement:

- EMC's disk Mirroring provides the highest data availability for mission-critical applications. By creating two copies of data on separate disk drives, Mirroring ensures both the highest availability and highest system performance.
- SRDF software maintains mirrored copies of data on physically separated Symmetrix systems to ensure continuous business operations in the event of planned or unplanned system or data center outages and disasters.
- EMC TimeFinder™ allows businesses to create independently addressable business continuance volumes (BCVs) for mainframe and open systems enterprise information. The BCVs are copies of active production volumes that can be used to run simultaneous tasks in parallel with one another. This gives customers the ability to do concurrent operations, such as data warehouse loads and refreshes or point-in-time backups, without affecting production systems.
- Symmetrix systems support non-disruptive microcode update loading. The business or agency remains online and unaffected even as it gains the advantages offered by enhanced capabilities.
- Symmetrix systems feature a full-system battery that guarantees no lost writes and orderly transitions or shutdowns during power outages. Extensive proactive and predictive intelligent maintenance features, such as cache and disk scrubbing and an integrated Remote Maintenance Processor (RMP), add to Symmetrix's information protection and continuous information availability features.

The Symmetrix 3000 family provides the highest performance systems to enhance online transaction processing and other response-time intensive applications:

- Up to 16GB of non-volatile cache (8GB on Symmetrix 3630 systems) helps ensure that all of the applications run at top speed.
- In addition to its large, intelligent cache, Symmetrix's parallel processing capabilities achieve levels of performance that result in dramatic reductions in both online response times and batch processing windows.

The major components in the Symmetrix 3000 are the directors (channel directors and disk directors), cache, and disk devices, as discussed below:

Ultra-SCSI Director:

The Ultra SCSI director is a single card that has four differential wide interfaces for connection to host systems and one high-speed path to cache. It can attach to hosts supporting Ultra-SCSI connectivity.

and Fast-Wide differential SCSI connectivity. The Ultra SCSI director contains two advanced microprocessors that process commands and data from the host and manage access to cache. They support data transfer rates up to 40 MB/sec with a host over each channel interface simultaneously. On each Ultra-SCSI channel director, data transfers from the host to cache occur as four concurrent operations. Each Ultra SCSI director can support up to 960 logical volumes (with a maximum of 2,048 logical volumes per Symmetrix 3830 and Symmetrix 3930 and 1,024 logical volumes for the 3630 Symmetrix)

Fibre Channel Director:

The Fibre Channel director is a single card that has two FC ANSI compliant 1 Gigabit Fibre Channel interfaces for connection to open systems hosts and one high-speed path to cache. It supports a data transfer rate of up to 100 MB/sec. The Fibre Channel director contains two advanced microprocessors that process commands and data from the host and manage access to cache. The Fibre Channel SCSI protocol mapping and upper level protocol layers are both implemented within the director. Each Fibre Channel director can support up to 256 logical volumes per Symmetrix system.

Serial Channel Director:

The serial channel director processes frames from the mainframe host and manages access to cache. The serial channel director supports data transfer rates up to 17 MB/sec with the host. With the IBM ESCON Multiple Image Facility (EMIF) Symmetrix can contain up to 1,024 different images. EMC offers four-port serial channel directors, which can support up to 1,024 logical volumes per board. Symmetrix serial channel directors support 2 Control Unit Address (CUADD) images, 512 logical devices per ESCON port and 32 separate logical paths (LPaths) addressable to one port. The 32 logical paths may be shared in any fashion between the 2 CU images. For example, all 32 logical paths can be configured on one CU image and none on the other. Or, 32 logical paths may be split between the ports (for example, 18 on CUADD 0 and 14 on CUADD 1)

SRDF Remote Link Director:

The Remote Link Director (RLD) is a 4-port serial channel director microcode configured as the link between Symmetrix units in a Symmetrix Remote Data Facility (SRDF) configuration. The Remote Link Director (RLD) interfaces to Symmetrix channels via a serial channel interface adapter. The Remote Link Director supports data transfer rates up to 17 MB/sec and supports up to 1,024 logical volumes per board. Symmetrix requires a minimum of two and supports up to four RLDs in each Symmetrix 3630 unit used in an SRDF configuration. When one of the processors of a serial channel director (two ports on each processor) is configured as an RLD, *only one of the ports* on that processor can be configured as a remote link, while the remaining port is not used. The second processor can be configured as a serial director, with *both ports* being used for serial channels. If two ports of the four-port RLD are needed as remote links to other Symmetrix units, only one port from each processor can be used.

Disk Director:

The disk director is a single card that provides an interface between cache and the disk devices. Each

disk director supports one disk device on each of its four SCSI buses, but is capable of supporting up to eight devices per SCSI bus in the Symmetrix 3930 (six in the 3830, four in the 3630). Each disk director provides an alternate path to the disk devices of the other disk director. That is, should the primary path through a disk director to a disk device fail, the Symmetrix 3000 accesses that device through the other disk director.

Cache:

The Symmetrix 3630 model has two standard cache slots. Symmetrix 3830 and 3930 models have four standard cache slots. The Symmetrix 3630 models support a maximum of 8,192 MB of cache when 4 GB cache cards are installed in both slots. The Symmetrix 3830 and 3930 support a maximum of 16,384 MB of cache when 4 GB cache cards are installed in all four slots. Individual cache memory cards are available in 512 MB, 1 GB, 2 GB, and 4 GB sizes.

Symmetrix 3000 model specifications:

	Connectivity directors											
Model	**Ultra SCSI**		**Fibre Channel**		**Serial Channel**		**Remote Link**		**Cache directors**		**Disk devices**	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3630-18/36	2	4	2	4	2	4	2	2	2	2	8	32
3830-18/36	2	4	2	4	2	4	2	2	2	4	16	96
3830-18/36(1)	2	6	2	6	2	6	2	4	2	2	16	96
3930-18/36	2	8	2	8	2	8	2	6	2	4	32	256

(1) With option to convert to cache slots in Front End Director slots.

5.9. Serial Storage Architecture (SSA) Disk Subsystems

Notes: Discontinued: 30 June 1999. However, SSA disks will still be available as an add-on option. Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

The Serial Storage Architecture (SSA) Disk Subsystems are second-generation, leading-edge serial storage subsystems that implement industry-standard Serial Storage Architecture (SSA) to deliver outstanding performance, capacity, and availability in a low cost, scalable package.
In the transaction processing environment, the SSA Disk Subsystems provide the ideal solution when used as mirrored storage in a "high availability" server systems for applications that require sustained high performance despite a single failure. If the cost of data protection is more important than high performance, then RAID 5 should be considered. In engineering/scientific, data-mining, data-warehousing, and decision support applications, the ability to sustain high data rates makes the SSA Disk Subsystems an attractive solution.

5.9.1. SSA Disk Subsystem Models

The SSA Disk Subsystem offer is comprised of two functionally equivalent models. The Rack Model

is designed to be mounted in a standard 19-inch rack and is four EIA units high. The Deskside Model is a standalone unit.
The SSA Disk Subsystem provides power and packaging for SSA disk drive modules.

The two SSA Disk Subsystem models (rack and deskside) can be populated with up to 16 auto-docking, customer replaceable, SSA disk drive modules. These 16 disks are grouped together in fours. The rack and deskside models provide circuitry that will automatically connect these groups of disk drives together. The automatic connections are made based on the presence of signals on the external connector. If there are signals present at one connector of a pair of connectors then these connectors will not be connected automatically. If there is not a signal at both of the connectors in a pair then these connectors will be connected automatically.

The disk drive modules are connected to each other strings of four modules (two strings at the front of the SSA Subsystem and two strings at the back). These strings can be connected to each other, to strings in other SSA Disk Subsystem, or to SSA adapters. The adapters can be in separate using systems or in the same using system.

The disk drive modules are available in two different capacities: 4.5GB, and 9.1GB.
The 9.1GB SSA Disk Drive features require AIX 4.1.5.
The basic SSA Disk Subsystem is delivered with four 4.5GB disk drives. However, select features allow these to be replaced by the 9.1GB modules at time of original order. Features are provided to add any combination of supported SSA disk drive modules, up to a maximum of 16, providing up to 145.6GB of disk storage capacity (using 9.1GB disk drives).
The shared SSA Disk Subsystem in High Availability Solution is available. In this case the basic delivery is eight 4.5GB "mirrored" disk drives (with an option to select 9.1GB).

The two SSA Disk Subsystems include three auto-docking power/cooling units. These provide redundant power to all sixteen disk drive module positions. These units can also be replaced by the customer.

The SSA Disk Subsystem is configured with three fan-and-power-supply assemblies. The fan-and-power-supply assemblies can run on either ac or dc power.
They provide all the power generation and distribution for the SSA Disk Subsystem.

The SSA Disk Subsystem can be disconnected from its related SSA adapters while the using system is running. Also, most of the field-replaceable units (FRUs) of the SSA Disk Subsystem can be removed and replaced while the Subsystem and the using System are running.

These models offer:

Outstanding Capacity/Footprint

- 4.5GB, and 9.1GB drives
- Four to 16 drives per Subsystem.

Outstanding Subsystem and Adapter Performance

- Up to 8,000 ops/sec/subsystem
- Up to 140MB/sec/subsystem
- Up to 3,000 ops/sec/adapter
- Up to 35MB/sec/adapter.

Outstanding Availability and Reliability

- SSA dual paths to every disk
- Redundant power and cooling
- Concurrent maintenance on power, cooling, and drives.

For SSA attachments refer to the Adapters description.

5.9.2. SSA Disk Drive Modules and Capacity

The SSA Disk Subsystem is configured with 4 Disk Drive Modules (18 GB up to 36.4GB using 9.1GB disk drive). Up to 16 Disk Drive Modules (72 GB up to 145.6GB using 9.1GB disk drive) can be connected to the Subsystem.

All the Disk Drive Modules start their power sequence when the input voltage is inside the specified limits. Their motors are started under control of the SSA adapters in the using system. To prevent the need for excessive electrical current, the Disk Drive Module motors are not all started together (at least 10 seconds delayed).

5.9.3. SSA Loops and Links

The Disk Drive Modules of the SSA Subsystem are connected through two or more SSA links to an SSA adapter that is located in the using System. The Disk Drive Modules, SSA links, and SSA Adapter are configured in loops. Each loop provides a data path that starts at one connector of the SSA Adapter and passes through a link (SSA cable) to the Disk Drive.

5.9.4. Disk Drive Module String

In the SSA Subsystem, the Disk Drive Modules are arranged in strings of four modules. Each string has its own two SSA connectors and can be connected through external SSA cables to a pair of connectors on the SSA adapter to make a SSA loop of four modules.
A string can also be connected to other strings to make a bigger loop.
The strings can be in the same SSA Subsystem or in different SSA Subsystems.

6. Tape Libraries and Subsystems

6.1. DLT 4000 and DLT 7000-Cartridge Tape Library

This DLT 4000/7000-Cartridge Tape Library is also designed in Bull as "DLT LibraryXpress". It is a stand-alone subsystem providing 10-cartridge capacity and housing up to two DLT4000 (20/40 GB/s) or DLT7000 (35/70 GB/s) drives.

The DLT technology is available with the 10-cartridge library (Overland) fitted with 2 DLT drives, offering a 400GB capability and a 6MB/second transfer rate

The DLT Library Xpress gives you the most options for capacity, performance and growth of any tape library available.

Then, as your needs grow even greater, the exclusive SmartScale Storage design will let you snap on additional modules for a simple expansion of up to 3.2 Terabytes with transfer rates of up to 172 GB/hour, all while protecting your original investment!

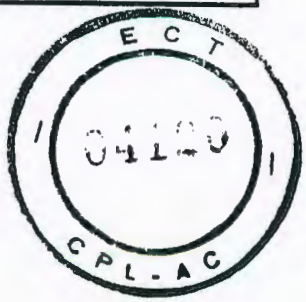
The combination of high-performance DLT drive technology and Overland Data's proven Mainframe Class library robotics gives you peace of mind. Your data is safe when you combine the highly reliable Library Xpress and backup & storage solutions across Bull platforms.

Specifications

Drives and Media	LXB4210
Drive type	DLT4000
Number of drives	Two
Media type	CompacTape IV
Tape type	5 in. metal particle, .5 mil thick
Tape length	1800 feet
Cartridge size	4.1 in. * 4.1 in. * 4.1 in.
Magazine size	10 cartridges

System performance

Read/write tape speed	110 ips, streaming
Search tape speed	streaming 150 ips
Sustained native transfer rate (max/drive.)	5 MB/sec. - 180 MB/min.
Peak SCSI transfer rate per drive	20 MB/sec. synchronous mode
Cartridge load /unload time	10 seconds
Average access time from (BOT)	45 seconds
Average rewind time	45 seconds



Data organization

Data compatibility	digital linear tape
Recording format	128 track serial serpentine
Recording density	82,000 bpi
Read/write head w/MIG	2 channel ferrite
Native capacity	200 GB
Data compression	Standard Digital Lempel-Ziv (DLZ) algorithm
Compressed capacity (2:1)	400 GB

System reliability & data integrity

Head life	10,000 hours
Mechanism life	500,000 cycles
Media life	500,000 passes
Error correction code	Reed Solomon ECC, 64-bit CRC on each 4 KB of data, 16-bit parity check on each record, internal parity check on the buffer
Hard error rate	less than 1 to 1017 bits read
Undetected error rate	less than 1 to 1030 bits read

Connectivity & system compatibility

Drive interface (diff.)	Fast SCSI-2
Library interface (diff.)	Fast SCSI-2

Physical dimensions

Dimensions rackmount (H * W * D)	17 in. * 17 in. * 22 in. (17.78 cm * 43.2 cm * 55.88 cm)
Dimensions desktop (H * W * D)	8 in. * 19 in. * 23 in. (20.32 cm * 48.26 cm * 58.42 cm)
Weight rackmount	65 lbs. / 29.53 kg
Weight desktop	70 lbs. / 31.8 kg

A 4-line, 20-character LCD front-panel display provides direct access to comprehensive library status. Configure the library or drives through the panel or from software. Check the loader robotics and magazine status, and access system statistics and command history.

Magazine handling is easy, just push one button to load or unload, or lock it in the LibraryXpress for security.

Standard Connection (recommended)

- One SCSI-DE connection to the robotics control and two drives.

High Availability Connection

- One SCSI-DE connection to the robotics control and to one drive
- One dedicated SCSI-DE board and cable to the second drive.

The DLT Entry Library is sourced from Overland Data, where it is designated as LPX4210.

The DLT Entry Library is supported through services offered by NetBackup Software.

6.2. Magnetic Tape Drive

A Magnetic tape drawer is available for open-reel tape configurations. It is made by Bull's partner StorageTeK. It runs 9-track, ½ inch standard tapes.

6.2.1. STK9914 1/2" 9 TrackTape Drive Drawer

(Discontinued)
Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

The Optional 1/2-Inch 9-Track Tape Drive Drawer contains the STK9914 Tape Drive.
The STK9914 is an autoloading, autothreading, reel to reel tape device.

Its main features are:

- ANSI Standard 9-track tape interchange,
- selectable tape density: 6250bpi (GCR mode), 1600bpi and 3200bpi (PE mode) and 800bpi (NRZ mode),
- transfer rate: 781kB/s,
- tape speed: 42/125ips,
- reel size: 6 to 10.5" (IBM Hub)
- tape length: up to 3600'
- MTBF (specified): 25000H.

Attachment

- Connection to an SCSI2-DE controller.

The 1/2-inch 9-Track Tape Drive Drawer does not have support for battery backup operation.

7. Storage Area Network (SAN)

The term SAN designates a new type of storage architecture in which the storage systems are attached to a high speed network dedicated exclusively to storage. Connections between storage systems and servers or clients use interconnect technologies such as hubs and switches. SANs enable storage to be externalized from servers improving system performance. The application servers (usually UNIX or NT based) connected to this high-speed network exchange data using a SCSI-type I/O protocol.

7.1. SilkWorm 2800 Fibre Channel Switch

7.1.1. Highlights

The SilkWorm® 2800 switch is a 16-port Fibre Channel Gigabit switch that provides connectivity for up to 16 Fibre Channel compliant device ports. The SilkWorm 2800 switch is used to connect servers with storage devices to create a SAN (Storage Area Network). Devices in a Fibre Channel SAN can access information anywhere in the SAN.

The SilkWorm 2800 switch features:

- Simple hardware installation thanks to universal ports: each port supports F, FL or E-port mode of operation, which is automatically selected by the switch software itself.
- Easy setup and configuration: simple network initialization by entering the IP address on the front panel (no need to connect a terminal).
- Automatic discovery of all the devices connected to the switch.
- Plug-and-play connections without powering down the switch.
- Convenience of switch connections and controls at the front panel.
- Switch interconnection to build various topologies, including fully meshed and high available fibre channel network.
- Dynamic addition of a new switch to a running network.
- Zoning services to create virtual independent area within or across several switches.
- Translative mode to reconnect the fabric devices that support only the PLDA protocol (private loop).
- Quick Loop, to create virtual private loops across the switch.
- Management tools accessible from the front panel, Telnet or via the WEB.
- Software products offering advanced features to manage the SAN and secure access to information.

Top performance to satisfy high expectations

- Data path in hardware results in lowest end-to-end latency time in the industry, increasing throughput.
- Cut-through frame forwarding moves frame traffic efficiently without having to receive the complete frame first.
- In-order delivery of data frames guarantees that frames are delivered to a destination in the same order as received by the switch from the originator.

- Flexible switch buffering stores a data frame for only as long as is absolutely necessary, moving data faster through the switch.

7.1.2. Limitations

- Minimum firmware and software level are required for disk subsystems and PCI adapter to interoperate with the switch.
- Translative mode, quick loop and switch interconnection are not yet validated in the AIX environment.
- FL-port and connection of hubs or loops on the switch are not supported.
- The Silkworm 2400 (8 port model available in the StoreWay catalog) has not been validated with AIX servers.

Hardware components

The SilkWorm 2800 switch includes the following hardware components:

- Motherboard containing the CPU, memories and ASICs.
- Hot swappable auto-ranging power supply. An optional redundant power supply can be installed in the switch.
- Hot swappable fan assembly with redundant fans.
- Up to 16 1-gigabit-per-second (GB/sec) full duplex ports supporting ShortWave multimode GBIC (dual SC connectors), allowing connections up to 500 m without additional link extender.
- Front panel with buttons and display to manage the switch and launch diagnostics.
- 10/100 Base T Ethernet connection (RJ45 connector).

Software components

The SilkWorm 2800 switch includes the following software components:

- The fabric operating system allowing the operation and management of the fabric.
- A Simple Name Server, which discovers connected devices, and registers/deregisters the device information when a connection changes.
- The Registered State Change Notification: dynamic detection of changes in topology and port status.
- Multicast Service (Alias Server): sends a single data copy simultaneously to group members.
- A switch management accessible through 5 access methods:
  - front panel controls located on the switch.
  - Telnet commands via Ethernet connection.
  - SNMP agent embedded in the switch.
  - SES (SCSI-3 Enclosure Services) access via Ethernet connection.
  - WEB based management tools.
- Zoning Service: confines access among devices by creating logical subsets of devices for additional management of and security in the SAN.

- Diagnostics: Embedded online and offline diagnostics.

Hardware requirements

The Escala PCI servers supporting the PCI fibre channel adapter (DCCG141-0000) can be connected to a switch, using:

- MIA (Media Interface Adapter)
- Optical Fibre Channel cable.

Software requirements

AIX 4.3.2 or later.

Supported Storage Subsystems

Symmetrix and DAE/DAS 5000 support, with the releases of microcode or flares mentioned below, the fabric protocol required to be connected to a switch.

The **Symmetrix family** can be connected to the switch, using

- Fibre Channel Director
- Optical Fibre Channel cable.

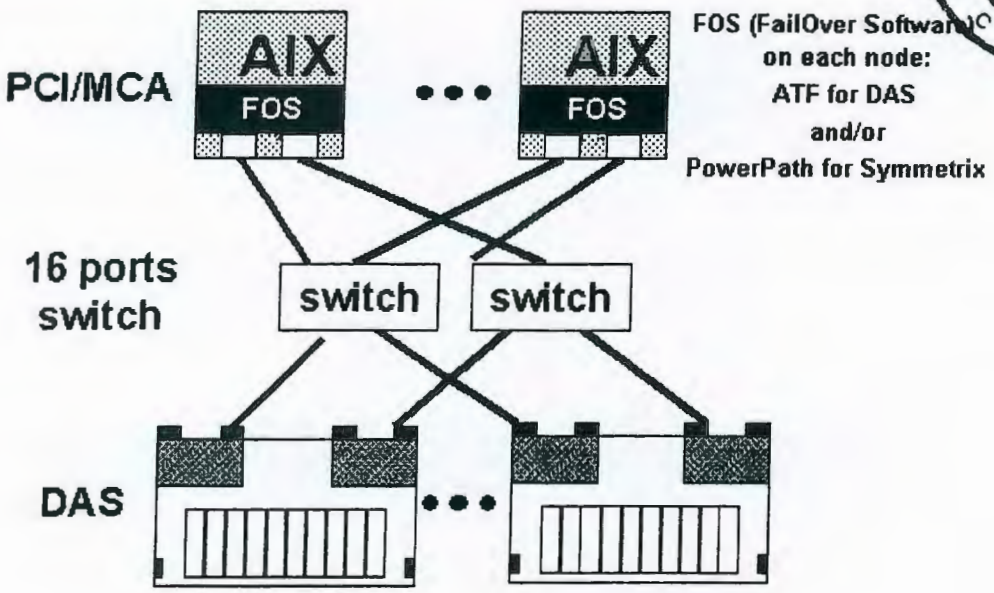
Minimum Symmetrix microcode release: 5265

The **DAS5700 family** can be connected to the switch, using

- Optical Fibre Channel cable
- MIA (Media Interface Adapter).

Minimum flare level on the DAS5700: 4.12.02

Sample configuration: multiple servers, dual path, dual switch



7.1.3. Technical specifications

Fibre Channel protocol:	Fibre Channel ANSI Standards: FC-AL (v 4.5), FC-AL-2 (v 5.7), FC- FLA (v 2.7), FC-GS-2 (v 4.0), FC-PH (v 4.3), FC-PH-2 (v 7.4), FC-PH-3 (v 9.4), FC-PLDA (v 2.1), FC-SW (v 3.3), FCP (rev 012), SES (rev 8a)
Number of Fibre Channel ports:	16
Fibre Channel port speed:	1.0625 GB/sec, full duplex
Operation modes:	Fibre Channel Class-2 and -3 connectionless service
Switch bandwidth:	16 GB/sec end-to-end
Frame buffers:	16 frame buffers for each port at 2,112 bytes per frame
Fabric latency:	<2 µsec with no contention
Data traffic types:	Unicast, multicast, and broadcast
Data transmission ranges:	Up to 500m with short-wave GBIC
Port types:	Universal ports: G_Port (E- and F-Port modes) or FL_Port automatic configuration
Weight:	8.6 kg (19 lbs.) with 4 option modules.

Chassis types

Rackmount dimensions

2U, 19-in. (EIA compliant)

H: 8.7 cm (3.44 in.), W: 44.75 cm (17.62 in.), D: 43.1 cm (16.99 in.)

Tabletop dimensions

H: 8.7 cm (3.44 in.), W: 42.9 cm (16.88 in.), D: 43.1 cm (16.99in.)

Power Requirements

Nominal:
100-120 VAC, 50/60 Hz
200-250 VAC, 50/60 Hz
Operational:
90-134 VAC, 50/60 Hz
180-257 VAC, 50/60 Hz

Operating Environment

Temperature (operating):	10°C -- 40°C
Temperature (non operating):	-35°C - 65°C
Humidity:	5% 85% non-condensing @ 40°C (104°F)
Altitude:	Up to 3,000 m (9,800 ft)
Shock (operating):	5 G, 11 ms_half sine

Safety

European Union Market
Compliance with the Low Voltage Directive EEC/73/23 amended by EEC/93/68 and thus to the following European standards:

- EN 60950
- EN 60825 *

* Only applicable for laser product.

North American Market
Certified in conformance to UL 1950 (USA) and CSA 950 (Canada), and display the UL and CSA labels.

Other Countries
Certified as conforming to IEC950.

Electromagnetic Compatibility

European Union Market
Compliance with the EMC directive EEC/89/336 amended by EEC/93/68 and thus the following European Standards:

- EN55022 Class A
- EN50082-1
- EN61000-3-2 *
- EN61000-3-3 *

* Mandatory at least for all shipped products on January first 2001.

North American Market
Compliance with the following requirements:

- For USA: FCC part 15 Class A.
- For Canada: CSA C108-8 & IECS-003 Class A.

Other Countries
Compliance with the following requirements:

- Japan: VCCI Class 1 (or A).
- Rest of the World: CISPR22 class A.

Localization

Local country power cord supplied.

7.2. Fibre Channel Optical Link Extender

7.2.1. Highlights

The FLX-2000 extends the distance of high-speed optical fibers well beyond the 500 m limit of multimode optical fibers. Finisar's Optical Link Extenders facilitate new applications such as remote storage and disaster recovery.

A pair of FLX-2000s extend a link by converting the short-haul copper or multi-mode optical signal to a long-haul, single-mode signal, and vice versa. Its internal Digital Signal Conditioner re-times the signal over the long-served over long distances with a bit error rate of 10^{-12} or better.

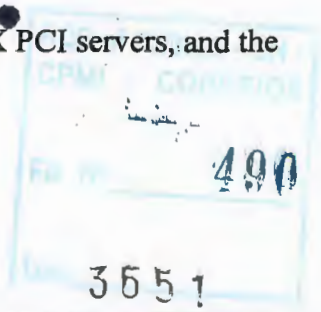
Simple to install, FLX-2000 link extenders include comprehensive system status monitoring and link diagnostics. The link monitoring and diagnostics provide quick fault detection and isolation. Integration with network management is provided via an RS232 serial port attached to a local terminal or modem to allow remote access.

7.2.2. SAN topologies & interoperability

Long distance links have been qualified only with one Optical link extender at both ends of the fiber. Interoperability with other devices on the long-haul optical fiber has not been qualified.

The Optical link extender has been qualified with links up to 10 km. Longer distances can be obtained in SFR (up to 120 km).

The short-haul connection has been qualified with DAS RAID subsystems, AIX PCI servers, and the Gadzoox Bitstrip fibre channel hub.



7.2.3. Packaging

The Optical Link Extender is a tabletop equipment, which can be stacked. Flat mounting on a wall is possible. Rack mounting kit is not available.

7.2.4. Technical specifications

Fibre channel specification

Protocol: Fibre Channel
Data rate: 1.062 Gbps

Electrical specification

Power requirement: +5 V (3 A), redundant inputs
Power supply: 110/220 V input, +5 V (4 A) output

Front-panel LED

Power
System
Short-haul
Long-haul

Short-haul connectivity

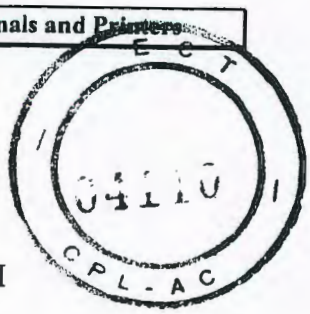
Short-haul copper cable: Shielded balance per FC-PH specification
Maximum short-haul copper distance: 25 m

Long-haul connectivity

Long-haul fiber connector: ST
Long-haul fiber cable: Single-mode zero dispersion at 1310 nm, 9/125 µm
Maximum long-haul distance: 10 km (optional up to 120 km)
Minimum Tx power: -3 dBm
Minimum Rx sensitivity: -26 dBm

Physical Dimensions

Dimensions: 8.2" x 7.5" x 1"(20,8 cm x 19,5 cm x 2,5 cm)
Weight: 2.5 lbs (1.3 kg)
Operating Temperature: 0 to 50°C



Other

Laser safety: Class 1 per FDA/CDRH, IEC 825-1
Agency Approvals: UL1950, CSA 22.2 950, EN 60950,IEC 950, CE Mark, VCCI

Electromagnetic Specifications

Emission: FCC Part 15 Class A, EN55022A, EN 55022, DOC CAS C108.8
Immunity: EN 50082-1

7.3. Gadzoox Biststrip™TW Fibre Channel Hub

7.3.1. Highlights

The Gadzoox Bitstrip™ TW Fibre Channel Arbitrated Loop (FC-AL) hub is specifically designed to be a cost effective entry point into high availability, gigabit storage networking. The Bitstrip TW incorporates several active features, such as Gadzoox' Reflex intelligent port bypass and per port data regeneration, which ensure reliable, trouble free, plug and play operation as well as a high degree of data integrity.

The Bitstrip TW is a 9-port FC-AL active hub that uses a DB-9 connector for each port allowing native connection to copper cabling. The Bitstrip TW also supports optics on all 9 ports through the use of external DB-9 to optics Media Interface Adapters (MIAs). MIAs are hot-pluggable and field upgradable, providing hub users with maximum flexibility in mixing copper and optical connections in their Fibre Channel systems. Power is automatically supplied on a per port basis to each connected MIA.

The Reflex feature, an intelligent port detection and bypass capability, dynamically reconfigures the arbitrated loop network to preserve communication between all operating devices. Using Reflex, the Bitstrip TW manages movement of nodes on and off the network, constantly monitoring nodes for failure, cable disconnection or network reconfiguration. Non-operating nodes are automatically bypassed, newly communicating nodes are automatically entered onto the loop. All loop reconfiguration is handled by the Bitstrip TW without disrupting communication on the remainder of the network. In the absence of the Bitstrip TW, the physical loop would need to be recabled on the addition or removal of a node, bringing the network down and disrupting communications.

The Bitstrip TW can be cascaded to other FC-AL hubs for the expansion of the loop. Port expansion is supported to the FC-AL limit of 126 nodes. Any port may be used for cascading.

The Bitstrip TW implements the most complete suite of intelligent data detection tests to ensure the highest availability of the Fibre Channel Arbitrated Loop. This test suite includes:

- Valid 8B/10B Data Detection
- Oscillation Detection
- Open Cable Detection

These three tests allow the Bitstrip TW to differentiate between valid Fibre Channel data and erroneous data, preventing corruption on the loop. Multiple detection circuits ensure that nodes will be bypassed only on real line failures, allowing transient events such as bit failures to be handled by the Fibre Channel frame level protocol. In the event that a node is bypassed, front panel LEDs provide convenient indications.

7.3.2. SAN topologies & interoperability

Despite the advanced features of the hub to retime and regenerate the signal allowing hub cascading, hubs interconnections must be avoided because of the risk of performance bottleneck. The hub shares the 100 MB/s bandwidth between the connected devices. Thus with 8 servers connected to a single hub, the average bandwidth per server is only 12,5 MB/s (100/8), i.e. much less than SCSI. Interconnecting hubs does not increase the available bandwidth, but at the opposite share the 100 MB/s between more devices. The single case where hubs interconnection is tolerated (but should not exceed 3) is when there is no more than 9 devices (host bus adapters or storage subsystems) and the interconnection simplify the cabling. Typical examples are the disaster recovery configurations. Please refer to the SAN configuration guide for more information.

Another consequence of the bandwidth sharing concerns servers with multiple adapters: attempting to connect multiple adapters to a single hub is a design error. It will not increase the bandwidth available for the server, and furthermore, a failure of the hub (like a power outage) will impact all the connected adapters.

The interconnection of hubs and switches has not yet been qualified.

7.3.3. Packaging

The hub is a tabletop equipment.

It can also be mounted into a rack. It is designed as a precise half rack chassis so that two hubs installed with a single, 1U-height rack space. There is a double rack mount kit designed for mounting two hubs, side by side into a rack.

7.3.4. Technical Specifications

Bit Rate

1.0625 Gigabit/Second, 8B/10B encoded

Data Rate

100 MByte/Second each direction

Standards Support

Fibre Channel Arbitrated Loop

Physical Specifications

(H) 1.7 in./43mm, (W) 8.7in/221mm, (D) 5.7 in./145mm

Weight

Net - 3 lbs., Shipping - 3.3 lbs.

LED Indicators

1 Amber/port - LED on indicates port by-pass
1 Green - LED on indicates power on

Environmental Specifications

Operating temperature: +10 deg. C to +40 deg. C
Storage temperature: -30 deg. C to +60 deg. C
Operating humidity: 80% maximum relative humidity

Electrical Specifications

AC Voltage: 100-240 VAC
Power: 2A, 50-60 Hz

Electromagnetic Specifications

FCC Part 15 Class A, EN55022A

Agency Approvals

UL1950, CSA 950, EN60950 (IEC950), CE Mark, VCCI

7.4. MIA

7.4.1. Highligths

The MIA is a high performance integrated duplex data link for bi-directional communication over multimode optical fiber for Fibre Channel applications. It is compliant with the Media Interface Adapter (MIA) specification. The MIA is specifically designed to connect to electrical high speed data communications links that require extended distance performance. The previous limit of 30 m in copper connections can easily be extended to 500 m with multimode.

7.4.2. SAN topologies & interoperability

The MIA has been qualified with Gadzoox hubs and DAS subsystems.

Caution

This MIA, introduced in 9/99, replaces the product number MI DCOQ001-0000. It is not compatible with PCI copper DB9 fibre channel PCI adapters (LP 6000: DCCG166-0000, LP 7000e: DCCG141-0000, LP 8000: DCCG147-0000). To support optical connections on AIX servers, a PCI adapter with the native optical interface must be used. If necessary, existing adapters must be replaced.

7.4.3. Packaging

The MIA is plugged directly on copper / DB9 connectors on hub's ports or on DAS host interface ports.

7.4.4. Technical specifications

Bit Rate

1.0625 Gigabit/Second, 8B/10B encoded

Data Rate

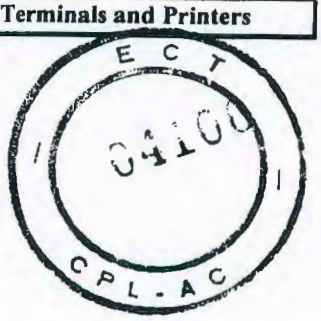
100 MByte/Second each direction

Standards Support

Fibre Channel

Physical Specifications

(H) 0.63 in./ 16 mm, (W) 1.4 in. / 36 mm, (D) 2.7 in. / 68.6 mm



Environmental Specifications

Operating temperature: +0 deg. C to +70 deg. C
Storage temperature: -40 deg. C to +85 deg. C

Optical interface

SC Duplex Optical Interface
50 µm multimode optical fibers
62.5 µm multimode optical fibers

Electrical Interface

DB-9
75 ohm Input / Output
Single +5V Power Supply

Safety

Class 1 Laser Safety Compliance IEC825-1
FDA radiation performance standards 21 CFR, chapter 1 subchapter J
UL 1950 Approved
FCC Part 15 class B

Chapter 4: Memory Expansion Cards

1. EPC400 Memory

The Escala EPC400 Model system memory is organized in memory banks made up of four memory DIMMs.

The four memory connectors on the System Planar can house:

- Either one memory bank
- Or four memory risers hosting up to six memory banks.

Each memory riser hosts six memory DIMM connectors.

A memory bank hosted on memory risers is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs)

The maximum memory bank is 512 MB.
The maximum memory configuration is 3 GB.

The Escala EPC400 Model supports the following memory DIMMs:

- DIMM Standard 72 bit 168 pin with EDAC
- VCC 3.3V
- Time of Access 60 ns
- Functionality Extended Data Output (EDO)
- Height 1.25 inch max
- Package Type TSOPII
- Application ECC
- Memory Data Bus peak throughput: 2.8 GB/s

A memory bank can be made up of DIMMs having capacity of 16/32/64/128 MB.

Table of the memory bank capacity

Technology	DIMM Size (MB)	Memory Bank Capacity
16 Mbits	16 MB	64 MB
16 Mbits	32 MB	128 MB
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB

2. EPC430 Memory

The Escala EPC430 system memory is organized in memory banks made up of four memory DIMMs. Memory banks are hosted on four memory riser cards connected to the planar board.

Each memory riser card has eight memory DIMM connectors.

A memory bank hosted on four memory riser cards is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs).

The maximum size of a memory bank is 1 GB.
The maximum memory configuration is 8 GB.

The Escala EPC430 supports the following memory DIMMs:

- SDRAM DIMM, 72 bit, 168 pin
- VCC 3.3V
- Access Time 10 ns (100MHz, CAS latency 2 mode)
- Height 1.65 inch
- Application ECC
- LVTTL electrical interface
- Memory Data Bus peak throughput: 5.6 GB/s
- PC100 Intel specifications compliant.

A memory bank can be made up of DIMMs having capacity of 64/128/256 MB.

Table of the memory bank capacity

Technology	DIMM Size	Memory Bank Capacity
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB
128 Mbits	256 MB	1 GB

3. EPC440 Memory

The Escala EPC440 Model system memory is organized in 2 memory cards. Each memory card can house 8 pairs of synchronous DRAM (SDRAM) DIMMs of the same capacity.

The following DIMMs are available:

- 128 MB (64 Mbits technology)
- 256 MB (128 Mbits technology).

The minimum memory capacity is 256 MB.
The maximum memory capacity is 8 GB (2 memory cards + 32x256 MB DIMMs).

The Escala EPC440 Model supports the following memory DIMMs:

- DIMM Standard 72 bit 200 pin JDEC
- 10ns clock size
- 64 data bits + 8 ECC bits
- Single bit correct, double bit detect, single packet detect ECC

4. EPC450 Memory

The Escala EPC450 system memory is organized in memory banks made up of four memory DIMMs. Memory banks are hosted on four memory riser cards connected to the planar board.

Each memory riser card has eight memory DIMM connectors.

A memory bank hosted on four memory riser cards is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs).

The maximum size of a memory bank is 1 GB.
The maximum memory configuration is 8 GB.

The Escala EPC450 supports the following memory DIMMs:

- SDRAM DIMM, 72 bit, 168 pin
- VCC 3.3V
- Access Time 10 ns (100MHz, CAS latency 2 mode)
- Height 1.65 inch
- Application ECC
- LVTTL electrical interface
- Memory Data Bus peak throughput: 5.6 GB/s
- PC100 Intel specifications compliant.

A memory bank can be made up of DIMMs having capacity of 64/128/256 MB.

Table of the memory bank capacity

Technology	DIMM Size	Memory Bank Capacity
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB
128 Mbits	256 MB	1 GB

5. EPC800 Memory

5.1. For 604e models - "up to 4 GB"

Four memory slots are available on this series; it is possible, at the initial order or on site to increase the memory capacity up to 4096MB by adding memory motherboard (up to 4 boards) and SIMMs.

The SIMMs are mounted on a memory motherboard "up to 1GB".

5.1.1. Memory Motherboard "up to 1 GB"

The motherboard "up to 1GB" allows to install up to four sets of 4 SIMMs (4 x 16/32/64MB) on four banks; all SIMMs in a bank must be of the same type.

5.1.2. Memory Modules

5.1.2.1. 64 MB MM64 Module

The 64MB MM64 Module provides a set of four 16MB SIMMs.

- 60-ns 16 mega-bit/chip
- 5.0-volt

5.1.2.2. 128 MB MM128 Module

The 128MB MM128 Module provides a set of four 32MB SIMMs.

- 60-ns 16 mega-bit/chip
- 5.0-volt

5.1.2.3. 256 MB MM256 Module

The 256MB MM256 Module provides a set of four 64MB SIMMs.

- 60-ns 16 mega-bit/chip
- 5.0-volt

6. EPC1200 and EPC1200A Memory

The system memory of the Escala EPC1200 and Escala EPC1200A is organized in quads. Four memory boards are addressed at the same time. Each board in a quad must be of the same size. The system can contain up to five quads (20 memory boards – time of access 10ns). For outstanding reliability, these boards use ECC SDRAM memory.

The following types of quad-memory boards are available:

- 512 MB (4x128 MB)
- 1 GB (4x256 MB)
- 2 GB (4x512MB)
- 4 GB (4x1024MB)
- 8 GB (4x2048MB).

The base EPC1200 comes with 512MB (4x128 MB) of memory, while the base EPC1200A comes with 1GB (4x256 MB) of memory. For both models, the maximum configuration is 32 GB of memory (the system could house physically up to 40 GB of memory, but it is limited to 32 GB).

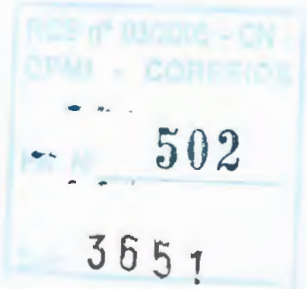
System memory is accessed through two distinct ports. For optimal performance, memory should be installed balanced between the two memory ports. For example, better performance is achieved if the system uses two 1GB boards balanced between the two ports than if it uses a single 2GB board.

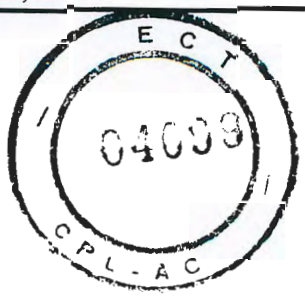
7. EPC2400 Memory

The system memory of the Escala EPC2400 is organized in quads. Four memory boards are addressed at the same time. Each board in a quad must be of the same size. The system can contain up to four quads (16 memory boards). For outstanding reliability, these boards use ECC SDRAM memory.

The following types of quad-memory boards are available:

- 2 GB (4x512 MB)
- 4 GB (4x1024 MB)
- 8 GB (4x2048 MB)
- 16 GB (4x4096 MB).

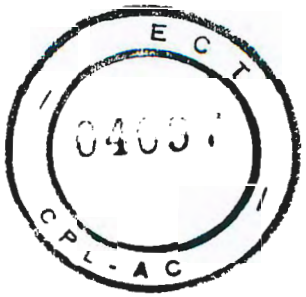




The base EPC2400 comes with 2 GB (4x512 MB) of memory. The maximum configuration is 64 GB of memory.

The memory is accessed as four related but distinct ports. Balanced accesses use all four ports in a coordinated parallel manner and can obtain up to four times the data in the same amount of time. Unbalanced configurations will function properly, but the unbalanced portion of the memory will not make use of the full memory bus bandwidth.

Example: A system with 8 GB of memory should perform better if two 4 GB features are installed than one 8 GB feature is installed, while installing four 2 GB features may provide additional performance for some applications.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Chapter 5: Interconnections, Communications Adapters and Modems

1. Communication Technologies and Networks

Communications technologies are classified in three groups available on Escala EPC:

- LAN: Ethernet Thick/Thin/Twisted pair, Ethernet 100Mbps, (fast Ethernet), Gigabit Ethernet, FDDI Fibre single ring, FDDI Fibre Dual Ring, FDDI UTP, Token Ring, ATM
- WAN: 1- or 4- port multi-protocol serial I/, 1 or 4 port HiSpeed WAN, 4 port multiprotocol, ISDN
- Asynchronous Network: 8/16/64/128 port async EIA-232, 8/16/64/128 port async EIA-422)

Based on these technologies, different communications are necessary to build a cluster:

- back-end communication networks or interconnects
- a front-end communication network (TCP-IP based)
- a serial network or heart beat link
- an administration network (dedicated to administration or linked with enterprise network)
- other front-end network (per ex : X25 based) (See WAN controllers and Multiport controllers)

1.1. Front-end Communication Network (TCP-IP based)

The front-end communication is often the enterprise network to which the nodes of the clustered server are connected. This network is based on TCP-IP communication protocol and LAN technologies. For HA purposes, the network availability features need at least 2 network accesses per node, which means 2 adapters per nodes connected to 2 different networks.
The front-end communication network is also named External LAN and is configured node per node, when required. Controllers are generated. Cabling is optional when available.
Ethernet, Fast Ethernet, Gigabit Ethernet, Token-ring, FDDI (Single ring or dual ring), and ATM are supported (Gigabit Ethernet is available on PCI bus based servers only)
For more information, see the section describing each controller.

1.2. Serial Network or Heart Beat Link

The serial network is used by the HACMP subsystem to exchange cluster state (heart beat) protocol information (exchange keep-alive and event information). The nodes are linked together by serial lines. Each node is connected by a serial line to one (for 2-node configurations) or two nodes in order to build a ring figure.

1.3. Administration Network

The Administration Network is used for general-purpose and faster administration; a separate Ethernet-based network linking all the EPC components can be used. This network is constructed by a dedicated hub linking all the nodes, the console concentrator, if any, and either the PowerConsole or the cluster console. Establishing a separate network for administration operations brings security but requires a dedicated Ethernet adapter on every node.
For resource optimization purpose, this network may be the front-end network or the basic interconnect used for only HA configurations or server consolidation.
This administration network is generated with the PowerConsole whatever the number of nodes. The Ethernet controller integrated in each node is used to build the network. If this Ethernet controller is already used for the front-end network, it is possible to connect the hub to the front-end network for resource optimization or to add an Ethernet controller in each node to build a private and dedicated network.

1.4. Back-end Communication Networks or Interconnects

Interconnect communication network is also named back-end network or private network.
An interconnect is a complete network dedicated to internode communications by applications. The interconnect links a group of nodes inside the cluster. This network is dedicated and private to the cluster.
It is possible to have multiple interconnects for different purpose linking different groups of nodes

An interconnect can be used as a high-performance network for exchanging information related to CMP mode operation (concurrent access). An interconnect can also be used to handle data exchanges in Client/Server or three-tier architectures. The interconnect protocol supported is TCP-IP. A number of implementations, based on different technologies (Ethernet, Fast Ethernet, Gigabit Ethernet, FDDI), different levels of redundancy (simple or double connections), and optional network devices (hubs, switches), are possible. The following interconnect kits are available:

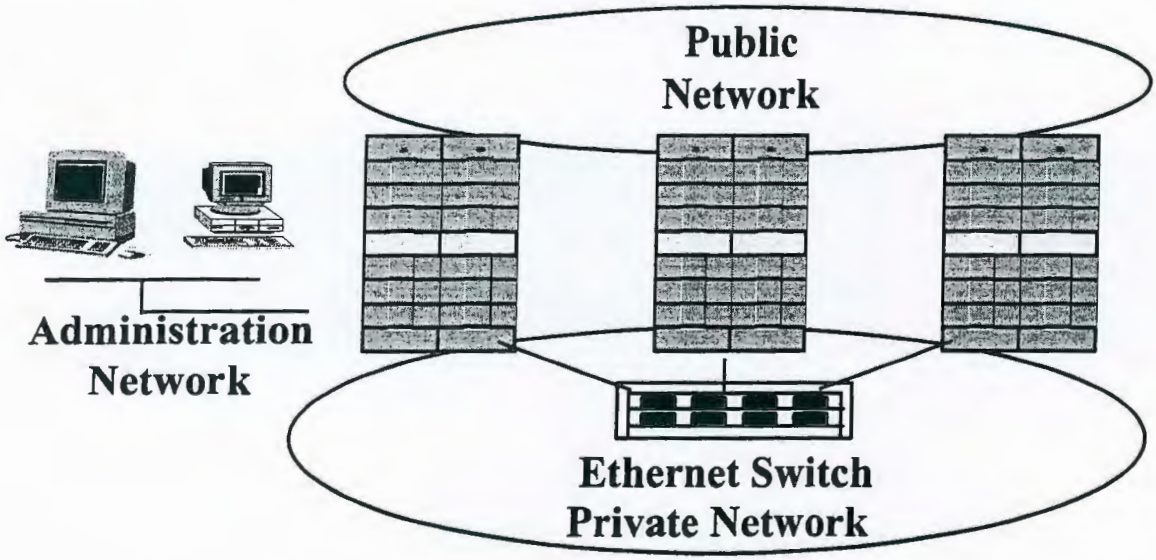
- Ethernet 100Mbps single connection (with 1 hubs for more than 2 nodes interconnects)
- Gigabit Ethernet single connection (with 1 switch for more than 2 nodes interconnects)
- FDDI dual ring 100Mbits/N (with 2 hubs for more than 2 nodes interconnects)

(Note: When needed, double connection interconnects can be implemented by using two interconnect kits for single connection.)

It is possible to have no interconnect, for example in a consolidation server configuration.

1.4.1. Ethernet 100 Mbps Interconnects

For two interconnected nodes: 2 Ethernet 100 Mbps controllers one for each node and 1 RJ45/RJ45 cross cable to link both adapters and build a private Ethernet network are necessary.
Beyond 2 interconnected nodes, it is necessary to have a Ethernet 100Mbps single switch kit based on 3COM Supertack II switch 3000 and 3300 models (the 3300 model is the successor of the 3000 model). An Ethernet interconnect base kit is needed for each interconnected node. This kit contains one Ethernet 100Mbps controller and one RJ45/RJ45 cable to be connected to the switch.



This is a basic interconnect implementation without redundancy for Client/Server communication.

1.4.2. Interconnect Fast Ethernet Switch

The Fast Ethernet switch comes from 3COM: SuperStack II Switch 3000 and 3300 models (the 3300 model is the successor of the 3000 model).

The SuperStack II Switch 3x00 12 port supports Ethernet and Fast Ethernet Switching in one stackable switch. It supports both full & half duplex on all ports which is able to provide 200 Mbps of bandwidth to each connected device, with auto-negotiation providing smooth migration from Ethernet to Fast Ethernet. There are 12 Copper Fast Ethernet Ports: autosensing 10BASE-T/100BASE-TX interfaces (RJ-45 connector). The SuperStack II Switch 3x00 switch also offers an optional high-speed slot for an additional Fast Ethernet port (RJ-45 copper or SC fiber) support. It provides full duplex Fast Ethernet and 2 km distance on fiber. Local management can be performed via an RS-232 (DB-9 port) line. The SuperStack II Switch 3x00 switch supports up to 8,160 MAC addresses for the largest, high-performance networks.

1.4.3. Gigabit Ethernet Interconnects

For two interconnected nodes: 2 Gigabit Ethernet adapters one for each node and 1 SC-SC optical fiber cable to link both adapters and build a private Gigabit Ethernet network are necessary.

Beyond 2 interconnected nodes, it is necessary to have a Gigabit Ethernet switch based on the 3COM SuperStack II 9300 model. A Gigabit Ethernet interconnect base kit is needed for each interconnected node. This kit contains one Gigabit Ethernet adapter and one SC-SC optical fiber cable to be connected to the switch.

1.4.4. Interconnect Gigabit Ethernet Switch

The Gigabit Ethernet switch comes from 3COM: SuperStack II Switch 9300 model.

This switch provides 12 Gigabit Ethernet ports. It delivers full line rate, non-blocking switching among all ports. It supports full-duplex mode on all ports and up to 16,000 MAC addresses.

1.4.5. FDDI Interconnects

FDDI-based Interconnect Architectures

- Dual Ring FDDI without Hub for 2 nodes

Dual Ring allow to build a redundant network interconnect to a cluster of 2 nodes. It is targeted to Client/Server applications.

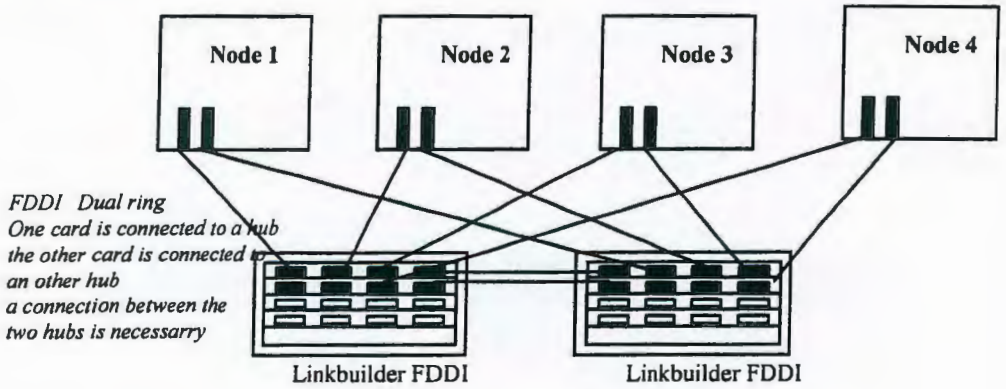
- FDDI with two Hubs in Dual homing configuration

Beyond 2 nodes to insure ring integrity, it is necessary to add hubs that can re-routed messages when a failure occurs. Hub high availability feature will be given by a Dual homing configuration based on two hubs.
The hub FDDI is the Linkbuilder FDDI of 3COM with Module type « 4 port fibre ». The dual homing configuration gives the ability to interconnect up to 14 nodes.

The FDDI Hub Kit contains:

- 2 Linkbuilder FDDI (each based on 4 slot chassis)
- 2 FDDI Fibre MIC-MIC cable (6m) to interconnect the two hubs and build the two rings between the hubs.
- 2 Management modules, one per Linkbuilder, in one slot of each Linkbuilder
- 4 « Fibre 4-ports » modules, 2 per Linkbuilder. One module takes one slot in the Linkbuilder.

The FDDI Hub kit allows to interconnect up to 6 nodes of an Escala EPC configuration.
An FDDI Hub Extension kit allows to interconnect a 7th and a 8th node. This extension kit contains 2 « Fibre 4-ports » modules, 1 per Linkbuilder.
A FDDI Interconnect base kit is necessary for each node to be interconnected. The kit contains a FDDI Dual Ring Adapter and two FDDI Fibre MIC-MIC Cable (6m). One cable will be connected to one of the Linkbuilder, the other to the other Linkbuilder as displayed in the following figure.



Dual Homing configuration

2. Modems

An ISA modem adapter and an external modem are available.

2.1. ISA Modem Adapter

The ISA modem adapter provides support for a modem line to an Escala EPC400, EPC430, EPC450 or a PowerConsole (Escala S100). It is used for RSF (Remote Services Facilities) usage to allow communications with a Customer Service Center for maintenance purpose: it allows asynchronous communications in a reliable way via a connection to the PSTN (Public Switched Telephone Network).

This adapter features:

- automatic adaptation to the line conditions and capacities of the remote modem
- support for data transmission rate up to 33.6 kbps
- full or half-duplex mode on the switched telephone network
- automatic or manual dialing
- automatic or manual answer

Hardware:

- 1 RJ11 connector
- ISA bus
- Form factor: short length card

Cables:

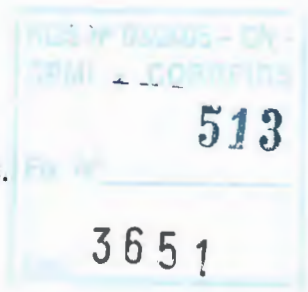
The base board provides a RJ11 connector and a RJ11 cable is delivered with it according to the country.
For the United States, there is a specific and additional connector to connect directly the Phone on the [illegible]1.

Attachment:

The controller fits into a single ISA slot.

Operating System Requirement:

- AIX 4.2.1, or later



2.2. External Modem

An external modem is available for EPC440, EPC1200, EPC1200A and EPC2400 servers.

The modem is intended to be dedicated to RSF (Remote Services Facilities) operation. RSF is a Bull software that performs system error monitoring and handles communications for remote maintenance operations. The modem, together with RSF, provides a link, via a phone line, between the system at the customer site and a Bull Customer Service.

The external modem has the following features:

- automatic adaptation to the line condition and capacities of the remote modem for the following standards: V34, AT&T V32terbo, V32bis, V32, Bell 212A and 103/113, V22, V22bis, V29, V42, V42bis.
- support for data transmission rate up to 33.6 kbps
- full or half-duplex mode on the switched telephone network
- automatic or manual dialing, automatic or manual answer

The modem is available for the following countries: France, UK, Germany, Italy, Belgium, Netherland, US.

Hardware:

- Modem box with a RS232 DB25 connector, a power connector and two RJ11 connectors for the phone line and the phone set.
- Modular power supply with jack (cable length 1.8m), specific voltage input and plug depending on the country choice.

Cables and adapters:

- RS232 cable, DB25M/DB9F, 1.7 meter
- RJ11/RJ11 cable, specific wall socket adapter depending on the country choice.

Note: a specific kit (rack cables set) is needed for connection to RL470/RL470A or EPC1200/EPC1200A systems.

Operating System Requirement:

- AIX 4.3 or later.

3. Multiport Controllers

3.1. Multiport Controllers on EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

3.1.1. 8-Port Async Controller EIA-232 (EPC400, EPC430 and EPC450)

The 8-port Async Controller provides support for attaching a maximum of eight EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC400, EPC430 or EPC450 system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with EIA-232D requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- Form factor : short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect)

Cables:

The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2., or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.2. 8-Port Async Controller RS-422A (EPC400, EPC430 and EPC450)

The 8-port Async Controller provides support for attaching a maximum of eight RS-422A asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC400, EPC430 or EPC450 system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with RS_422A requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- Form factor: short length card

Cables:

The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment.

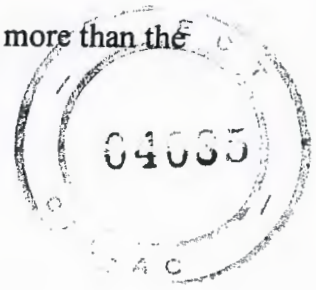
Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2., or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8



Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.3. 8-Port Async Controller EIA-232 and RS-422 (EPC440, EPC1200, EPC1200A and EPC2400)

The 8-port Async Controller provides support for attaching a maximum of eight EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with EIA-232D and RS-422A requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200 and 230000 bps, and 5, 6, 7, 8 bits per character
- Form factor : short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect)

Cables:

The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment. Two modem cables are available (EIA-232 and RS-422) 3 meters long. One terminal/printer cable (EIA-232) 20 meters long.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.3, or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.4. 64 Port Async Controller EIA-232/RS-422A (EPC400, EPC430 and EPC450)

The 64 port Async Controller provides support for attaching a maximum of 64 EIA-232 or RS-422A asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC400, EPC430 or EPC450 system unit.
The Controller is delivered with a 3 meters EBI (External Bus Interface) cable and has an EBI out connector, that allows up to four 16 ports connector boxes to be daisy chained. The maximum distance between the adapter and a connector box is 6 meters. EIA-232 and RS-422A connector boxes can be mixed on the same daisy link. The first 2 connector boxes are power supplied by the 64 port adapter; the third requires an external power supply for the two last ones.
This configuration provides support for up to 64 EIA-232 or RS-422A devices per PCI slot

Hardware:

- Up to 64 asynchronous ports
- PCI bus
- 20 MHz IDT3051 RISC processor
- 1 Mbyte of dual port DRAM

- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps[1]
- Form factor: short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect) on all EIA-232 lines

Cables:

The base board provides an EBI connector and a 3-meter EBI cable comes standard with the controller.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2., or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

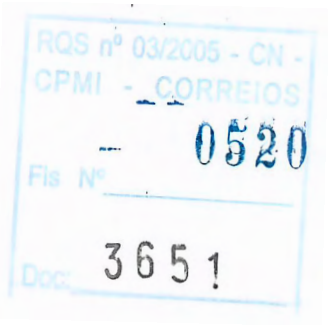
Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.5. 16 Port Connector Box EIA-232 for 64 ports Async Controller (EPC400, EPC430 and EPC450)

The 16 port Connector Box is a subsystem with four 16C554-compatible UARTS which support sixteen RJ45 EIA-232 serial ports. It is connected to the 64 Port Async Controller with an EBI (External Bus Interface) cable. When used as third connector box linked to the same 64 Port Async Controller, it requires an additional power supply to power the third and the fourth ones.

[1] For the moment, the Software limits the troughput to 38.4 Kbps


RQS nº 03/2005 - CN -
CPMI - CORREIOS
0520
Fls Nº
3651
Doc

The connector box features the following:

- 16 async ports, each with a data interchange rate of up to 115,2 kbps
- EIA-232D compatibility
- full set of modem control signals (including Ring Indicator and Carrier Detect)
- surge suppression circuitry

A 0,4-meter EBI cable comes together with the connector box. This cable can be used to link another connector box which can be either another EIA-232 or an RS-422A connector box.

Conformance to standard

This connector box meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.6. 16 Port Connector Box RS-422A for 64 ports Async Controller (EPC400, EPC430 and EPC450)

The 16 port Connector Box is a subsystem with four 16C554-compatible UARTS which support sixteen DB25 RS-422A serial ports. It is connected to the 64 Port Async Controller with an EBI (External Bus Interface) cable. When used as third connector box linked to the same 64 Port Async Controller, it requires an additional power supply to power the third and the fourth ones.

The connector box features the following:

- 16 async ports, each with a data interchange rate of up to 115,2 kbps
- RS-422A compatibility
- surge suppression circuitry

A 0,4-meter EBI cable comes together with the connector box. This cable can be used to link another connector box which can be either another EIA-232 or an RS-422A connector box.

Conformance to standard

This connector box meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.7. Auxiliary power supply for 16 port connector box for 64 port Async controller (EPC400)

An auxiliary international power supply is required on the 3rd connector box, if more than 2 connector boxes (EIA-232 or RS-422A) are connected to a 64-port Async controller.
The power supply is delivered with an additional plug adapter necessary for the 16-port EIA-232 concentrator. It uses a 5 pin DIN plug connector on a 6-foot cable.

3.1.8. 128-Port Async Controller EIA-232 (EPC400, EPC430, EPC440, EPC450 and EPC2400)

The 128-port Async Controller provides support for attaching a maximum of 128 EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC system unit.

The Controller features two V11 synchronous channels that can link up to four Cluster Boxes (RANs) each via a "daisy chain". Each of those lines must be terminated by a terminator plug (delivered with the adapter).
This configuration provides support for up to 128 EIA-232 devices per PCI slot.

The ability to use synchronous attachments to any Remote Async Node provides even greater flexibility in system configuration, allowing customers to use synchronous modems for long-distance connectivity.
It is possible to use either V11/RS422 or V24/RS232 synchronous modems.
However, it is not possible to interpose more than one pair of such synchronous modems within this "daisy chain" of RANs.

Hardware:

- PCI bus
- 20 MHz IDT3041 RISC processor

- 1 Megabytes of tri-port DRAM
- Maximum EIA-232 distance supported is 62 meters (200 feet).
- Full modem support on all the lines, including Ring Indicator and Data Carrier Detect.
- dual high speed V11 channels : up to 3,7 Mbps per channel
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- surge suppression circuitry
- Form factor : short length card

Cables:

DB15-DB15 cables are required for the connection of the cluster boxes. Three lengths are available: 20-meter, 4,6-meter (direct connection or modem connection), 15-meter.

Attachment:

The controller fits into a single PCI adapter slot.

Operating System Requirement:

- AIX 4.2 or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8f
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.9. 16 Port Cluster Box (RAN) for 128 port-adapter (EPC400, EPC430, EPC440, EPC450 and EPC2400)

The Cluster Box, also called Remote Async Node, is an intelligent interface device for use with the 128 Ports Async Controller.
It is connected to the 128 Ports Async Controller through a synchronous link.

The Cluster Box features the following:

- 16 async ports (RJ45 connectors), each with a data interchange rate of up to 115,2 Kbps
- support for cable lengths of up to 61m (200 ft) (provided the cable does not exceed a load capacitance of 2500pf).
- EIA-232D compatibility
- full set of modem control signals
- external power supply
- Machine-readable Vital Product Data (VPD)
- Character processing capability

The cluster-box requires a power supply that is delivered with it together with the power cord. It also requires a terminator plug when used as the last element of a daisy-chain; this plug is delivered with it.

This cluster box meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

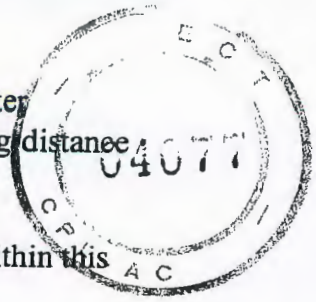
Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.10. 128-Port Async Controller EIA-232 / RS422 (EPC1200, EPC1200A)

The 128-port Async Controller provides support for attaching a maximum of 128 EIA-232 or RS422 asynchronous serial devices (such as modems, terminals, and printers) to an Escala system unit.

The Controller features two V11 synchronous channels that can link up to four Cluster Boxes (RANs) each via a "daisy chain". Each of those lines must be terminated by a terminator plug (delivered with the adapter).
This configuration provides support for up to 128 EIA-232 or RS422 devices per PCI slot.



The ability to use synchronous attachments to any Remote Async Node provides even greater flexibility in system configuration, allowing customers to use synchronous modems for long distanee connectivity.
It is possible to use either V11/RS422 or V24/RS232 synchronous modems.
However, it is not possible to interpose more than one pair of such synchronous modems within this "daisy chain" of RANs.

Hardware:

- PCI bus
- 20 MHz IDT3041 RISC processor
- 1 Megabyte of tri-port DRAM
- Maximum RAN distance supported is 300 meters (1000 feet).
- dual high speed V11 channels : up to 3,7 Mbps per channel
- surge suppression circuitry
- Form factor: short length card

Cables:

DB15-DB15 cables are required for the connection of the cluster boxes. Three lengths are available: 0,20-meter, 4,6-meter (direct connection or modem connection), 15-meter.

Attachment:

The controller fits into a single PCI adapter slot.

Operating System Requirement:

- AIX 4.3 or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standards

This board meets the following electromagnetic emissions and safety standards:

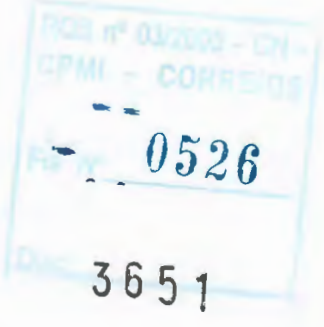
Emissions:

- FCC Part 15, class B
- DOC CSA C108.8f
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950

- IEC 950 Safety (TUV) EN (60950)



3.1.11. 16 Port Cluster Box (RAN) for 128 port-adapter

The Cluster Box, also called Remote Async Node, is an intelligent interface device for use with the 128 Ports Async Controller.
It is connected to the 128 Ports Async Controller through a synchronous link (max. distance: 300m/1000feet).

There are two types of box style Remote Async Nodes: EIA-232 and RS-422

The Cluster Box features the following:

- 16 async ports (RJ45 10 positions connectors)
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400 and 57600 bps, and 5, 6, 7, 8 bits per character
- support for cable lengths of up to 61m (200 ft) (provided the cable does not exceed a load capacitance of 2500pf).
- EIA-232D or RS-422A compatibility
- full set of modem control signals
- external power supply 100-250Vac at 50 or 60 Hz
- Machine-readable Vital Product Data (VPD)
- Character processing capability

The cluster-box requires a power supply that is delivered with it together with the power cord. It also requires a terminator plug when used as the last element of a daisy-chain; this plug is delivered with it.

This cluster box meets the following electromagnetic emissions and safety standards:

Emissions:

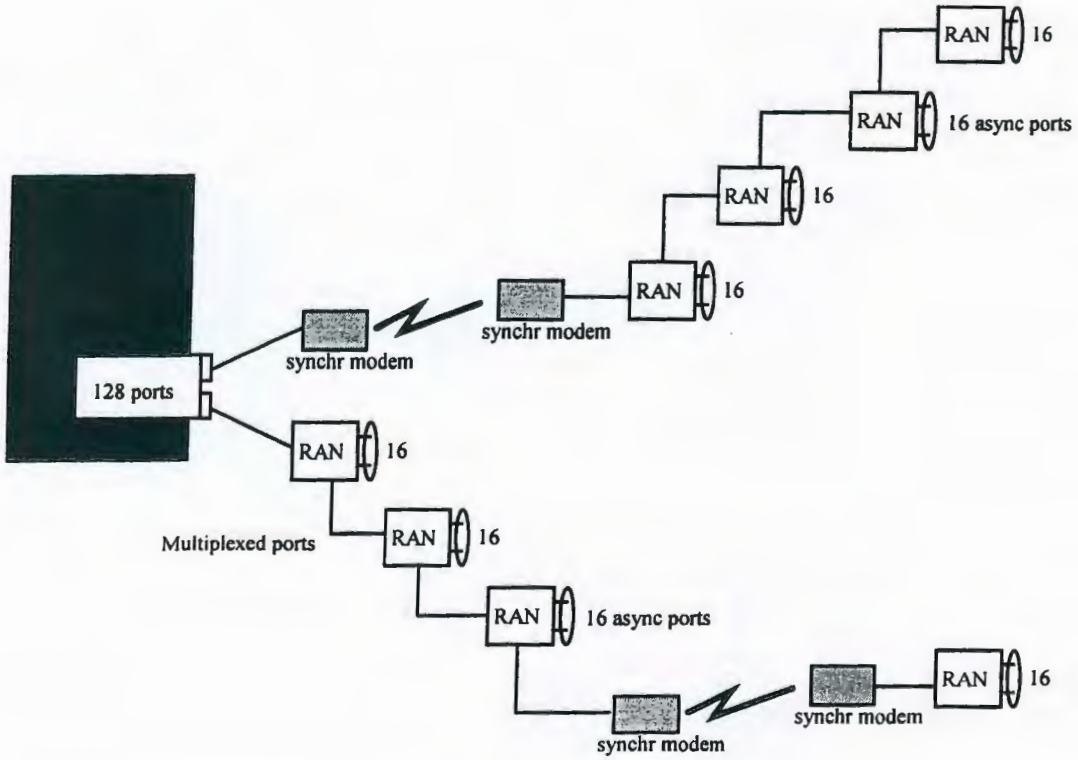
- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.12. Multiport Controllers Usage Summary Table

	Printers, Terminals	Async Modems	Sync Modems
8 Port EIA-232 Controller	X	X	
8 Port RS-422A Controller	X		
64 Port EIA-232/RS-422A Controller			X (to Cluster Box)
16 Port Connector Box EIA-232 for 64 Port EIA-232/RS-422A Controller	X	X	
16 Port Connector Box RS-422A for 64 Port EIA-232/RS-422A Controller	X		
128 Port EIA-232 Controller			X (to Cluster Box)
16 Port Cluster Box (RAN) for 128 Port EIA-232 Controller	X	X	X (to other Cluster Box or to 128 port adapter)



3.2. Multiport Controllers on EPC800

3.2.1. 8-Port Async Enhanced Controller-EIA-232

The 8-port Async Enhanced Controller-EIA-232 provides support for attaching a maximum of eight EIA-232D asynchronous serial devices (such as modems, terminals, and printers) to the system unit.

Hardware

- Eight asynchronous ports, each with a data interchange rate of up to 38.4K bps,
- Full set of modem control lines,
- 12.5MHz 80C186 processor,
- 256KB memory,
- 32 KB memory window,
- 8530 serial communication controller,
- Compatibility with EIA-232D requirements,
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, and 38400 bps.

Cables

The base board provides a 78-pin female D-shell connector. An 8-port DB25 Connector Box comes standard with the controller and provides the eight connectors for device attachment. It supports cable lengths of up to 61 m (200 ft.), provided the cable does not exceed a load capacitance of 2500 pico-farads.

Attachment

The controller fits into a single Micro Channel adapter slot.

3.2.2. 8-Port Async Enhanced Controller-EIA-422A

The 8-port Async Enhanced Controller-EIA-422A provides support for attaching a maximum of eight EIA-422A asynchronous serial devices such as modems, terminals, and printers to the system unit.

Hardware

- Eight asynchronous ports, each with a data interchange rate of up to 38.4K bps
- 12.5MHz 80C186 processor
- 256KB memory
- 32 KB memory window
- 8530 serial communication controller
- Compatibility with the EIA-422A requirements

- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, and 38400 bps.

Cables

The base board provides a 78-pin female D-shell connector. An 8-port DB25 Connector Box comes standard with the controller and provides the eight connectors for device attachment. It supports cable lengths up to 1220m (4000 ft).

Attachment

The controller fits into a single Micro Channel adapter slot.

3.2.3. 16-Port Async Controller-EIA-232

The 16-Port Async Controller-EIA-232 provides support for attaching a maximum of 16-EIA-232D asynchronous serial devices such as terminals and printers to the system unit.

Hardware

16 asynchronous ports, each with data interchange rate of up to 38.4K bps
16-byte buffering on transmit and receive operations
Compatibility with EIA-232D requirements
Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, and 38400 bps.
The controller supports the following signal lines: RxD, TxD, DTR, DCD, and RTS (RTS always high). It does not support modems.
- Wrap plug for 78-pin connector (supplied for testing).

Micro Channel considerations:
- ### I/O slave
- ### 16-bit data and address widths
- ### Support for data and address parity
- ### Type 3 adapter card size.

Cables

The base board provides a 78-pin female D-shell connector. A 16-port DB25 Connector Box comes standard with the controller and provides the sixteen connectors for device attachment. It supports cable lengths of up to 61 m (200 ft.), provided the cable does not exceed a load capacitance of 2500 pico-farads.

Attachment

The controller fits into a single Micro Channel adapter slot.

3.2.4. 16-Port Async Controller-EIA-422A

The 16-Port Async Controller-EIA-422A provides support for attaching a maximum of 16 EIA-422A asynchronous serial devices such as terminals and printers to the system unit.

Hardware

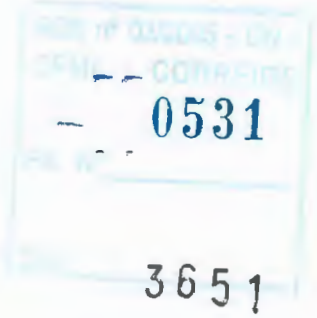
16 asynchronous ports, each with a data interchange rate of up to 38.4K bps
Built-in surge protection circuitry on the controller
16-byte buffering on transmit and receive operations
Compatibility with the EIA-422A requirements
Wrap plug for 78-pin connector (supplied for testing).
Micro Channel considerations:
- ### I/O slave
- ### 16-bit data and address widths
- ### Support for data and address parity
- ### Type 3 adapter card size.

Cables

The base board provides a 78-pin female D-shell connector. A 16-port DB25 Connector Box comes standard with the controller and provides the sixteen connectors for device attachment. It supports cable lengths up to 1220m (4000 ft).

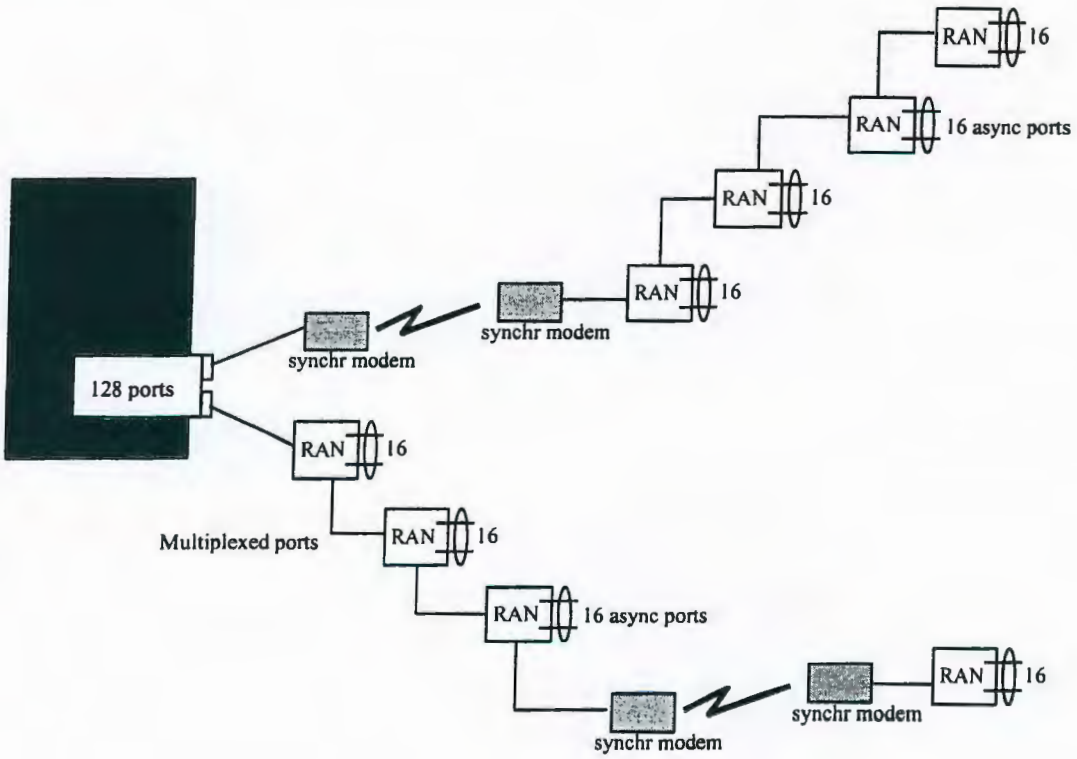
Attachment

The controller fits into a single Micro Channel adapter slot.



3.2.5. Multiport Controllers Usage Summary Table

	Printers, Terminals	Async Modems	Sync Modems
8 Port EIA232	X	X	
8 Port EIA422A	X		
16 Port EIA232	X		
16 Port EIA422A	X		
128 Port EIA232			X (to Cluster Box)
16 Port Cluster Box (linked to 128 the Port board)	X	X	X (to other Cluster Box or to 128 port adapter)



4. WAN Controllers

4.1. WAN Controllers for EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

4.1.1. 4Ports Multi-protocol Serial I/O Adapter (EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400)

The 4Ports Multi-protocol Serial I/O Adapter is a high end SDLC and X.25 adapter which provides a very powerful SDLC and X.25 offer at a moderate pricing.

The 4Ports Multi-protocol Serial I/O Adapter consists of a card that supports 4 ports with either V.24 or V.35 or V.11/X.21 physical interface. Each port can run either SDLC or X.25 and its physical interface type is software selectable

The 4Ports Multi-protocol Serial I/O Adapter is fully integrated in the Bull communication offer:

TCP/IP, XTI, XX25 and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits per port according to stacks capabilities.

SNA/20 applications can run and have access to SDLC network through this adapter (EPC400, EPC430, EPC440 and EPC450 only).

The adapter can support up to 2500 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware:

- ### PCI long card, 1 slot used
- ### NET2 conformance
- ### 2 Mbps per port (4 x 2Mbps Max)
- ### Maximum line speed :
  - ### V24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 2 Mbps
- 4 x HDLC communication controllers (4 x ZILOG IUSC) available on the card:
  Each one is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21. This adapter allows to have either 4 times the same interface or different types of interfaces on the same board. The **4Ports Multi-protocol Serial I/O Adapter** provides an efficient way to have independent ports and allows a high availability of the board in case of troubles. Furthermore, flexibility is insured in case of evolution of one of the interfaces.

Cables:

The board provides a 100 points female connector. A 2m cable attaches the 100-point connector to a distribution box. The distribution box has four 25-point connectors that could be connected to appropriate cables providing different types of interfaces. The cables are listed hereafter:

V.24 cable: up to 28.8 Kbps (10m)
V.35 cable: up to 64 Kbps (10m)
V.11/X.21 cables: up to 2 Mbps (10m)

Attachment:

The controller fit into a single long PCI adapter slot

SX25 Software:

PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to PSX25 Software description for more details.

Operating System Requirement

AIX 4.2.1, or later: TCP/IP, OSI, XTI, XX25, SNA/20 and HVX stacks

Limitation:

- the total number of 4ports and 1 port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the model, and in any case limited to 8.
- the 4ports Multi-protocol Serial I/O Adapter cannot be plugged in the first and the last PCI slot of an Escala EPC400, EPC430 and EPC450 model.

4.1.2. 1Port Multi-protocol Serial I/O Adapter (EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400)

The **1Port Multi-protocol Serial I/O Adapter** is an entry level SDLC and X.25 adapter which provides a powerful X.25 and SDLC offer at a very competitive pricing.

The **1Port Multi-protocol Serial I/O Adapter** consists of a card that supports either one V.24 or V.35 or V.11/X.21 physical interface. This physical interface type is software selectable.

The **1Port Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, XTI, XX25** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits according to stacks capabilities.

- **SNA/20** applications can run and have access to SDLC network through this adapter (EPC400, EPC430, EPC440 and EPC450 only).

###

The adapter can support up to 200 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware:

PCI short card, 1 slot used
NET2 conformance
Maximum line speed:

V24:	28.8 Kbps
V.35:	64 Kbps
V.11/X.21:	128 Kbps

1 HDLC communication controllers (ZILOG IUSC) available on the card:
It is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21.

Cables:

The board provides a 25 points female connector that could be connected to appropriate cables providing different types of interfaces. The cables are same as for 4Ports Multi-protocol Serial I/O Adapter and are listed hereafter:

V.24 cable: up to 28.8 Kbps (10m)
V.35 cable: up to 64 Kbps (10m)
V.11/X.21 cables: up to 128Kbps (10m)

Attachment:

The controller fits into a single short PCI adapter slot

PSX25 Software:

PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to PSX25 Software description for more details.

Operating System Requirement

AIX 4.2.1, or later: TCP/IP, OSI, XTI, XX25, SNA/20 and HVX stacks.

Limitation:

the total number of 4ports and 1port Multi-protocol Serial I/O Adapters cannot be more than the maximum supported by the model, and in any case limited to 8.

4.1.3. PSX25 Software (EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400)

PSX25 software is dedicated to the support of the 4ports and 1port Multi-protocol Serial I/O Adapters.

The X.25.2 and X.25.3 software, compliant with X.25-92 and ISO 8822, is running on the host.

The **PSX25** software running under AIX is made of the following components:

interfaces for the:
- AIX TCP/IP stack and enabling to run any TCP/IP application over X.25
- OSI X.25 stack and the OSI (MAX3) X.25 API
- XTI and XX25 APIs
- SNA/20 stack and enabling to run SNA/20 applications in QLLC/X.25 mode.
- HVX stack and enabling to run HVX applications over X.25 networks.

Configuration tools integrated with SMIT providing an easy configuration of the adapters.
A large set of utilities to administrate and monitor the adapters.

PSX25 software supports simultaneous accesses of the various communication stacks to the same or different physical links. It is provided under a base and additional extension MI's:
- access to a single X.25 line
- access from 2 to 4 X.24 lines
- access from 5 to 8 X.25 lines
- access from 9 to 32 X.25 lines

PSX25 product includes a local SNMP agent with a Management Information that contains statistics, operational and configuration tables. This includes:

- A subset of the Management Information Base defined by the Internet Standards RFC 1381 and RFC 1382. This is made to interoperate with market existing manager.
- A specific Management Information Base which goals the completeness of information and gives a full advantage of **PSX25** stack management.
- A browser that provides system operators with an easy-to-use interface to monitor and configure PSX25 lines through the SNMP agent. It is based on the AIX standard SMIT interface

Limitations:

The IBM X.25 API provided by IBM's X.25 Software cannot be used through the PSX25 product. The Bull X.25 APIs (MAX3 or XTI) has to be used.
does not support SNA Server

4.1.4. 2-Port Multiprotocol PCI Adapter (EPC1200, EPC1200A and EPC2400)

The **2-Port Multiprotocol PCI Adapter** allows connections between stand alone system on a Wide Area Network (WAN). To access WAN lines, the 2-port Multiprotocol PCI Adapter connects via external communications equipment including Channel Service Units, Data Service Units and Synchronous Modems.

The **2-Port Multiprotocol PCI Adapter** consists of a card that supports 2 ports with either V.24 or V.35 or V.11/X.21 physical interface. Each port can run either SDLC or X.25.

The **2-Port Multiprotocol PCI Adapter** offer:

TCP/IP, Communication Server applications run and have access to X.25 networks through this adapter.

Communication Server application run and have access to SDLC networks through this adapter.

Hardware:

- PCI short card, 1 slot used
- 2 Mbps full duplex per port (2 x 2Mbps Max)
- PCI bus compatible (32-bit slot)
- HDLC controller at 10 MHz (HITACHI 64570)
- 512 KB of DRAM
- Automatic configuration of interrupt request level setting and memory address
- 32-bit memory access
- Two 36-pin female VHSI ports connect to 36-pin high-density male connectors
- Support for V.24/EIA-232, V.35, and X21 with V.11(X.27) signaling
- External clocking

Cables:

Each port accepts a high-density 36-pin male cable connector. The types of connector used on the interface-specific end of cable are:

Interface	Connector
V.35	Type M
V.24	DB25
X.21	DB15

The 2-Port Multiprotocol PCI Adapter recognizes the cable and automatically prepares the port for that interface.

ttachment:

The controller fit into a single short PCI adapter slot

AIX Link X25 Software:

AIX Link X25 software is dedicated to the support X.25 on the **2-Port Multiprotocol PCI Adapter.**

Operating System Requirement

AIX 4.3, or later: TCP/IP, Communication Server stacks

4.1.5. AIXlink X.25 software (EPC1200, EPC1200A and EPC2400)

Under AIX, using the X.25 communication controller requires the AIX link X.25 software.

The software supports TCP/IP as well as IBM specific API and applications such as X.25 API and SNA Server. It includes an SNMP proxy agent and MIB support for X.25 and LAP-B statistics of the X.25 Communication Controller. It also includes an X.3, X.28 and X.29 PAD function for attachment of asynchronous terminal and devices.

This software applies only to the X.25 Communication Controller for EPC800 and to the 2-Port Multiprotocol PCI Adapter for EPC1200, EPC1200A and EPC2400.

4.2. WAN Controllers for EPC800

4.2.1. 4Ports Multi-protocol Serial I/O Adapter

The **4Ports Multi-protocol Serial I/O Adapter** is a high end SDLC and X.25 adapter which provides a very powerful SDLC and X.25 offer at a moderate pricing.

The **4Ports Multi-protocol Serial I/O Adapter** consists of a card that supports 4 ports with either V.24 or V.35 or V.11/X.21 physical interface. Each port can run either SDLC or X.25 and its physical interface type is software selectable

The **4Ports Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, SNA/20, HVX, XTI** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits per port according to stacks capabilities.

- **SNA/20** applications run and have access to SDLC networks through this adapter.

The adapter can support up to 2000 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware

- Type 3 adapter, 1 slot used
- NET2 conformance
- 2 Mbps per port (4 x 2Mbps Max)
- Maximum line speed :
  - V.24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 2 Mbps
- 4 x HDLC/SDLC communication controllers (4 x ZILOG IUSC) available on the card: Each one is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21. This adapter allows to have either 4 times the same interface or different types of interfaces on the same board. The **4Ports Multi-protocol Serial I/O Adapter** provides an efficient way to have independent ports and allows a high availability of the board in case of troubles. Furthermore, flexibility is insured in case of evolution of one of the interfaces.

Cables

The board provides a 100 points female connector. A 2m cable attaches the 100-point connector to a distribution box. The distribution box has four 25-point connectors that could be connected to appropriate cables providing different types of interfaces. The cables are listed hereafter:

- V.24 cable: up to 28.8 Kbps (10m)
- V.35 cable: up to 64 Kbps (10m)

- V.11/X.21 cables: up to 2 Mbps (10m)

Attachment

The controller fit into a single type 3 MCA adapter slot.

PSX25 Software

The PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to the PSX25 Software description for more details.

Operating System Requirement

- AIX 4.1.5 :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : none
- AIX 4.2.1, or later :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : SNA/20

Limitation

- the total number of 4ports and 1 port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the model with an extension cabinet, and in any case limited to 8.

4.2.2. 1Port Multi-protocol Serial I/O Adapter

The **1Port Multi-protocol Serial I/O Adapter** is an entry level SDLC and X.25 adapter which provides a powerful X.25 and SDLC offer at a very competitive pricing.

The **1Port Multi-protocol Serial I/O Adapter** consists of a card that supports either one V.24 or V.35 or V.11/X.21 physical interface. This physical interface type is software selectable.

The **1Port Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, SNA/20, HVX, XTI** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits according to stacks capabilities.
- **SNA/20** applications run and have access to SDLC networks through this adapter.

The adapter can support up to 200 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware

- Type 3 adapter, 1 slot used
- NET2 conformance
- Maximum line speed :
  - V.24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 128 Kbps
- 1 HDLC/SDLC communication controllers (ZILOG IUSC) available on the card:
  It is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21.

Cables

The board provides a 25 points female connector that could be connected to appropriate cables providing different types of interfaces. The cables are same as for 4Ports Multi-protocol Serial I/O Adapter and are listed hereafter:

- V.24 cable: up to 28.8 Kbps (10m)
- V.35 cable: up to 64 Kbps (10m)
- V.11/X.21 cables: up to 128Kbps (10m)

Attachment

The controller fit into a single type 3 MCA adapter slot.

PSX25 Software

The PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to the PSX25 Software description for more details.

Operating System Requirement

- AIX 4.1.5 :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : none
- AIX 4.2.1, or later :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : SNA/20

Limitation

- the total number of 4ports and 1port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the model and its extension cabinet, and in any case limited to 7.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4.2.3. PSX25 Software

The **PSX25** software is dedicated to the support of the 4ports and 1port Multi-protocol Serial I/O Adapters.

The X.25.2 and X.25.3 software, compliant with X.25-92 and ISO 8822, is running on the host.

The **PSX25** software running under AIX is made of the following components:

- interfaces for the :
  - AIX TCP/IP stack and enabling to run any TCP/IP application over X.25
  - OSI X.25 stack and the OSI (MAX3) X.25 API
  - SNA/20 stack and enabling to run SNA/20 applications in QLLC/X.25 mode.
  - HVX stack and enabling to run HVX applications over X.25 networks.
- Configuration tools integrated with SMIT providing an easy configuration of the adapters.
- A large set of utilities to administrate and monitor the adapters.

The **PSX25** software supports simultaneous accesses of the various communication stacks to the same or different physical links. It is provided under a base and additional extension MI's:

- access to a single X.25 line
- access from 2 to 4 X.24 lines
- access from 5 to 8 X.25 lines
- access from 9 to 32 X.25 lines

The **PSX25** product includes a local SNMP agent with a Management Information that contains statistics, operational and configuration tables. This includes:

- A subset of the Management Information Base defined by the Internet Standards RFC 1381 and RFC 1382. This is made to interoperate with market existing manager.
- A specific Management Information Base which goals the completeness of information and gives a full advantage of **PSX25** stack management.
- A browser that provides system operators with an easy-to-use interface to monitor and configure PSX25 lines through the SNMP agent. It is based on the AIX standard SMIT interface.

Limitations

- The IBM X.25 API provided by IBM's X.25 Software cannot be used through the PSX25 product. The Bull X.25 APIs (MAX3 or XTI) has to be used.
- does not support SNA Server

4.2.4. 4-Port HiSpeed WAN Communication Adapter

This adapter is a high end X.25 adapter that provides a very powerful X.25 offer at a moderate pricing.

This adapter enables the system to gain access to X25 networks. The product consists of a base card that should be completed with 4 daughter cards regarding the interface chosen. 3 interfaces are supported: V35, V11, V24.

This adapter is fully integrated in Bull's communication offer. **TCP/IP, SNA/20, HVX** and **OSI** applications have access to X25 networks through this adapter. This board can support up to 1024 virtual circuits and up to 1500 X25 packets/s (with packet size = 128) according to the stacks capability.

Hardware

Type 5 adapter, 1 slot used
Micro Channel bus 32 bits
RISC 32 bits processor: LSI LOGIC LR33000; 25MHZ
4 MB memory
NET2 conformance
2 Mbps across 4 ports (2Mbps Max)
Maximum line speed: V35: 64 Kbps, V11: 2 Mbps, V24/V28: 19.2 Kbps
4 x HDLC communication controllers (4 x ZILOG IUSC 20 MHz) available on the base card: Each one is personalized with an interface card providing one of the following interfaces: V35, V24, V11. This adapter allows either 4 times the same interface or different types of interfaces on the same board. The **4Port HiSpeed WAN Communication Adapter** provides an efficient way to have independent ports and allows a high availability of the board in case of trouble. Furthermore, flexibility is insured in the event of evolution of one of the interfaces.

+	4port HiSpeed X25 comm adapter		
+	V35 HiSpeed X25 interface card	max 4 |	
+	V24 HiSpeed X25 interface card	max 4 |	
+	V11 HiSpeed X25 interface card	max 4 |	total: max 4

Cables

The base board provides a 78-point female connector. A 3m cable attaches the 78-point connector to a distribution box. The distribution box has four 25-point connectors that could be connected to appropriate cables providing different types of interfaces. The cables are listed hereafter:

V35 cable: up to 64 Kbps (10m)
V11/X21 cables: up to 2 Mbps (10m)
V24 cable: up to 19.2 Kbps (10m).

Attachment

The controller fit into a single type 5 Micro channel adapter slot.

HiSpeed X.25 Software

The HiSpeed X.25 software is dedicated to the support of the 1-port and the 4-port communication adapters. Refer to the HiSpeed X.25 Software description for more details.

An SNMP agent is also available to manage HiSpeed boards. Refer to SNMP Agent for HiSpeed Adapters software description for more details.

Limitation:

the total number of 4 port HiSpeed WAN adapter and 1 port HiSpeed WAN adapter cannot be more than the maximum supported by the model, and in any case limited to 6.

The 4-Port HiSpeed WAN Communication Adapter is certified BABT.

4.2.5. 1-Port HiSpeed WAN Communication Adapter

This adapter is an entry level X.25 adapter that provides a powerful X.25 offer at very competitive pricing.

This adapter enables the system unit to gain access to X25 networks. The product consists of a base card that should be completed with 1 daughter card regarding the interface chosen. 3 interfaces are supported: V35, V11, V24.

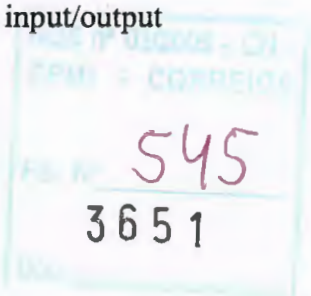
This adapter is fully integrated in Bull's communication offer. **TCP/IP, SNA/20, HVX** and **OSI** applications can access X25 networks through this adapter. This board can support up to 256 virtual circuits and up to 200 X25 packets/s (with packet size = 128) according to the stacks capability.

This adapter design will replace the old **1Port HiSpeed WAN Communication Adapter** and supports the new features:

same daughter boards as the 4Port HiSpeed Communication Adapter
same cables as the 4Port HiSpeed Communication Adapter

Hardware

Intelligent adapter: two DMA channels, three timers, interrupt controller, input/output predecoder and so on.
Type 3 adapter, 1 slot used
Micro Channel bus 8 bits
80C186 INTEL processor, 15.36 MHz
1 MB memory
VDE & FCC class A conformance



Line speed up to 128 Kbps: V35: 64 Kbps, V11: 128 Kbps, V24/V28: 19.2 Kbps

1 HDLC communication controllers available on the base card:
It is personalized with an interface card providing one of the following interfaces: V35, V24, V11.

+ 1port HiSpeed X25 comm adapter			
+ V35 HiSpeed X25 interface card	max 1	|	
+ V24 HiSpeed X25 interface card	max 1	|	
+ V11 HiSpeed X25 interface card	max 1	|	total: max 1

Cables

The base board provides a 25-point female connector that could be connected to appropriate cables providing different types of interfaces. The cables are same as for 4Port HiSpeed Communication Adapter and are listed hereafter:

V35 cable: up to 64 Kbps (10m)
V11/X21 cables: up to 2 Mbps (10m)
V24 cable: up to 19.2 Kbps (10m)

Attachment

The controller fit into a single Micro channel adapter slot.

HiSpeed X.25 Software

The HiSpeed X.25 software is dedicated to the support of the 1-port and 4-port communication adapters. Refer to the HiSpeed X.25 Software description for more details.

An SNMP agent is also available to manage HiSpeed boards. Refer to SNMP Agent for HiSpeed Adapters software description for more details.

Limitation:

the total number of 4 port HiSpeed WAN adapter and 1 port HiSpeed WAN adapter cannot be more than the maximum supported by the model, and in any case limited to 6.

The 1Port HiSpeed WAN Communication Adapter is BABT certified.

4.2.6. HiSpeed X.25 Software

The HiSpeed X.25 software is dedicated to the support of the 1-port and the 4-port communication adapters. The actual X.25.2 and X.25.3 software, compliant with X.25-88 and ISO 8822, is loaded on the adapter itself. The HiSpeed X.25 software running under AIX consists of the following components:

Interfaces for:
- AIX TCP/IP stack, enabling any TCP/IP application to be run over X.25
- OSI X.25 stack and the OSI (MAX3) X.25 API
- SNA/20 stack, enabling SNA/20 applications to run in QLLC/X.25 mode.
- HVX stack, enabling HVX applications to run over X.25 networks.

Configuration tools integrated with SMIT providing easy configuration of the adapters.
A set of utilities to administer and monitor the adapter.

This software does not support the IBM specific X.25 API provided by IBM's X.25 Software.

The HiSpeed X.25 software supports simultaneous accesses of the various communication stacks to the same or different physical links. It is provided under two separate MI's, one for the 4-port adapter supporting 1024 VC's and up to 1500 packets/s and one for the 1-port adapter supporting 256 VC's and up to 200 packets/s.

Limitations:

The IBM X25 API provided by IBM's X.25 Software cannot be used through the Hi Speed X25 boards. The Bull X25 API (MAX3) has to be used.
No support of SNA Server.

4.2.7. SNMP Agent for HiSpeed Adapters

An agent is a component of a network management system, which is responsible for a managed node. It responds to requests made by a manager components and issues notifications to them when particular events occur. Communication with the manager or network-control host (for example the ISM manager) is accomplished by means of the Simple Network Management Protocol (SNMP v1).

The SNMP Agent for HiSpeed Adapters performs the monitoring of the resources related to all HiSpeed WAN Comm. Adapters present on the managed node, in order to provide up to date information regarding their performances and behaviors, and control on their configurations.

4.2.7.1. Standard Functionalities

The Management Information Base supported by the SNMP Agent for HiSpeed Adapters contains statistics, operational and configuration tables. The statistic tables contain statistics information about the HiSpeed Adapters. The operational tables contain configuration information currently set in the HiSpeed Adapters. The configuration tables contain objects that can be changed to manage the HiSpeed Adapters configuration.

This includes:

- A subset of the Management Information Base defined by the Internet Standards RFC 1381 and RFC 1382. This is made to interoperate with market existing manager.
- A HiSpeed Adapters specific Management Information Base which goals the completeness of information and gives a full advantage of the HiSpeed Adapters management.

4.2.7.2. Enhanced Functionality: the browser

The aim of this tool is to provide system operators with an easy-to-use interface to monitor and configure the local and remote nodes' HiSpeed Adapters through the SNMP agent installed on the target node.

Using the MIB browser, users are allowed to access any line of SNMP table supported by the agent to access the values of its objects. For statistics and operational tables, the access is read-only, so that no update can be performed by the users. For configuration tables, users are allowed to:

- Read the current object values.
- Update the objects with the values supplied by the users, when allowed.

This tool is based on the AIX standard SMIT interface and is provided as a utility with the SNMP Agent for HiSpeed Adapters.

4.2.8. 4-Port Multiprotocol Communications Controller (MPQP)

The 4-Port Multiprotocol Communications Controller attaches a system unit to synchronous communications networks using EIA-232D/V.24, EIA-422A, V.35, or X.21 physical interfaces. The controller only supports indoor operation on the EIA-422A interface.

The controller consists of a base card and a daughter card. The two cards are physically connected and require a single Micro Channel adapter slot.

The base card prepares all inbound and outbound data, performs address searches, and in general relieves the system processor of many communications tasks. This controller supports bit synchronous, character synchronous, and asynchronous protocols when appropriately programmed with loadable application software. Not all of the features of the 4-Port Multiprotocol Communications Controller are supported by the software.

The daughter card supports four interfaces: EIA 232D/V.24 on Ports 0 to 3, EIA 422A on Ports 0 and 2, CCITT X.21 on Port 0, and CCITT V.35 on Ports 0 and 1. It also provides drivers, receivers, and surge protection. Surge protection is provided only on the EIA-422A interface on Port2. The EIA-422A interface on Port 0 is designed to operate using synchronous protocols with attachment cables less than 25m (82.5 ft) long.

Hardware

Supports four ports concurrently,
512KB memory,
16-bit DMA data transfer width,
Two selectable interrupt levels,
Supports the following interfaces in international countries: EIA-232D/V.24, V.35, and X.21,
CRC generation and checking,
Micro Channel considerations:
Memory and I/O slave,
16-bit data width.

Cables

Devices are attached to the controller using a 4-Port Multiprotocol Interface Cable, which connects to the daughter card.

4.2.9. X.25 Communication Controller (CoPro2)

This is an X.25 adapter provided by IBM on RS/6000. This product is an ***alternative to the 1Port HiSpeed WAN Communication Adapter, but with a much less attractive price/performance ratio***. It should be used only when there is a need to support software products not supported by the HiSpeed X.25 or PSX25 software.

The X.25 Communication Controller provides support for attaching a system unit to an X.25 network. The controller provides a single port that can accommodate three selectable interfaces: V.11, V.24 and V.35. The port has a 37-pin female D-shell connector.

This board can support up to 512 virtual circuits and up to 40 X.25 packets/s.

Hardware:

512KB memory
Full-duplex synchronous protocol
Supports the following interfaces in international countries:
Leased X.21 interface at up to 64Kbps
EIA-232D/V.24 interface at 19.2Kbps
V.35 interface at 56Kbps
Wrap plug for 37-pin connector (supplied for testing).
Micro Channel considerations:
I/O slave
16-bit data width
24-bit address width
Type 3 adapter card size

Cables:

Six separate cable lengths are optionally available with the controller (two for each interface). For more information on the cables mentioned, see the Cable Configurator.

Attachment:

The controller fits into a single Micro Channel adapter slot.

X.25 Software

For AIX 4.1, the X.25 software is no more delivered free of charge with the AIX operating system. A dedicated AIX link X.25 software is needed.

Operating System Requirement

AIX 4.1., or later

4.2.10. AIX link X.25 software

Under AIX, using the X.25 communication controller requires the AIX link X.25 software.

The software supports TCP/IP as well as IBM specific API and applications such as X.25 API and SNA Server. It includes an SNMP proxy agent and MIB support for X.25 and LAP-B statistics of the X.25 Communication Controller. It also includes an X.3, X.28 and X.29 PAD function for attachment of asynchronous terminal and devices.

This software applies only to the X.25 Communication Controller for EPC800 and to the 2-Port Multiprotocol PCI Adapter for EPC1200, EPC1200A and EPC2400.

5. LAN Controllers

5.1. LAN Controllers for EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

5.1.1. Ethernet 10/100 Mbps (Fast Ethernet) PCI Controller

The Ethernet 10/100 Mbps PCI Controller is a Fast Ethernet network adapter that allows Escala EPC400, EPC430, EPC440, EPC450, EPC1200 and EPC1200A systems to connect to 10 Mbps or 100 Mbps Ethernet network. It works with PCI (Peripheral Component Interconnect) buses and connects to any 10Base-T or 100Base-TX compliant Ethernet hub to deliver 10 times the bandwidth delivered by Ethernet.
The adapter automatically selects between 10 and 100 Mbps operation.
For 100 Mbps operation, the adapter supports operation on two pairs category 5 unshielded twisted-pair (UTP).
For 10 Mbps operation, the adapter supports Category 3,4, or 5 UTP cable.

TCP/IP, SNA/20, HVX, XTI, and **OSI** applications are run through this adapter.

Connectivity rules:

The maximum length of a twisted pair segment- distance from a repeater to a host system-is 100 meters.
The diameter of collision domain -distance between two end-stations- is 205 meters.

Features

- 10 Base-T (twisted-pair) support
- 100 Base-TX support
- Support Full-Duplex operation at 100 Mbps
- Support for Category 3 or 4 UTP cable for 10 Mbps, category 5 UTP cable for 10 Mbps and 100 Mbps
- Activity (transmit/receive) and Link Integrity LED indicators mounted on bracket.
- Does not support Full-Duplex operation at 10 Mbps.
- IEEE 802.3
- CSMA/CD
- TCP/IP, SNMP Complient
- Automatically selects between 10 Mbps and 100 Mbps operation.

Hardware:

- Interface with the 32-bits PCI local bus
- 32-bit data path with bus-master design

Cables:

Refer to the Cabling Guide for more details.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2 or later

5.1.2. Gigabit Ethernet-SX PCI Adapter

The Gigabit Ethernet-SX PCI based adapter is available on EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400 systems. This technology allows to provide the scalability and performance required to meet the increasing demands on today's communications.

Technical Overview:

The adapter provides one full-duplex 1000Base-SX connection. It is a short form factor PCI card with a SC-fiber connector to connect with short-wave (850 nm) 62.5 or 50 micron multi-mode fiber (MMF) to a Gigabit Ethernet network. The adapter requires a 32 or 64 bit PCI bus slot running at 33 or 66 MHz and supports both 3.3 V and 5 V signaling. The adapter conforms to PCI (Peripheral Component Interconnect) Local Bus Revision 2.0 and 2.1, IEEE 802.3z Gigabit Ethernet, and IEEE 802.3x flow control standards.

Connectivity Rules:

The following table gives the range of cable lengths from the adapter to another Gigabit Ethernet equipment:

Fiber type:	*Modal bandwidth MHz-km:*	*Minimum length meters:*	*Maximum length meters:*
MMF 62.5 um	160	2	220
MMF 62.5 um	200	2	275
MMF 50 um	400	2	500
MMF 50 um	500	2	500

Features:

- Provides a 1 Gbps (1000BaseSX) full-duplex Ethernet LAN connection.
- Activity (transmit/receive) and Link Integrity LED indicators mounted
- on bracket.
- 1 MB on-card FIFO for transmit and receive

Hardware:

- 64 bit single PCI slot, 64-bit data path with bus-master design

Operating System requirement:

- AIX Versions 4.3.2 or later.
- AIX 4.3.2 or later is required for Jumbo Frame support.

Machine requirements:

- EPC400, EPC430, EPC440 and EPC450: Up to 2 adapters are allowed in the system.
- EPC1200, EPC1200A and EPC2400: Up to 8 adapters are allowed in the system, provided that the following maximum limits are respected: 1 adapter per PCI bus, 3 in the primary I/O drawer, 4 in secondary I/O drawers.

5.1.3. Token Ring 16/4 PCI Controller

The Token Ring PCI adapter is designed to allow Escala EPC400, EPC430, EPC440, EPC450, EPC1200 and EPC1200A systems to connect to a 4 Mbps or 16 Mbps Token Ring local area networks. This adapter automatically selects the Correct Token-Ring speed (4 or 16 Mbps).

The adapter has:

- one connector RJ45 to attach to UTP cabling.
- one connector DB9 to attach to STP (IBM type 1) cabling.

TCP/IP, SNA/20, HVX, XTI, and **OSI** applications are run through this adapter.

Features

- 4 Mbps or 16 Mbps
  compatible with IEEE 802.5 specifications
- Support Full-Duplex

Hardware:

- Interface with the 32-bits PCI local bus
- 32-bit data path with bus-master design
- PCI Short - Form factor adapter

Cables:

Refer to the Cabling Guide for more details.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2.1, or later

5.1.4. ATM 155 Mbps Controller

The Asynchronous Transfer Mode (ATM) Controller is a high-performance PCI controller that allows Escala EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400 systems to connect to an ATM network.

The controller is designed to provide a bandwidth of 155 Mbps on the ATM network and allows operation in a Classical IP or LAN Emulation (LANE) network environment.

TCP/IP with AIX 4.2.1 (or higher version) applications run through this adapter.

atures:

- RFC 1577 Classical IP support
- LAN Emulation V1.0 support
- Compliant with ATM ForumUNI Specification V3.0 and V3.1 for switched virtual circuits
- Virtual connection setup and tear down
- PVC and SVC concurrent support
- Maximum of 110 VC's
- ATM Adaptation Layer (AAL-5) support
- Bandwidth allocation and management
- SNMP sub-agent

Hardware:

- Compliant with ATM Forum standards
- Self configuration
- 32-bit PCI bus master
- Type short adapter card size

Cables:

Requires a 65 micron multi-mode fiber cable with SC connector

Attachment:

The controller fits into a single PCI slot

Operating System Requirement:

- AIX 4.2.1 or later

5.1.5. Fibre Distributed Data Interface (FDDI) Controllers

The Fibre Distributed Data Interface FDDI is designed to allow Escala EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400 systems to connect to:

- Multi-mode fiber Single-Attach Station (SAS) or Dual-Attach Station (DAS)
- UTP (Unshielded Twisted Pair) Single Attach Station (SAS)

A FDDI LAN can be up to 100 km (62 miles) and can include up to 500 system units. There can be up to:

- 2 km (1.24 miles) between system units or concentrators when using multi-mode fiber,
- 100 meters between system units or concentrators when using UTP.

Remote IPL is not supported via FDDI devices.

TCP/IP, SNA/20, HVX, XTI, and **OSI** applications are run through these adapters.

Hardware:

- Data rate of up to 100Mbps
- PCI features:
  - Bus master
  - Memory and I/O slave
  - 32-bit address and data width
  - Support of "Dual Homing"
  - Machine-readable Vital Product Data (VPD)
  - PCI short-form factor adapter (SAS or DAS)
- Physical Medium Dependent (PMD)
  - Fiber ANSI X3T9.5 compliant
    Up to 2 Km between nodes
    SC connector
  - UTP ANSI X3T12 TP-PMD compliant
    Up to 100m between nodes
    1 RJ45 connector
- Station Management SMT 7.3
- SNMP Management

Cables:

- Fiber MIC 62.5µm Multi-mode
- UTP UTP cross over category 5 cable

Attachment:

The FDDI controller (SAS or DAS) fits into a single PCI adapter slot.

Operating System Environment

- AIX 4.2.1 or later

5.2. LAN Controllers for EPC800

5.2.1. Token-Ring Network Controller

The Token-Ring Network Controller is a Micro Channel bus master DMA controller used to attach the system unit to either a 4M bps or a 16M bps Token-Ring local area network.

This controller supports high-performance applications. The Token-Ring High-Performance Network Controller is cable- and network-compatible with existing token-ring controllers, so no new cables or network components are required. All controllers on a token-ring network must operate at the same speed.

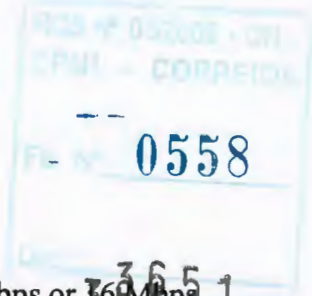
TCP/IP, OSI (& SNA/20 with AIX 4.1) applications run through this adapter.

Hardware

- IEEE 802.5 compatibility
- Eight Address/interrupt states supported
- Controller cable supplied to connect to the Cabling System socket
- Micro Channel considerations:
  - Bus master
  - I/O slave
  - 16-bit data width
  - 24-bit address width
  - Support for data and address parity
  - Support for streaming data (only as a DMA bus master)
  - Type 3 adapter card size.
- One 9-pin female D-shell connector.

Attachment

The controller fits into a single Micro Channel adapter slot.



5.2.2. Auto Token-Ring LANstreamer MC32 Adapter

The Token Ring MCA adapter is designed to allow a Escala system to connect to a 4 Mbps or 16 Mbps Token Ring local area networks. This adapter automatically selects the Correct Token-Ring speed (4 or 16 Mbps)
The adapter has one connector RJ45. The RJ-45 connector is used to attach to UTP cabling.

A 30cm conversion cable is included with the adapter to attach to STP (IBM type 1) cabling.

TCP/IP, OSI, SNA/20 applications run through this adapter.

Features

4 Mbps or 16 Mbps
compatible with IEEE 802.5 specifications

Hardware

Interface with the 32-bits MCA local bus
32-bit data path with bus-master design

Cables

The cable is not delivered with the adapter. It can be ordered from Bull Express:

- Ref 5153 (5 meters) from the host to a Token-ring hub (RJ45/RJ45 cable),
- Ref 5155 (15 meters) from the host to a Token-ring hub (RJ45/RJ45 cable),
- Ref 5828 (4 meters) from the host to the filter MAU.

Attachment

The controller fits into a single MCA slot.

Operating System Requirement

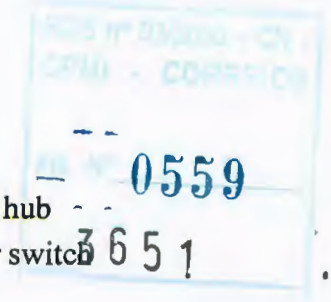
AIX 4.1.4, or later

.2.3. Ethernet 10/100 Mbps (Fast Ethernet) MCA Controller

The Ethernet 10/100 Mbps MCA Controller is a Fast Ethernet network adapter that allows an Escala system to connect to 10 Mbps or 100 Mbps Ethernet network. It provides network performance improvement over existing 10 Mbps Ethernet LANs and can connect to any 100BaseTx compliant Ethernet network to deliver 10 times the bandwidth delivered by Ethernet.

The adapter automatically selects between 10 Mbps and 100 Mbps operation.

OSI, SNA/20 and **TCP/IP** applications run through this adapter.



Features

- Single-port connection to 10BaseT or 100BaseTx Ethernet LANs through switch or hub
- Automatic operation at 10 Mbps or 100 Mbps depending on port speed at the hub or switch

- Fully 802.3u Fast Ethernet standard compatible
- Full-duplex capability
- Full-frame buffering on both transmit and receive
- 32-bit Micro Channel DMA bus master
- Support for full 64-bit streaming with 80MB capability on MCA bus
- Type 3 Micro Channel form factor
- Support for network boot operations
- MCA parity generation and detection

Hardware Requirements

- The controller fits into a single MCA slot.

The Ethernet 10/100 Mbps MCA Controller provides a single-port connection to 10BaseT or 100BaseTx Ethernet LANs.

- Connect to 10BaseT Ethernet LAN via 10BaseT hub or switch using Category 3, 4, or 5 unshielded twisted pair (UTP) wiring
- Connect to 100BaseTx Ethernet LAN via 100BaseTx capable hub or switch using Category 5 unshielded twisted pair (UTP) wiring

The maximum length of a twisted pair segment - distance from a repeater to a host system - is 100 meters.
The diameter of collision domain -distance between two end-stations- is 205 meters.

Software Requirements

- AIX Version 4.1.5 or Version 4.2.1, or later

5.2.4. Ethernet LAN Controller (LSA component)

The Ethernet LAN Controller (LSA) is a high-performance Micro Channel bus master DMA controller that allows the system unit to attach to an Ethernet network.

The controller is designed to provide a connection to a 10Mbps Carrier Sense Multiple Access/Collision Detection (CSMA/CD) Ethernet network.

The controller provides connectors compliant with 10 Base 5 and 10 Base T (RJ45).

To attach the system unit to the network for connection to RJ45 Twisted Pair, the customer must supply the appropriate cable.

To attach the system unit to the network for connection to the standard 50-ohm (thick) the customer must supply the appropriate cable and order an external transceiver.

TCP/IP, OSI, SNA/20 applications run through this adapter.

Hardware

- IEEE 802.3 or Ethernet Version 2 compatibility
- Selectable interrupt levels
- 32-bit cyclic redundancy check
- Micro Channel considerations
  - Bus master
  - I/O slave
  - 32-bit data and address widths
  - Support for data address parity
  - Type 5 adapter card size.

Attachment

The controller fits into a single MCA slot.

5.2.5. ATM 155 Mbps Controller

The Asynchronous Transfer Mode (ATM) Controller is a high-performance Micro Channel controller that allows the system unit to attach to an ATM network.

The controller is designed to provide a bandwidth of 155 Mbps on the ATM network and allows operation in a Classical IP network environment.

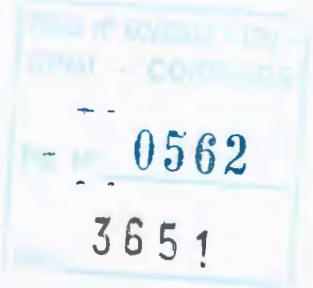
TCP/IP with AIX 4.1.4 (or higher version) applications run through this adapter.

Features

- RFC 1577 Classical IP support
- Compliant with ATM ForumUNI Specification V3.0 for switched virtual circuits
- Virtual connection setup and tear down
- PVC and SVC concurrent support
- Maximum of 1024 VC's
- ATM Adaptation Layer (AAL-5) support
- Bandwidth allocation and management
- SNMP sub-agent

Hardware

- Compliant with ATM Forum standards
- ATM segmentation and reassembly
- Self configuration
- Micro Channel considerations
- Bus master
- Type 5 adapter card size



Cables

Requires a 65 micron multi-mode fiber cable with SC connector

Attachment

The controller fits into a single MCA slot

Operating System Requirement

- AIX 4.1.5 or later

5.2.6. Fibre Distributed Data Interface (FDDI) Controllers

The Fibre Distributed Data Interface (FDDI) Controller is designed to support all TCP/IP, NFS and SNA operations in either Multi-Mode fiber or shielded twisted-pair (STP) wiring.

The base adapter allows communications on a Single-Attach Station (SAS) network, while the optional upgrade allows communications on a Dual-Attach Station (DAS) network.

A FDDI LAN can be up to 100 km (62 miles) and can include up to 500 system units. There can be up to 2 km (1.24 miles) between system units or concentrators.

Remote IPL is not supported via FDDI devices. An API is provided for the device driver.

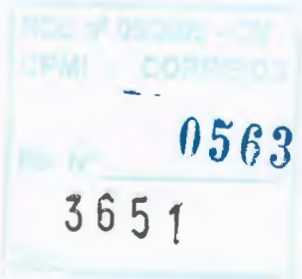
Hardware

Data rate of up to 100Mbps
4B/5B encoding of data for transmission
320C25 Microprocessor
Micro Channel features:
- Bus master
- Memory and I/O slave
- 32-bit data width
- 32- bit address width
- Support for data and address parity
- Machine-readable Vital Product Data (VPD)
- Type-3-adapter-card size (SAS or DAS upgrade).

Cables

All FDDI controllers require Multi-Mode FDDI optical fiber jumper cables.

Attachment



The standard controller fits into a single Micro Channel adapter slot. The optional upgrade requires an additional slot.

Chapter 6: Cluster Management, Terminals and Printers

1. Cluster management

Cluster management capability is an essential feature that contributes to reduce the cost of system administration.
Escala Cluster is based on standard Escala platform and AIX system so each node has:

- a serial port S1 for low level connection to a console for basic system installation, configuration, debugging or messages, service diagnostics mode and maintenance
- a serial port S2 for connection to a modem for Remote Maintenance capabilities.
- a dedicated system administration interface (SMIT)

Cluster management answers to the need to provide a single point of administration build on a single hardware console such that both system console and system management interface will be supported.

Main hardware components used for Cluster Management are the following:

- System Console
- Cluster Console
- PowerConsole
- Administration Hub
- Console Concentrator

The cluster management capability is three-fold:

- A single system console
- A single point of control: a collection of administration tools for managing the entire cluster from a single X/Window graphical console
- Integration in a customer's centralized enterprise management such as ISM (see cluster management software)

System Console

A System Console of a Unix server is an alphanumerical terminal that allows to boot, stop and troubleshoot the system. The system console for the EPC systems is a BQ306 terminal. This solution provides basic system management.

1.2. Graphical Consoles and Infrastructure

1.2.1. Cluster PowerConsole

Cluster PowerConsole designates a configuration of an Estrella graphical workstation or an Escala S100 graphical workstation, a console concentrator, a hub along with the necessary cabling, and cluster management software (including ClusterAssistant, ClusterWatch, Netscape browser, PTX, ArrayGuide...).

The Cluster PowerConsole may be supplemented by any 'ISM Server'. ISM brings a customizable comprehensive and sophisticated suite of tools for the professional information systems administrator that can be leveraged with the dedicated cluster management tools (See below). The user takes benefits of ISM capabilities for visualization of cluster topology, life monitoring of the entire cluster and centralized alarm management.

EPC content

The PowerConsole is factory integrated and preloaded with the administration graphic interface.

PowerConsole 1° hardware (Estrella based) content:

1) Estrella 300-200 MHz base with
   - 1 PowerPC 604/ev processor @200Mhz
   - 4 sockets for SIMM memories
   - 1 SCSI-2 F/W adapter
   - 1 Business audio board
   - 1 Eth. port 10/100Mbps (RJ45 and AUI)
   - 2 serial ports (RS232C)
   - 1 parallel IEEEE port
   - Keyboard, Mouse and Monitor ports
   - 5 PCI/ISA slots (2PCI, 2ISA, 1 shared)
2) 1 floppy 1.44MB in diskette bay
3) 5 SCSI devices bays (Two 3.5", three 5.25")
4) 1 CD-ROM (600MB 8x) (in 5.25" bay)
5) 1 4.3GB SCSI-2 F/W High Perf disk drive (in 3.5" bay)
6) 512 KB L2 Cache Memory base option
7) 64 MB DIMM Memory ECC-EDO
8) High Resolution Graphic Adapter (PCI) with 2MB Memory
9) Keyboard, 3-button Mouse
10) 17" Color display with cables (Europe)
11) 8 Port Asynchronous adapter EIA-232 (ISA) W/Connector box
12) Asynchronous RS232 and Eth cables

Optional and highly recommended QIC or DAT or VDAT media (in 5.25" bay).
(Note: This Estrella-based hardware offer has been discontinued.)

PowerConsole 2° hardware (Escala S100 based) content:

1) Escala S100-233 MHz base with

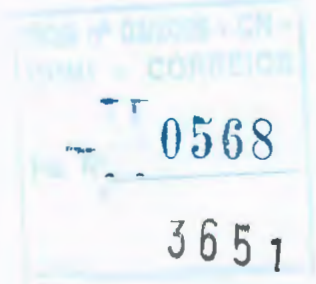
- 1 PowerPC 604e processor @233Mhz - 1MB L2cache
- 128MB RAM
- 9.1GB SCSI-2 F/W disk
- 1 CD-ROM
- 1 SCSI-2 F/W bus for disks
- 1 Eth. port 10Mbps (RJ45)
- 1 Floppy disk 1.44MB
- Keyboard and Mouse ports
- 2 serial ports - 1 centronics port
- 5 I/O slots (3xPCI, 2xPCI/ISA)
- 2 open bays for 1 media/disk or 2 disks

2) Graphics components with

- 1 GXT130P Graphics Adapter
- 17" Color Display
- 3-Button Mouse and Keyboard

Optional

Highly recommended QIC or DAT or VDAT media.
Additional 9.1GB or 4.5GB disks
Additional communication adapters (Ethernet 10/100 Mbps, Token-Ring, FDDI)
Electronic ISA modem board



PowerConsole enhancements

Most of the PowerConsole hardware enhancements are for higher configurability

- High-resolution graphics adapter with extension memory:

For simultaneous High level graphical applications (in conjunction with Netscape navigator for example), it is recommended to configure the PowerConsole 1° with a High-resolution graphics adapter available on Estrella 300. The PowerConsole 1° is an Estrella 300 that in a standard configuration offers the Bull SVGA CIRROS entry-level graphics adapter. For better resolution and avoid conflict in color palette when running in parallel different graphical tools, the High-Resolution Graphics Adapter with appropriate VRAM extension memory is now offered. The High-Resolution Graphics Adapter is a version of the Millennium board from MATROX, which is a more powerful graphics PCI board for Estrella Series 300. In complement, 6MB VRAM Extension Memory allows to provide better resolutions and color depth.

- Optional internal disks for higher storage capacity:

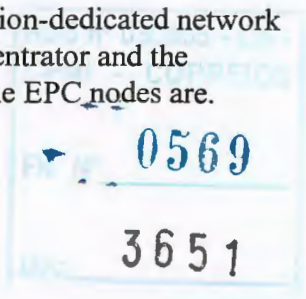
The PowerConsole functionalities offer the integration of NIM (Network Installation Management) application for the backup of system disks of the EPC nodes. System disk backups can be stored on a particular cluster node or on the PowerConsole. In that late case, additional storage capacity is required on the PowerConsole. This optional extra disk capacity can be a 4.3 GB disk, or a 9 GB disk, or both as permitted in PowerConsole configurations.

- Optional communication adapter for connection to customer's network:

Better explanation is provided for establishing the TCP-IP network for administration purpose. The remaining ambiguity on administration-dedicated network has been solved, and an important concern with respect to the customer's network infrastructure is now fully treated with the optional support of an extra adapter for connecting the PowerConsole to that network according to its type (Ethernet, FDDI, Token-ring).

⇒ The administration-dedicated network is an Ethernet-based private network made of an administration hub connecting the EPC nodes, the console concentrator and the PowerConsole. Besides, the nodes (S1 plug) are wired to the serial ports on the console concentrator. This administration-dedicated network utilizes an Ethernet board on any node and the PowerConsole. The nodes are connected to the customer's public network through other network boards. For allowing remote access to the PowerConsole from an X-terminal or any station with X-Terminal emulation on the customer's network, the PowerConsole can be equipped with an additional network adapter connecting it to the customer's network. Be careful that remote access from an X-terminal is only possible if its windows manager resides on the PowerConsole.

⇒ When the customer's network is an Ethernet network, the administration-dedicated network becomes an option. When that option is not chosen, the console concentrator and the PowerConsole are directly connected to the customer's network, as the EPC nodes are.



1.2.2. Cluster Console

The Explora 17" Color X-Terminal is used on Escala EPC as Cluster Console.
The Cluster Console solution is suggested with a Console concentrator for any EPC configurations, as an alternative cost-effective choice to the PowerConsole. In that case, a self-bootable X-terminal (NCD Explora Console) replaces the Estrella workstation, but ClusterAssistant, the PowerConsole software is no longer available.

For 2-node configuration, the Cluster Console has a particular implementation. A serial line links the X-terminal to the S1 plug of a node. This node is in turn linked to the S1 plug of the other node. The two nodes and the X-terminal are also connected through the administration hub. Such an X-terminal can thus both act as single system console and single point of control. The provided console switching facility is software and based on standard CU commands. Such a solution is called Cluster Console.

The Cluster Console solution has been discontinued as of 30 June 1999.

1.2.3. Console Concentrator

A Console Concentrator (3COM CS/2600) is a device connected to S1 console plug of every cluster node which allows any ASCII terminal connected to it through a serial line to act as cluster system console. Wiring the cluster nodes with serial lines to the console concentrator makes troubleshooting possible even when node network interface is down. The console concentrator can be rack mounted and there can be such a device for 8 nodes. Larger configurations will require additional console concentrators linked together through Ethernet network. Connecting the Console Concentrator to the enterprise network allows to use any workstation (like ISM station) or X-terminal on the network as remote administration console in addition to the PowerConsole or the Cluster Console. The Console Concentrator is one or more 3COM's CS/2600 terminal servers. A Console Concentrator can serve a configuration up to 8 nodes. The 3COM's CS/2600 terminal server offers a ten-port capacity with full modem support and simultaneous support for multiple protocols for connecting up to 10 system consoles:

- 10 Ports for Multiprotocol Connections: the concentrator support TCP/IP (Transmission Control Protocol/ Internet Protocol), TN3270, and OSI (Open Systems Interconnect) standard.
- Support for up to eight concurrent sessions per port (subject to total system limitations) gives easy access to multiple hosts
- RS-422 signal support allows terminal connections at distances exceeding 1000 feet (305 meters)
- Full modem support on all ports
- Support for the Serial Line Internet Protocol (SLIP) and the Point-to-Point Protocol (PPP) enables dial-up access to TCP/IP resources
- 3Com's Transcend ® Remote Boot and Configuration Services (RBCS) Version 2.1 software provides an SNMP-based environment for central booting and configuration, enabling to boot and configure multiple devices from one location.

1.2.4. Ethernet-based Administration Hub

An Ethernet-based Administration Hub (3COM Hub Superstack II) is provided to make the interconnection of the nodes and the console concentrator, and provide a faster network for administration graphical tools. This Ethernet hub (3Com Hub Superstack II 12 ports) is provided to build a private Administration Network between the nodes, the cluster console or the PowerConsole, and the Console Concentrator.

1.2.5. System Console

An alphanumeric terminal is provided as basic cluster ASCII System Console, which can be used for maintenance operations, and especially as spare console when the graphical console is out of order.

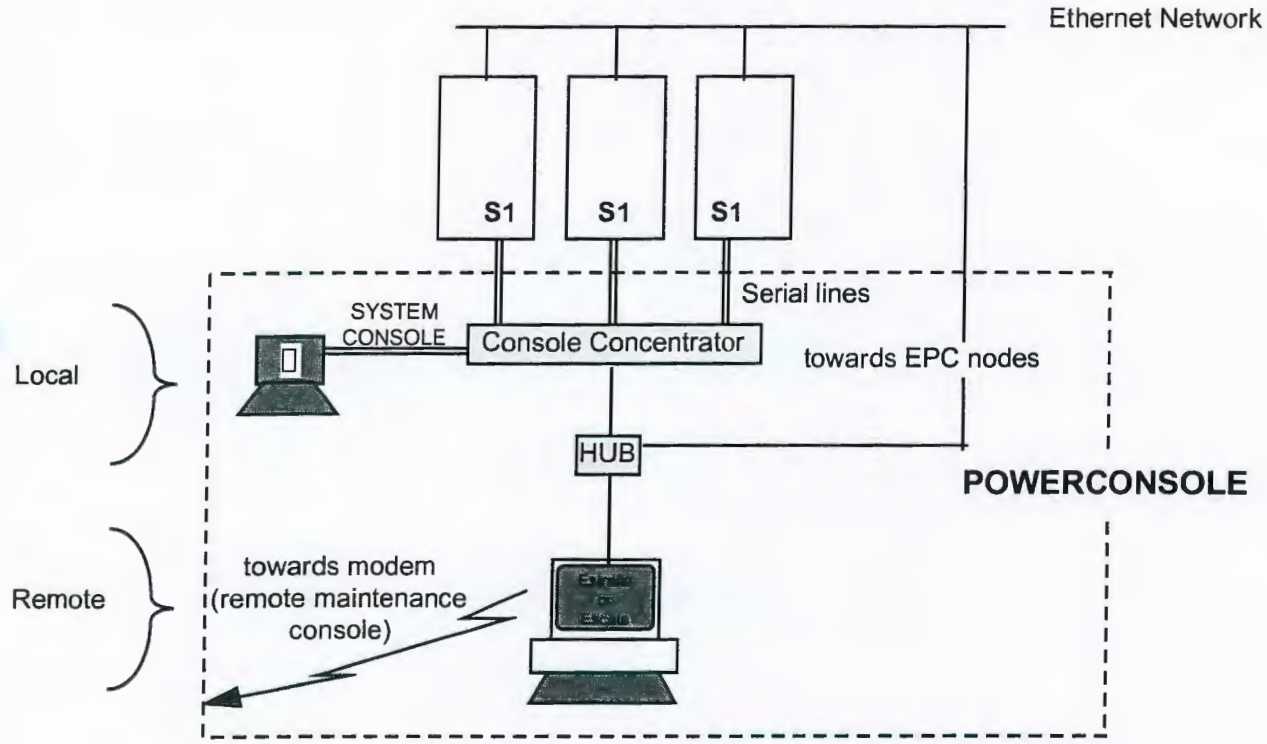
1.3. Packages and Configurations

The solution could consist of different packages and configurations:

- A System Console, an ASCII-Terminal (BQ306). To have only the system console is only possible with 2 nodes Escala EPC configurations. This is an entry-offer for cluster administration. As soon as a Cluster Console or a Cluster PowerConsole is configured, a System console is generated for local system maintenance and backup console.
- A Graphical Console, i.e. a PowerConsole (Estrella workstation - model 340) or a Cluster Console (X-Terminal Explora console).
- Beyond 2 nodes Escala EPC configurations, a Cluster Console or a Cluster PowerConsole is mandatory. A cluster Ethernet administration Hub and Console Concentrator are systematically generated with the first Cluster Console and Cluster PowerConsole.
- For 2 nodes Escala EPC configurations, Cluster console or Cluster PowerConsole is optional. If Cluster console is chosen, then Cluster administration Hub is systematically generated but no Console Concentrator for cost effectiveness. If Cluster PowerConsole is chosen, then cluster Ethernet administration Hub and Console Concentrator are systematically generated with the first Cluster PowerConsole.
- A second Cluster console is allowed only if a first one has been chosen, but not if a Cluster PowerConsole has been chosen first. It is not possible to mix Cluster Console and Cluster PowerConsole in the same Escala EPC configuration.
- A second Cluster PowerConsole is allowed only if a first one has been chosen, but not if a Cluster Console has been chosen. It is not possible to mix Cluster Console and Cluster PowerConsole in the same Escala EPC configuration.
- A Console Concentrator, a 3COM CS/2600 terminal server connected to the console plugs of the EPC nodes. A CS/2600 terminal server can serves up to 8 nodes. There may be several CS/2600 terminal servers for larger configurations.
- Serial cables for linking the cluster nodes (up to 8), the PowerConsole or the Cluster Console, and possibly the System Console, to the Console Concentrator. For every node there is a cable which links the node to the Console Concentrator. It is connected to the node's S1 plug.
- For remote maintenance, a modem can be plugged onto the PowerConsole, if any. Otherwise, a modem is connected to a node's S2 plug. One modem is used for the in-calls and the out-calls. RSF is installed in cluster configuration mode. RSF client on every node and RSF server on the

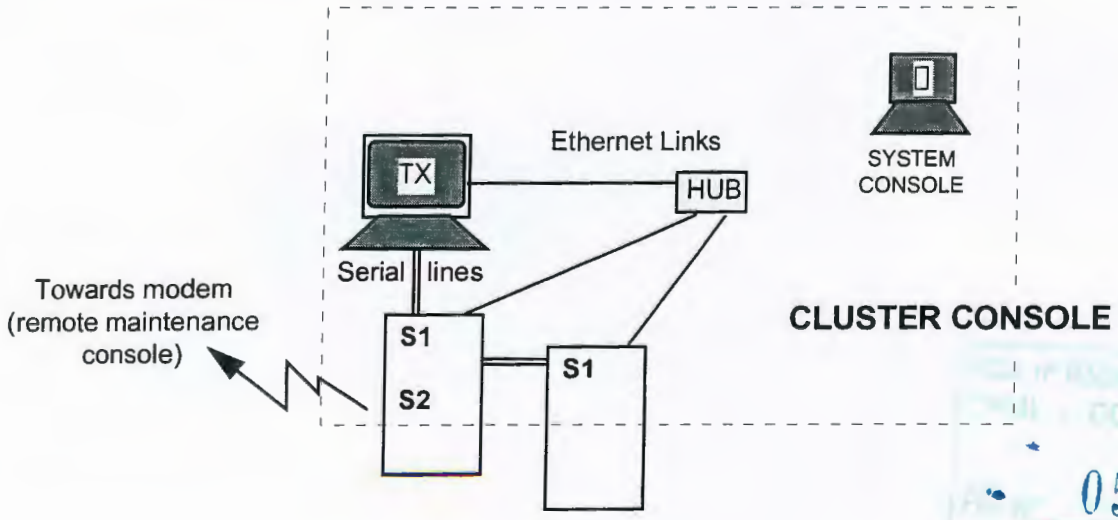
PowerConsole or on the node the modem is connected to. Alternatively, you can install a modem and RSF on each node.

- The cluster nodes are connected to an Ethernet-based network for faster administration. The Console Concentrator and the PowerConsole or the Cluster Console are linked to that Ethernet network. An Ethernet Hub, said administration hub, is provided for making the connection.



Cluster PowerConsole

- For two-node configuration, the Console Concentrator is an option. In that case, the Cluster Console can be directly connected to the S1 plug of a node.



Cluster Console (2-node EPC)

1.4. Cluster Management Consoles and Cluster Management Software

The use of one console to manage the activity of all the cluster nodes not only saves floor space but provides an intelligent method for managing the cluster.

1.4.1. System Administration

The Cluster Console or PowerConsole is the single point of control where all the cluster system administration tools can be invoked. In particular this interface allows an operator to perform basic console tasks such as:

- accessing console(s)
- booting / rebooting nodes
- installing/configuring software

1.4.2. Cluster PowerConsole Management Software: ClusterAssistant

The ClusterAssistant, a GUI (CDE) type tool, enables the administrator to manage via icons and function sequences the several nodes of an Escala EPC system as if it was a single-node system. For cluster-wide management, the PowerConsole can, through the ClusterAssistant (an X/Windows GUI), launch sophisticated administration tools for control and monitoring resources over the cluster. These tools address on a global and an individual basis the different management phases such as deployment, operation, administration, security and availability.
Whereas the PowerConsole provides a single control point, the ClusterAssistant can be said to provide a single system view, in that it can launch cluster-wide administration tools. The "Full" Cluster management facilities are built upon the HACMP framework: installation of HACMP package on every cluster node is mandatory. The PowerConsole is able to manage HA nodes on a "Full" Cluster management mode and "non-HA" nodes with "reduced" Cluster management. On "non-HA" mode, the PowerConsole features supported encompass:

- System Console and Rlogin
- Operating System Backup and Release management through NIM
- Support of optional graphical management host such as ArrayGUIde and Performance ToolBox.

This also applies for a server consolidation even though there is no need of high availability features.

ClusterAssistant is only available on the PowerConsole.

ClusterAssistant Enhancement

The ClusterAssistant is an application group within the Common Desktop Environment, running on the PowerConsole. The ClusterAssistant GUI is mainly augmented with an application group and icons for new operations.
The enhancements of ClusterAssistant are related to the integration of NIM (Network Installation Management), access to interconnect equipment management tools and a lightweight access control.

Network Installation Management (NIM)

NIM for AIX is a client/server software implementing remote software distribution and maintenance facilities. NIM is part of AIX. Integrated in EPC, it enables to install the Base Operating System (BOS) and optional software on one or more nodes, and to create the backup files of system disk (*rootvg*) of the nodes on the PowerConsole. NIM integration allows to avoid the need of tape device for each node.
A NIM configuration comprises of servers providing resources (System image, PTFs, LPPs) for installations, a set of installable client nodes, and definitions of available networks in the NIM environment. An administration server for configuring, controlling, and updating the NIM environment is known as the NIM Master. The PowerConsole hosts the NIM Master and evenly a NIM resource server. The NIM resource server can also be hosted on an EPC node, but in this version, the NIM server is not redundant and no failover scripts are supplied.

The integration of NIM consists of:

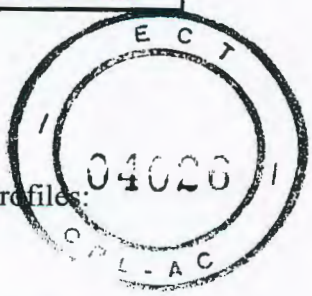
- Assisted configuration of NIM in a EPC environment: it is based on the cluster topology data kept in a repository on the PowerConsole
- NIM save / restore of system images: such an operation applies to the *rootvg* disks of the cluster nodes. The administrator can backup the system of a group of nodes. The resulting system image can be stored on an internal disk then on a tape of the PowerConsole or on a resource server, which can be a particular node. Conversely the administrator can restore the system of one node from the image stored on a tape of the resource server
- Centralized distribution of LPPs : on a group of cluster nodes the administrator can

  ⇒ install or upgrade AIX,
  ⇒ install or remove a LPP (Licensed Program Product)
  ⇒ install or remove a PTF (Program Temporary Fix)

NIM integration allows to handle EPC with NIM clients on nodes running AIX 4.3 as well as EPC with NIM clients on nodes running AIX 4.1 or 4.2 but with a different level of functionality and ease-of-use. Restrictions will appear in user documentation (PowerConsole and ClusterAssistant Setup Guide) or for the latest information in the SRB. The NIM Master runs on the PowerConsole workstation with AIX4.3. The point of control for NIM operations is the PowerConsole. Ease of use is improved by a graphical user interface developed into the cluster assistant. Standard administration tools of NIM, SMIT and VSM are accessible through ClusterAssistant. The GUI for NIM is a new application group folder containing the icons associated to the different NIM operations.
HACMP makes use of boot address and service address regarding an adapter. If there is no administration-dedicated network, IP aliasing mechanism is implemented such that NIM application can still work.

Interconnect equipment management

LinkBuilder FDDI hub, Oncore FDDI switch and Fast Ethernet 3COM's Switch 3x00 10/100 can be configured and monitored using a set of specific line commands executed via ASCII menu-driven tools. When there is a left serial port on the console concentrator, such an equipment can be connected on a free serial port of the console concentrator via an RS-232 cable enabling to open a telnet session to it from the PowerConsole. Icons providing for telnet session are added into ClusterAssistant.



Access Control Policy

A simple mechanism of access control is implemented in order to support two administrator profiles:

- a root administrator: an administrator with the *Root* rights
- a supervisor: an administrator who has not got the *Root* rights but who can access to the monitoring tools of the ClusterAssistant panel.

1.4.3. ClusterWatch

ClusterWatch is a monitoring tool for the clustered systems which provides both the current status (dynamic information reflecting the current cluster state and events) and configuration information (cluster topology and resources). The ClusterWatch is launched from the ClusterAssistant.
The ClusterWatch comprises a GUI (Web) interface providing the system status at a glance: system, memory, storage load and utilization, with colored alarms on thresholds and on hardware and software defects, and statistics on cluster reliability.
It provides users with the benefits of:

- Secure monitoring of the local or remote cluster
- Reduction in system management costs

ClusterWatch offers two user interfaces: a SMIT interface available on each node and a Web interface on the PowerConsole. ClusterWatch is made of a Web server part, which allows to be accessible from any Web browser to the network.

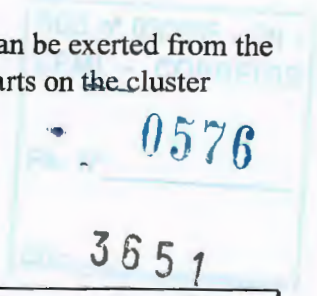
1.4.4. HACMP Services

The HACMP (High Availability Cluster MultiProcessing) software for AIX provides dynamic cluster reconfiguration on cluster modifications and updates. Key benefits include:

- Ability to link cluster modifications without stopping cluster operations,
- Dynamic and automatic migration and reconfiguration capability,
- Ease of use due to the Helps which contribute to increased levels of continuous operational support,
- Reduction in planned outages,
- Single entry point for user administration of clustered systems,
- Single view management, similar to managing a single system,
- Easier, faster cluster administration, because changes are made only once.
- Reduction in administrative errors.

1.4.5. Distributed Unix Utilities

The Distributed Unix Utilities, such as Array Guide, PTX, DSMIT, timed and RSF can be exerted from the PowerConsole, where the manager part resides and interacts with the agent counterparts on the cluster nodes.



1.4.6. Loadleveler

Loadleveler is a software distributed on the cluster nodes. The other tools such as CSPOC of HACMP, Cluster Diagnostic Tool, Clstat, Easy Configuration are installed on every node. The associated GUI can be accessible to any X-terminal connected a cluster node.

1.4.7. Cluster Console Management

The Cluster Console option provides an X-terminal that can be attached to any node of the EPC to perform cluster-wide management by exerting the various administration tools available on every node:

- Installation/configuration, change management, inventory and software distribution denotes the deployment phase. HACMP software includes such facilities. NIM application of AIX enables software distribution on cluster nodes from a single point.
- System monitoring, control, backup/restore, time synchronization and job scheduling represent activities of the operation phase. ClusterWatch, CSPOC, Clstat, Timed, LoadLeveler are tools that can be used for those activities, in addition to base SMIT tools of AIX. As far as LoadLeveler is concerned, the PowerConsole acts a submit-only node.
- Administration deals with user management, license management and accounting and can be performed through NIS and AIX tools
- Availability category groups activities which cover performance management, fault management, shared disk management, resource balancing, and remote maintenance, and which contribute to assure availability of the cluster. PTX, ClusterWatch, Cluster Diagnostic Tool, ArrayGuide, LoadLeveler, RSF meets these area.

1.4.8. Cluster Management

Cluster Management main features are:

- System Management:
  - Remote system boot and remote shutdown,
  - Software installation and updating facilities,
  - Global user management,
  - Mailing,
  - Remote commands execution.

- Centralized Management Interface:
  - Display or modify configuration parameters,
  - Help in failures detection and diagnostic,
  - Performance monitoring,
  - Easy installation and configuration,
  - Cluster PowerConsole configuration,
  - Cluster PowerConsole GUI customization,
  - Management of multiple Escala EPC systems (including central point of control for management of DAS storage subsystems through the Navisphere GUI).

2. Bull Display Terminals and Concentrators

2.1. BQ306 ASCII/ANSI Terminal

The BQ306 is a monochrome entry-level display terminal; it is used on Escala EPC as System Console.

It is a system-attached, 14-inch monochrome display station used for asynchronous communications. The display terminal supports the EIA-232D (CCITT V.24/28) interface or the EIA-422A (CCITT V.11) interface.

The BQ306 display terminal provides BQ303 and WYSE 55 emulation modes.

The display terminals support transmission speeds from 50 bps to 114Kbps on EIA-232D and EIA-422A interfaces.
The data stream is compliant with ANSI X3.4/3.64 standard.
The Character Sets available are ISO 646 with national versions (7 bits coding) and 8 bits coding ISO Latin-1 (Western Europe), Latin-2 (Eastern Europe) 8859/1 and 8859/2, Latin-5 (Western Europe + Turk) 8859/9, and Latin Cyrillic 8859/5, PC437, 86x, 85x.

The BQ306 can attach directly to a host processor, when using EIA-232C or EIA-422, at 50bps to 114Kbps.
It can communicate remotely to a host processor using EIA-232C interface at 50bps to 64Kbps.

BQ306 Features

The BQ306 terminal supports both ANSI-based and PC type character sets and keyboards. Furthermore, this terminal supports:

- DEC VT320, VT220, VT100, VT52, and WYSE 55 terminal personalities
- Up to 25 international keyboards languages
- 101/102 keys PC style keyboard and 105 keys DEC style keyboard
- ISO latin/1, /2, /5, Cyrillic supplementary character sets
- White and amber screen phosphor
- 24-line by 80/132 column data display and 25th status line
- 15x12 and 10x14 character matrix
- Screen saver feature
- Auxiliary printer port.

The terminal is available in two models:
An international model and a low emission version that supports up to 25 keyboard languages and user-selectable French, German, Italian, Spanish or English setup screens and status line messages

System attachment

The BQ306 is attached to the system unit standard serial port using appropriate asynchronous cables EIA-232/V.24, or to an 8, 16 or 64 port asynchronous adapter port using appropriate cables EIA-232/V.24 (see cabling configurator)

The BQ306 is also attachable to the 128 port asynchronous controller of the system via a 16-port cluster box using appropriate asynchronous cables EIA232.

2.2. Explora 17" Color X-Terminal

(This product has been discontinued.)

The Explora 17" Color X-Terminal is used on Escala EPC as Cluster Console.

The Explora 17" Color X-Terminal is a high-performance X terminal providing 64-bit performance and super-high resolution for demanding users requiring advanced graphics, imaging, digital video, animation, and sound capabilities.

User benefits

- Fastest Performance: Runs graphical applications more rapidly
- Highest resolution: Increases by 46% the amount of screen image viewable (compared to 1280x1024)
- Latest 64-bit Architecture: Provides full support for emerging multimedia applications
- Largest Standard Memory: Supports complex graphics software with ease
- Choice of monitors

Unrivaled Performance and Resolution

The Explora 17" Color X-Terminal sets remarkable new standards in resolution, architecture and performance whatever your benchmark. With unequaled 1600x1280 resolution and 200,000 Xstones rating, these models clearly outpace the competition, and at 3.83 Xmarks their leads increases even more dramatically.

Cutting-Edge Architecture

Powerful 64-bit processing - an X terminal first - is what makes such record-breaking performance possible. The R4600 processor's scalability also makes it easy to adapt to future technologies. And for even more dramatic performance improvements, the BQX architecture optimally balance every components including the software, custom ASICs, and other unique enhancements.

Unbeatable Application Access

When it comes to taking full advantage of highly complex graphical applications such as CAD, CASE, GIS, and technical publishing, these terminals have no peer. For example, they draw graphics with the fastest speed, while allowing you to view the maximum picture area of all the images you're displaying. Their sophisticated audio, imaging, and video capabilities also make them ideal for demanding multimedia applications, such as computer-aided training that incorporate MPEG-1 digital video.
Add to that an integral parallel port that allows easy attachment of input/output devices (such as printers, scanners, and floppy disk drivers), and full Energy Star compliance, and you have the industry's premier X terminal offer.

Ergonomics Features

- Display: Tilt and swivel functions, Silica coated, Anti-glare screens, Brightness and contrast controls
- Keyboards: Detached, adjustable tilt, matte-finish keys and housing

Hardware Architecture

- Processor: R4600 RISC @ 80 MHz
- Coprocessor: Three customs ASICS
- DRAM: 8 MB standard, expandable to 136 MB
- Memory upgrades: Industry-standard SIMMs fast-page mode
- Video memory: 2 MB
- Flash memory: Industry-standard PCMCIA
- NVRAM: 512 bytes of configuration memory

Color Displays

- Resolution: 1600x1280
- Color support: 8-bit (256 colors) index color model
- Color palette: 24-bit (16.7 million) look-up table
- Refresh rate: Up to 75 Hz non-interlaced
- Screen size: 17" anti-glare
- Active display area: 356x285mm

Keyboards

- Low-profile with two position tilt, detached with 1.5 meter coiled cable
- A large variety of national versions is available

Mouse

- Three-button, standard serial interface, 9-pin "D" connector, 1200 baud (9600 baud also supported)

Audio

- Resolution: 16-bit linear software conversion to 8-bit µlaw
- Sampling rates: 8,000 to 50,000 samples per second
- Input: One channel (mono), 3.5 mm stereo jack, line level or microphone level (software selectable), input impedance 47KW
- Output: Two channel (stereo), 3.5 mm stereo jack, line level or speaker out (1 Watt maximum per channel),
  line 775mV (typical)

Communication

- 10Base5 AUI interface (can use external 10Base2 or 10BaseT Transceiver)
- Full DB-25 serial port (dual channel) up to 115.2 Kbaud

Power

- AC voltage 110/230 VAC auto-switching, 47 to 63 Hz
- AC frequency 50 to 60 Hz
- Consumption: 169 watts max (17" monitor), 30 watts @ 115 VAC (base only)

Certification

- MPRII compliant
- Energy Star compliant
- Environmental Operating Range
- Temperature: 10 to 40° C – Non-operating range -10° to 60° C
- Humidity: 10 to 90% non-condensing
- Altitude: Up to 3000 meters above sea level

Physical Dimensions

17" Monitor	*Base*
Height: 470 mm	Height: 61 mm
Width: 500 mm	Width: 429 mm
Depth: 510 mm	Depth: 320 mm
Weight: 34 Kg	Weight: 5,2 Kg

Software

- Window system: X11R5 server
- Font service: TFTP, NFS, DAP, Font Server,
- Protocols: TCP/IP, Telnet, SLIP, LAT, MOP, BOOTP, RARP
- Name service: Domain, IEN 116
- Local clients: Telnet, LAT, Serial, Set up, NCDwm (window manager with OSF Motif look and feel and OPEN LOOK features)
- Boot options: PROM resident, download from central host, flash memory
- Network management: Information menus, SNMP (MBII compliant with NCD extensions), PING utility, Ethernet or token-ring statistics, protocol statistics, packet received LED configurable on keyboard, remote reset
- Configuration: Local, remote or download from central host, remote reset

2.3. 3Com's CS/2600 Terminal Server

The 3Com's CS/2600 Terminal Server is used on Escala EPC as Console Concentrator.

Refer to the Console Concentrator description.

3. Bull Line Matrix Printers

3.1. PR802A Line Matrix Printers

The PR802A is a high performance line matrix impact printer that is designed for heavy-duty dot-matrix printing applications. The PR802A allows to combine text, graphic, bar codes, logos ...

The PR802A features the following:

- 900/662/353 lines per minutes (high speed draft/Data processing/Near letter quality)
- 150 OCR A/B per minutes
- P-series protocol and various emulations (Serial Matrix, Proprinter, Epson FX)
- Dynamic font selection
- Major usual character sets are resident, including Arabic, Cyrillic, Greek, Hebrew, Turkish, etc...
- Up to 6 parts, continuous fan folded forms, with variable width from 3 to 17"
- 136 characters per line at 10 CPI
- VFU: 14 channels Electrical Vertical Format Unit used on P-Series emulation
- Parallel Centronics and serial EIA 232 / RS 422 interfaces
- Quiet cabinet allowing less than 52 dBA acoustic noise
- Energy saving mode feature

The PR802A can be equipped with an Intelligent Graphic Processor (IGP) which allows to use PGL and VGL languages in order to generate forms overlay, variable bar codes, expanded characters, graphics, logos, reverse printing, rotated printing, etc. The IGP is available as an option.

The PR802A is available in two versions: First version uses a gravity paper stacking, the second version is equipped with a powered paper stacking, which insure a perfect stacking of printed paper for heavy duty applications.

The PR802A provides Euro support.

System attachment

The PR802A attaches to the system unit using one of the following:

- parallel printer cable to the standard parallel port (see cable catalog for more information)
- asynchronous cables EIA-232C to a standard serial port or to an 8, 16 or 64 ports EIA-232C adapter port
- asynchronous cables RS-422A to a standard serial port or to an 8, 16 or 64 port RS-422A adapter port (available through a DPNS or a RPQ)
- Ethernet LAN (10BaseT and 10Base2)

3.2. PR902A Line Matrix Printers

The PR902A is a very high performance line matrix impact printer that is designed for heavy-duty dot-matrix printing applications. The PR902A allows to combine text, graphic, bar codes, logos ...

The PR902A features the following:

- 1400/1050/560 lines per minutes (high speed draft/Data processing/Near letter quality)
- 253 OCR A/B per minutes
- P-series protocol and various emulations (Serial Matrix, Proprinter, Epson FX)
- Dynamic font selection
- Major usual character sets are resident, including Arabic, Cyrillic, Greek, Hebrew, Turkish, etc...
- Up to 6 parts, continuous fan folded forms, with variable width from 3 to 17"
- 136 characters per line at 10 CPI
- VFU: 14 channels Electrical Vertical Format Unit used on P-Series emulation
- Parallel Centronics and serial EIA 232 / RS 422 interfaces
- Quiet cabinet allowing less than 52 dBA acoustic noise
- Energy saving mode feature

The PR902A can be equipped with an Intelligent Graphic Processor (IGP) which allows to use PGL and VGL languages in order to generate forms overlay, variable bar codes, expanded characters, graphics, logos, reverse printing, rotated printing, etc. The IGP is available as an option.

The PR902A is available in two versions: First version uses a gravity paper stacking, the second version is equipped with a powered paper stacking, which insure a perfect stacking of printed paper for heavy duty applications.

The PR902A provides Euro support.

System attachment

The PR902A attaches to the system unit using one of the following:

- parallel printer cable to the standard parallel port (see cable catalog for more information)
- asynchronous cables EIA-232C to a standard serial port or to an 8, 16 or 64 port EIA-232C adapter port
- asynchronous cables RS-422A to a standard serial port or to an 8, 16 or 64 port RS-422A adapter port (available through a DPNS or a RPQ)
- Ethernet LAN (10BaseT and 10Base2)

3.3. Printers Summary Table

	Line Matrix Printers, Graphics, Barcodes, Interfaces // and RS232C				
PRUF005-000A	PR802A	270/900	lpm	Cabinet Model	Stacking Gravity
PRUF008-000A	PR802AS	270/900	lpm	Cabinet Model	Powered Paper Stacker
PRUF006-000A	PR902A	432/1400	lpm	Cabinet Model	Stacking Gravity
PRUF007-000A	PR902AS	432/1400	lpm	Cabinet Model	Powered Paper Stacker
	Options for all Line Matrix Printers				
PRFF003-0000	Network (10-Base-T)				
PRFF005-0000	Graphic interface PRX02 and Euro				

	Line Matrix Printers Performances - lpm	
	Upper characters Draft/Data processing/Near letter quality	Mixed characters Draft/Data processing/Near letter quality
PR802/802A	900/662/353	770/529/270
PR902/902A	1400/1050/560	1197/840/432

4. Graphics Monitors

4.1. 15-inch Color Monitor

The 15" Color Display is intended for graphics applications. It provides sharp, bright and realistic colors with minimum distortion. The anti-reflective CRT surface treatment eliminates screen reflections while optimizing image quality.

The 15" Display is a high resolution multisync graphics raster scan color Display.

Main characteristics are:

Picture tube	Type and size	15", Diagonal, Flat
	Dot Pitch:	0.28 mm
	Face treatment	Non Glare, Anti-Static
Input	Signal	R.G.B. Analog
	Connector	15Pin, D-Type
Synchronization Range	Horizontal	30KHz to 70KHz (Automatic)
	Vertical	50Hz to 150Hz (Automatic)
Video Bandwidth		85MHz (-3dB)
Display	Area (H x V)	260 x 195 mm
	Color	Unlimited colors, depends on graphics board
	Resolution	Up to 1280x1024 at 60 Mhz
Compatibility	VGA, S-VGA, XGA, VESA	
Power Source	100-240VAC (Universal Power) 1.8A 80W (Max.)	
Dimensions	365(W)x370(H)x384(D)mm	
Weight	12.9 Kg	
Environment	Operating	+5°C to +35°C, Humidity 35% to 80%
	Storage	-30°C to +60°C, Humidity 30% to 85%

The 15" Display meets the following electromagnetic emissions and safety standards:

Emissions:

- Nordic MPR-II Basic
- FCC Part 15, Subpart J, Class B
- CE
- CSA C108.8, Class B
- CISPR 22, Class B EN (55022)
- EPA ENERGY STAR

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 220
- NEMKO, DEMKO, FIMKO, SEMKO
- IEC 380/950 Safety (TUV) EN (60950)
- ISO 9241 parts 3 recommendations for VDT ergonomics
- DHHS

4.2. Power GXT130P Graphics Accelerator (GTFG048-0000)

The POWER GXT130P is a versatile, low-priced 2D graphics accelerator for Escala servers. This accelerator delivers exceptional 2D graphics performance for AIX systems at a low price .
The POWER GXT130P is supported on the Escala S, E230, E250, T430 and T450.

Advantages

- Meets the performance and functional requirements of demanding 2D graphics for X Windows applications.
- Displays graphics and text for workstation applications that require very rich and complex visual information simultaneously.
- Provides an exceptional performance level of visual interaction for servers at an affordable price.

Hardware

- Utilizes a half-length PCI slot
- Concurrent colors: 256 out of 16.7 million
- RAM DAC frequency: 250MHz
- Maximum resolution: 1600 x1200 8-bit pixels
- Maximum refresh rate: 85Hz
- Memory bandwidth: 640MB/sec.
- Memory type: 8MB SDRAM
- Display Power Management Signaling (DPMS)

Features

- Supports 60 to 85Hz monitor refresh rates, including those that comply with ISO 9241 Part 3.
- Video acceleration features such as scaling and color space conversion.
- Supports screen resolutions of 640x480, 800x600, 1024x768, 1280x1024, 1600x1200 at 8-bits per pixel.
- Satisfies the ISO 9241 standard of visual quality, refreshing the screen at up to 85Hz for all resolutions.
- Provides a standard 15-pin DIN output connector for half-length PCI card slot.
- Supports:
  - Multisync monitors with at least a 64KHz horizontal scan capability.
  - DDC-2B-compliant multisync monitors with at least a 38KHz horizontal scan capability.

4.3 Keyboards

The keyboard features double-rate typematic default speed for the cursor keys. All keyboards are 102 keys, except the US model, which is 101 keys.

Keyboards available are:

- French
- US
- UK
- Italian
- German
- Spanish
- Danish
- Finnish/Swedish
- Norwegian
- Portuguese
- Belgian

ESCALA Attachment

The keyboard connects to the ESCALA keyboard port using a 2.75-m (9-ft) detachable cable with a 6-pin MINI-DIN connector.

4.3 Mouse

An optomechanical 3-Button Mouse (320 dpi) allows users to point to and select items on a display. The cover on the mouse snaps off for routine cleaning of the roller ball.

ESCALA Attachment

The mouse connects to the system unit mouse port using a 2.75-m (9ft) detachable cable with a 6-pin MINI-DIN connector. The mouse controller is built into the system unit.

Chapter 7: Reference Information

The following sections present information that will help you plan for the Escala EPC400, EPC430, EPC440, EPC450, EPC800, EPC1200, EPC1200A and EPC2400 system units, and devices.

1. Physical Considerations

The following is a summary of the information you can use to compare systems and external removable media, and plan office space for the Escala EPC Series.

System Unit or Device	Height	Width	Depth	Minimum Weight	Maximum Weight
Model EPC400 - Rack CPU drawer	1775 mm (69.8 in)	580 mm (22.8 in)	1080 mm (42.5 in)	-	490 kg (1089 lbs)
Model EPC440 CPU drawer	350 mm (13.8 in)	443 mm (17.5 in)	870 mm (34.3 in)	71.4 kg (157 lbs)	88.6 kg (195 lbs)
Model EPC800 - Rack CPU drawer	1775 mm (69.8 in)	580 mm (22.8 in)	1080 mm (42.5 in)	-	490 kg (1089 lbs)
Model EPC1200/1200A - CEC Rack I/O rack I/O drawer (7 EIA units, for EPC1200) I/O drawer (10 EIA units, for EPC1200A)	1577 mm (62 in) 1577 mm (62 in) 306 mm (12.1 in) 440 mm (17.3 in)	567 mm (22.3 in) 650 mm (25.5 in) 442 mm (17.4 in) 443 mm (17.5 in)	1041 mm (40.98 in) 1019 mm (40.1in) 748 mm (29.5 in) 843 mm (33.2 in)	-	400 kg (880 lbs) 159 kg (349 lbs) 61 kg (135 lbs) 93 kg (205 lbs)
Model EPC2400 - CEC Rack I/O rack I/O drawer (10 EIA units)	1577 mm (62 in) 1577 mm (62 in) 440 mm (17.3 in)	567 mm (22.3 in) 650 mm (25.5 in) 443 mm (17.5 in)	1041 mm (40.98 in) 1019 mm (40.1in) 843 mm (33.2 in)	- - 89 kg (195 lb)	400 kg (880 lbs) 130 kg (286 lbs) 93 kg (205 lbs)

System Unit or Device	Height	Width	Depth	Minimum Weight	Maximum Weight
DAS1300 - Rack unit	267 mm (10.5 in)	483 mm (19 in)	762 mm (30 in)		70 kg (155 lbs)
DAS2900 - Rack unit	356 mm (14 in)	483 mm (19 in)	762 mm (30 in)		79 kg (176 lbs)
DAS3200 - Rack unit	468 mm (18.4 in)	483 mm (19 in)	762 mm (30 in)		111 kg (254 lbs)
DAS3500 - Rack unit	468 mm (18.4 in)	483 mm (19 in)	762 mm (30 in)		99 kg (220 lbs)
DAS5700: DPE Enclosure rackmount	286 mm (11.25 in)	445 mm (17.5 in)	692 mm (27.2 in)		52 kg (115 lbs)
DAS5700: DAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		35.4 kg (78 lbs)
DAS5300: iDAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		36 kg (80 lbs)
DAS5300: DAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		35.4 kg (78 lbs)
DAE5000: DAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		35.4 kg (78 lbs)
SSA - Rack unit	171 mm (6.7 in)	444 mm (17.5 in)	665 mm (26.2 in)		50 kg
DLT4000/DLT7000 - Rack unit	146 mm (5.7 in)	235 mm (9.2 in)	332 mm (13 in)	6.6 kg (114.9 lbs)	7.1 kg (15 lbs)

2. Electrical Requirements & Considerations

System Unit or Device	Power Source Loading (Typical in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (Typical in BTU/hr)	Power Requirement (Typical in Watts)	Power Factor	Max. Altitude
Model EPC400 - CPU drawer	0.748	200 to 245	50 or 60	2550	-	-	2500 m (8202 ft)
Model EPC430 - CPU drawer	0.748	200 to 245	50 or 60	2550	-	-	2550 m (8366 ft)
Model EPC440 - CPU drawer	0.46	200 to 240	50 or 60	1485	434	0.9 - 0.98	915 m (3000 ft) (1)
Model EPC450 - CPU drawer	0.748	200 to 245	50 or 60	2550	-	-	2550 m (8366 ft)
Model EPC800 - CPU drawer	1.1	90 to 137 or 180 to 253 (autoranging)	50 or 60	2000 kcal/h	1000	0.95	2500 m (8202 ft)
Model EPC1200/1200A CEC rack I/O rack I/O drawer (EPC1200/1200A)	1.887 up to 4.8 per PDU 0.52	200 to 240	50 or 60	6055 3250	1774 900	-	2135 m (7000 ft)
Model EPC2400 CEC rack I/O rack I/O drawer	1.887 4.8 per PDU 0.4	200 to 240	50 or 60 - -	6055 - 1228	1774 - 360	0.96 - -	2135 m (7000 ft) - -

(1): For altitudes above 195 meters, the maximum temperature limit is derated by 1 degree C for every 137 meters of elevation above 195 meters

System Unit or Device	Power Source Loading (in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (in BTU/hr)	Power Requirement (in Watts)	Power Factor (min@full power)	Max. Altitude
DAS1300 - Rack unit	0.6 (max)	100 to 240 (autoranging)	47 to 63 (autoranging)	2000 (max)	575	0.95	2438m (8,000 ft)
DAS2900 - Rack unit	0.9 (max)	100 to 240 (autoranging)	47 to 63 (autoranging)	3000 (max)	880	0.95	2438m (8,000 ft)
DAS3200 - Rack unit	1.05 (max)	200 to 240 (autoranging)	47 to 63 (autoranging)	3500 (max)	1000	0.98	2438m (8,000 ft)
DAS3500 - Rack unit	1.2 (max)	200 to 240 (autoranging)	47 to 63 (autoranging)	4000 (max)	1150	0.95	2438m (8,000 ft)
DAS5700: DPE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.95	2438m (8,000 ft)
DAS5700: DAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.98	2438m (8,000 ft)
DAS5300: iDAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.95	2438m (8,000 ft)
DAS5300: DAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.98	2438m (8,000 ft)
DAE5000: DAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.98	2438m (8,000 ft)

System Unit or Device	Power Source Loading (Typical in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (Typical in BTU/hr)	Power Requirement (Typical in Watts)	Power Factor	Max. Altitude
SSA - Rack unit	0.657	90 to 260 (autoranging)	47 to 63 (autoranging)	2074	657	0.99	12192 m (40,000 ft)
DLT4000/DLT7000 - Rack unit	-	100 to 240 (autoranging)	47 to 63	-	50	-	9150 m (30000 ft)

3. Temperature, Relative Humidity, and Maximum Wet Bulb Requirements

System Unit or Device	Temperature		Relative Humidity (non-condensing)		Max Wet Bulb	
	Operating	Non-Operating	Operating	Non-Operating	Operating	Non-Operating
Model EPC400 - CPU drawer	10°C to 32°C Gradient: 10°C/h	5°C to 50°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC430 - CPU drawer	10°C to 32°C Gradient: 10°C/h	5°C to 50°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC440 - CPU drawer	10°C to 40°C	10°C to 52°C	8% to 80%	8% to 80%	27°C (80°F)	27°C (80°F)
Model EPC450 - CPU drawer	10°C to 32°C Gradient: 10°C/h	5°C to 50°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC800 - CPU drawer	10°C to 40°C Gradient: 10°C/h	5°C to 55°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC1200/1200A - CEC rack I/O rack - I/O drawer	10°C to 40°C	10°C to 52°C (50°F to 125°F)	8% to 80%	8 to 80%	23°C (73°F)	27°C (80°F)
Model EPC2400 - CEC rack I/O rack - I/O drawer	10°C to 40°C	10°C to 52°C (50°F to 125°F)	8% to 80%	8 to 80%	23°C (73°F)	27°C (80°F)

System Unit or Device	Temperature		Relative Humidity (non-condensing)		Max Wet Bulb	
	Operating	Non-Operating	Operating	Non-Operating	Operating	Non-Operating
DAS1300/2900/3200/3500, DAS5300 DAS5700, and DAE5000 - Rack units	10°C to 38°C	-40°C to 65°C	20 to 80%	10 to 90%	23°C (73°F)	27°C (80°F)
SSA - Rack unit	10°C to 40°C	10°C to 52°C	8 to 80%	8 to 80%	23°C (73°F)	27°C (80°F)
DLT4000/DLT700 - Rack unit	10°C to 40°C	10°C to 40°C	20 to 80%	10 to 90%	-	-

Note: If any tape drive is installed, the minimum relative humidity of a system unit is 20%. If a CD-ROM Drive is installed, the minimum relative humidity of a system unit is 10%.

4. Noise Emissions Values

System Unit or Device	LWAd		LpAm		<LpA>m			
	Operating (bels)	Idle (bels)	Operating (dBA)	Idle (dBA)	Operating (dBA)	Idle (dBA)	Impulsive Noises	Prominent Discrete Tones
Model EPC400 - CPU drawer	6.3	6.1	-	-	-	-	No	No
Model EPC430 - CPU drawer	6.6	6.4	-	-	-	-	No	No
Model EPC440 - CPU drawer	6.2	5.9	-	-	43	40	No	No
Model EPC450 - CPU drawer	6.6	6.4	-	-	-	-	No	No
Model EPC800 - CPU drawer	6.0	5.5	-	-	-	-	No	No
Model EPC1200/1200A - CEC rack	7.0	7.0	-	-	-	-	No	No
EPC1200 I/O drawer	5.9	5.8	-	-	39	38	No	No
EPC1200A I/O drawer	5.9	5.3	-	-	-	-	No	No
Model EPC2400 - I/O Drawer	5.9	5.3	-	-	-	-	No	No

System Unit or Device	LWAd		LpAm		<LpA>m			
	Operating (bels)	Idle (bels)	Operating (dBA)	Idle (dBA)	Operating (dBA)	Idle (dBA)	Impulsive Noises	Prominent Discrete Tones
DAS1300 - Rack unit			N/A	N/A			No	No
DAS2900 - Rack unit	6.8	6.6	N/A	N/A	55	50	No	No
DAS3200, DAS3500, DAS5700, and DAE5000 - Rack unit			N/A	N/A			No	No
SSA - Rack unit	6.15	6.1	N/A	N/A	-	-	No	No
DLT4000/DLT7000 - Rack unit	4.9	4.9	N/A	N/A	-	-	No	No
DAS5300					54	50	No	No

Notes about Noise Emission Values:

1. L_{WAd} is the declared sound power emission level for a production series of machines
2. L_{pAm} is the mean value of the sound pressure emission levels at the operator position (if any) for a production series of machines
3. $<L_{pA}>$ is the mean value of the space-averaged sound pressure emission levels at the one-meter positions for a production series of machines
4. N/A = Not Applicable (no operator position)
5. All measurements are made in accordance with ISO DIS 779, and reported in conformance with ISO DIS 7574/4

Chapter 8: Conformance to Standards

This Chapter provides information about Escala EPC conformance to standards.

The set of standards of Bull's Escala range is also fully applicable to Escala EPC.

1. Conformance to Standards—EPC400 and EPC430

Identification	Conformance	Certification	Comments
Electrical and Environmental Requirements			
Power			
EN 60950	Y	Y	Product ranking
IEC 555-2	Y	Y	
Safety Standards			
UL 1950	Y	Y	Underwriters Laboratories
CSA C22.2 No. 950-M89	Y	Y	
EN 60950 (1992 + A1 1993)	Y	Y	European Norm
IEC 950 Edition 1	Y	Y	International Electrotechnical Commission
Directive 73/23/EEC	Y	Y	CE Marking
EMC/EMI			Disturbances produced by devices
FCC CFR47 Class A	Y	Y	US
CSA C108.8 Class A	Y	Y	
VCCI Class 1	Y		Japan
EN 55022 (1988) Class A	Y	Y	Norway, Europe
CISPR 22 Class A	Y	Y	
Directive 89/336/EEC	Y	Y	CE Marking
Susceptibility to External Electromagnetic Disturbance			
EN 61000 -4 -2	Y	Y	Electrostatic discharges
EN 61000 -4 -3	Y	Y	Radiated, radio frequency, electromagnetic field
EN 61000 -4 -4	Y	Y	Electrical fast transient/burst
EN 61000 -4 -5	Y	Y	Surge immunity test
EN 61000 -4 -6	Y	Y	Conducted disturbances induced by radio frequency fields
EN 61000 -4 -11	Y	Y	Voltage dips, short interruptions and voltage variations
EN 61000 -3 -2	Y	Y	Limits for harmonic current emissions
EN 61000 -3 -3	Y	Y	Limitation of voltage fluctuation and flicker
Directive 89/336/EEC	Y	Y	CE Marking
Environment Temperature			
Operating limits: Max gradient 10C/hour	10 - 38°C		
Non-operating limits: Max gradient 25C/hour	5 - 50°C		
Relative Humidity			
Operating limits: Max gradient 10%/hour, Moisture content 0.019 Kg_water/Kg_dry_air		20 to 80%	Wet: bulb + 24°C
Non-operating limits: Max gradient 30%/hour, Moisture content 0.024 Kg_water/Kg_dry_air		5 to 95%	Wet: bulb + 28°C
Acoustic Noise			
ISO 7779			Reference
C012C Class 2	Y		
Mechanical Constraints			
IEC 68-2			Reference
C013C class 1	Y		Bull standard
Packing and Packaging			
ISO 780, 2234, 2248, 3676, 4180-2, 4189-2	Y		
C138C	Y		Bull standard: Packaging configuration and labels
European Directives			
72/23/CEE	Y	Y	
89/336/CEE	Y	Y	

2. Conformance to Standards—EPC800

Status of ESCALA conformance to standards

July 5, 1996

Identification	Conformance	Certification	Comments
Electrical and Environmental Requirements			
Power			
IEC 950 class I	Y	Y	Product ranking
IEC 555-2	Y	Y	
Safety Standards			
UL 1950	Y	Y	Underwriters Laboratories
CSA C22.2 No. 950-M89	Y	Y	
EN 60950 (1992 + A1 1993)	Y	Y	European Norm
IEC 950 Edition I	Y	Y	International Electrotechnical Commission
Directive 73/23/EEC	Y	Y	CE Marking
EMC/EMI			Disturbances produced by devices
FCC CFR47 Class A	Y	Y	US
VDE 871 6/78 Class A	Y		Germany
CSA C108.8 Class A	Y	Y	
VCCI Class I	Y		Japan
EN 55022 (1988) Class A	Y	Y	Norway, Europe
CISPR 22 Class A	Y	Y	
Directive 89/336/EEC	Y	Y	CE Marking
Susceptibility to External Electromagnetic Disturbance			
IEC 801-2 severity level 3	Y	Y	Electrostatic discharges
IEC 801-3 severity level 2	Y	Y	Electric field
IEC 801-4 severity level 3	Y	Y	Conducted disturbances (fast transiant)
IEC 801-5 severity level 3	Y	Y	Voltage/current surges
IEC 801-6 severity level 2	Y	Y	Conducted Sine Wave disturbance
EN 50082-1 (1992)	Y	Y	European Norm
Directive 89/336/EEC	Y	Y	CE Marking
Environment Temperature			
Operating limits: Max gradient 10C/hour	10 - 32°C		
Non-operating limits: Max gradient 25C/hour	5 - 50°C		
Relative Humidity			
Operating limits: Max gradient 10%/hour, Moisture content 0.019 Kg_water/Kg_dry_air		20 to 80%	Wet: bulb + 24°C
Non-operating limits: Max gradient 30%/hour, Moisture content 0.024 Kg_water/Kg_dry_air		5 to 95%	Wet: bulb + 28°C
Acoustic Noise			
ISO 7779			Reference
C012C Class 2	Y	Y	
Mechanical Constraints			
IEC 68-2			Reference
C013C class 1	Y	Y	Bull standard
Packing and Packaging			
ISO 780, 2234, 2248, 3676, 4180-2, 4189-2	Y		
C138C	Y		Bull standard: Packaging configuration and labels
European Directives			
72/23/CEE	Y	Y	
89/336/CEE	Y	Y	

Escala EPC Series Reference Guide

This edition of the Escala EPC Series Reference Guide describes the Escala EPC Series offer enhanced in:

- **30 April 1999**

The Escala Powercluster Technical Guide consists of a single section:

Section 1: System Hardware, Terminals and Printers

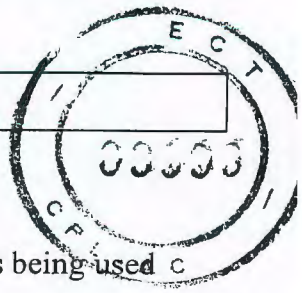
- This Section consists of 8 chapters: Hardware Overview, Models Description, Disks/Media/Subsystems and Libraries, Memory Expansion Cards, Interconnections, Communications Adapters, and Modems, Cluster Management/Terminals and Printers, Reference Information, Conformance to Standards

Escala EPC Series Reference Guide

Section 1

System Hardware, Terminals and Printers

Contents:



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Chapter 1: Hardware Overview

1. Escala EPC Positioning and Strategy

The Escala EPC is targeted to users who need:

- Server consolidation.
- Large OLTP server.
- E-commerce.
- Large database server (Datacenter).
- Large Decision Support (DSS) Server.
- Supply Chain Management (SCM).
- Customer Relationship Management (CRM).
- Enterprise Resource Planning (ERP) server in three tier architecture.

The Escala EPC provides:

- Solutions to improve decision making & enterprise department management (e.g. Supply Chain Management & Customer Relationship Management).
- Power & reliability for high-speed query response times, without system interruption.
- Consolidation solutions to avoid the high administration & maintenance costs of overly distributed systems.
- Scalability & flexibility to adapt to growing business needs and provide investment protection.
- High availability to avoid costly downtimes and data loss.
- Easy management facilities to reduce training costs.
- Unix high-level expertise to optimize implementation of customers' IT projects.
- Affordable prices to optimize IT budget allocation.

Customers' benefits with EPC solutions are the following:

- Lower investments (consolidation).
- Reduced total cost of ownership.
- Better budget allocation monitoring.
- Floor space use optimization.

The strategy is to enforce the Escala EPC offer in the following areas:

Performance & scalability

- Highly powerful, well-balanced architecture.
- 64-bit capable.
- Unlimited power growth allowing to cluster up to 32 nodes with 1 to 24 CPUs (depending on the EPC model) in a high availability environment, and even more nodes in a non-HA environment.

Robustness and availability for production

Downtime reduced to a few minutes per year, with HA, storage and backup solutions plus manageability tools.

Industry-leading solutions portfolio

Broadest choice of partner solutions and services: SAP, BAAN, Oracle, Informix, Netscape and over 15,000 AIX® applications.

Security for vital business assets

Leading set of security tools and solutions with AIX®, Internet/Intranet and end-to-end enterprise security management.

Expertise in services and support

A complete set of service packages, customer benchmarking facilities and highly skilled consulting services.

2. Escala EPC General Features

The Escala EPC provides easy-to-use clusterable SMP (Symmetrical Multi-Processing) nodes, based on Bull's PowerScale™ architecture and on PowerPC™ technology, giving exceptional reliability and availability, scalability and flexibility, parallel computing power and high levels of fault resiliency and redundancy.

Bull Escala EPC products are clusters of UNIX-based Escala computers. The Escala EPC family is based on the PowerPC RISC architecture using symmetric multiprocessing.

2.1. Reliability and Availability

Excellent quality and reliability are inherent in all facets of Bull EPC products. The measures taken help ensure that the products operate when required, perform reliably, efficiently handle infrequent failures in a nondisruptive fashion, and provide timely and competent repair to allow resumption of operations with minimal inconvenience. For example, the Escala EPC servers have embedded service processor and ECC memory.

The AIX operating system and appropriate software tools make the most of the Escala EPC hardware features by providing:

- Error monitoring (including alarm transmission).
- Remote service session management.

Remote maintenance and diagnostics - including console mirroring from a remote site - allows a service technician to dial in through a secure connection and correct a potential malfunction before it occurs or reboot and restore system function as soon as possible after an outage. For even greater reliability, the platform also supports HACMP clustering software, the leading UNIX clustering solution.

Reliability begins with the development of architectures, where RAS innovations are of paramount importance. It flows through design and product development stages, where RAS designs are reviewed, assessed, developed, evaluated, and optimized. It continues through the manufacturing and release processes, where the manufacturing quality is extensively measured and is under continual evaluation. It culminates in service and support, where reliability is consistently monitored for deviation from the criteria, warranty and maintenance have undivided focus, and where significant customer business problems are assigned to a key managerial representative and remedied by an expert team.

2.2. Scalability

Scalability is also a key design consideration. The Escala servers can be easily upgraded. The packaging permits convenient replacement or upgrading of processor, memory and I/O adapters. For example, processors are contained on processor cards that plug into slots on the system board. Upgrading a system is just a matter of plugging in an additional processor card.

The AIX operating system provides reliability and serviceability by means of Logical Volume Manager (LVM), Journaled File System (JFS) and dynamic kernel, all contributing to a reliable and robust operating system implementation.

2.3. Cluster Architecture - Escala EPC Clustering Design

A cluster architecture can be defined as a rather small set (a few tens) of interconnected systems that share some resources (which will be referred to as clustered resources) in a fully transparent manner. Each of these systems could be an independent system, because it has its own processor(s), memory, and I/O channels, as well as its own copy of the operating system.

The operating system for a cluster provides transparent access to clustered resources, and also provides a unified view of the cluster for system management.

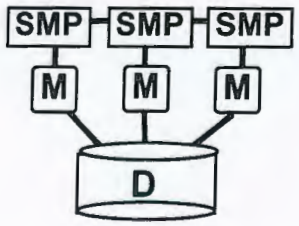
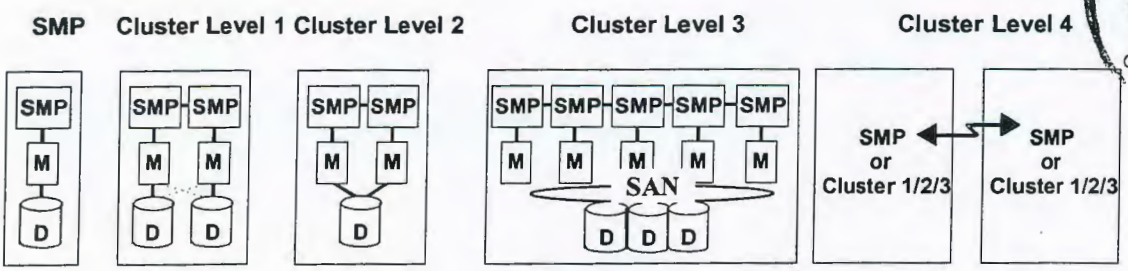


Figure 1: Cluster architecture

Clustering of Symmetric MultiProcessing (SMP) systems with shared disks is a choice acknowledged as the most appropriate to insure both full compatibility, high availability and a steady increase of the performance for UNIX production environment. The first Escala EPC cluster offers started with a shared disk architecture (depicted in figure 1 wherein M stands for Memory and D stands for shared disks). Clustering was an answer to overtop the limitations of SMP technology.

The EPC in its current stage encompasses, in a same cluster unit, cooperative SMP servers with or without shared disks, and individual SMP servers, as depicted in figure 2. With the construct of only individual servers, this cluster architecture includes the definition of server consolidation.



	Targets	Typical nb. of nodes	Typical apps.
SMP	non-critical applications departmental and dedicated server	1	DB/TP DW, WEB
Cluster Lev.1	critical (HA) applications departmental to enterprise dedicated server	2	DB/TP DW, WEB
Cluster Lev.2	critical, "share everything" applications (OPS) departmental to enterprise dedicated server	2 - 8	DB/TP Large DW
Cluster Lev.3	Storage Aera Network for critical and 3-tier applications, large department, enterprise server	2 - 32	ERP, WEB Large DW+data mart
Cluster Lev.4	geograhic cluster (disaster recovery) departmental to enterprise server	2 - 4	DB/TP, ERP Large DW

Figure 2: Cluster Main Topologies

HACMP (High Availability Cluster Multi-Processing for AIX) is the core framework for clustering. It provides mechanisms for controlling the cluster. The main HACMP module "High Availability Subsystem" (HAS) is in charge of recognizing changes within the cluster and starting, coordinating the actions needed, when a failure occurs, for reconfiguring the environment and assuring resources takeover. In addition, HACMP features a module, the "Concurrent Resource Manager" (CRM) which adds concurrent shared access management for the disks.

The Escala EPC implements the full HACMP functionality on rackmounted multiple clustered Escala systems, and achieves both inherent high availability and more performance with the CRM.

The HACMP 4.3 environment supports up to 32 nodes, while the CRM supports up to 8 nodes.

The cluster interconnect is based on Ethernet (10/100 Mb/s, 1 Gb/s) and FDDI. Dual connections are often used to increase availability.

The main benefits of the cluster architecture are:

- Centralized administration (single point of control).
- Scalability.
- Flexibility.
- Parallel performance.
- High Availability features.

The rationale of the Bull approach is to exploit the various architectural options in a common framework. The goal is to benefit from both SMP scalability (with the PowerScale Architecture) within the limits of the technology and cluster configurations for high availability, and higher performance for applications that can benefit from this form of parallelism.

2.4. PowerPC

2.4.1. Architecture

The PowerPC architecture is a derivative of the multi-chip POWER architecture that has been developed specifically for single-chip processor designs. The changes incorporated in the PowerPC architecture from POWER architectures are:

- Simplified instruction set.
- Single precision floating point.
- Modified storage model.
- Multi-processor support.
- Simplified I/O architecture.

The PowerPC architecture is binary compatible with applications written for POWER architecture. Any unimplemented, infrequently used POWER instructions are trapped and emulated.

2.4.2. Technology

PowerPC 604e Processor

The PowerPC 604e is a superscalar processor capable of issuing four instructions simultaneously. As many as seven instructions can finish execution in parallel. The PowerPC 604e has six execution units that can operate in parallel:

- Floating-point unit (FPU)
- Branch processing unit (BPU)
- Condition Register Units
- Load/store unit (LSU)
- Three integer units (IUs)
  - Two single-cycle integer units (SCIUs)
  - One multiple-cycle integer unit (MCIU).

This parallel design, combined with the PowerPC architecture's specification of uniform instructions that allows for rapid execution times, yields high efficiency and throughput. The PowerPC 604e's rename buffers, reservation stations, dynamic branch prediction, and completion unit increase instruction throughput, guarantee in-order completion, and ensure a precise exception model. (Note that the PowerPC architecture specification refers to all exceptions as interrupts.)

The PowerPC 604e has separate memory management units (MMUs), and separate 32-KB on-chip caches for instructions and data. The PowerPC 604e implements two 128-entry, two-way set (64-entry per set), associative Translation Lookaside Buffers (TLBs), one for instructions and one for data, and provides support for demand-pages virtual memory address translation and variable-sized block translation. The TLBs and the cache use least-recently used (LRU) replacement algorithms.

The PowerPC 604e has a 64-bit external data bus and a 32-bit address bus. The PowerPC 604e interface protocol allows multiple masters to compete for system resources through a central external arbiter. Additionally, on-chip snooping logic maintains data cache coherency for multiprocessor application. The PowerPC 604e supports single-beat, and burst data transfers for memory accesses and memory-mapped I/O accesses.
The PowerPC 604e uses an advanced, 3.3-V CMOS process technology and is fully compatible with TTL devices.

PowerPC RS64-II Processors

The PowerPC RS64-II is a 4-way, superscalar microprocessor implementing the 64-bit PowerPC architecture. The internal structure of the processor is optimized for commercial transactions.

- Full 64-bit implementation of PowerPC architecture.
- Architectural extensions for 32-bit OS migration support.
- PowerPC Common Hardware Reference Platform (CHRP) compliant.
- 4-way superscalar.
- On chip 64KB L1 Instruction cache and 64KB Data cache, 128-byte line size.
- On chip L2 cache controller:
  - Up to 8 MB 4-way set associative L2 cache using 4 Mbit SRAM chips.
  - Up to 32 MB 4-way set associative L2 cache using 16 Mbit SRAM chips.
  - 32 Byte Data Buses.
- PowerPC 6XX Bus Architecture:
  - 16 Byte data bus (2:1, 3:1 or 4:1).
- Full multiprocessor support.
- Technology:
  - CMOS 6S2.
  - Standard Cell Library.
- Data Integrity:
  - L1 Data cache = ECC.
  - L1 Instruction cache = Parity and Retry.
  - L2 cache = ECC.
  - Main Storage = ECC.
  - I/O and Bus = Parity.

PowerPC RS64-III Processors

The RS64 III superscalar processors have been well optimized for commercial workloads. Target environments are characterized by heavy demands on system memory, both in the form of very large working sets and latency-sensitive serial dependencies. As a result, the design of the RS64-III processors has focused on large cache sizes and data paths having high bandwidth and low latency.

The RS64 III processor has separate internal 128 KB L1 caches for instructions and data. Both L1 caches have doubled in size over the RS64-II. It contains an L2 cache controller and a dedicated 32-byte interface to a private 4-way set associative L2 cache. The L2 cache controller supports up to 8 MB L2 cache. The L2 interface runs at half processor speed, but transfers data twice per cycle to provide 14.4 GB/s of bandwidth. RS64 III internal data paths are 32 bytes wide. The RS64 III processor also has a separate 16-byte system bus interface.

The RS64-III has a total of five pipeline execution units. There is a Branch Unit, a Load/Store Unit, a Fixed-point Unit, a Complex Fixed-point Unit and a Floating-point Unit. The processor has a 32-byte interface to the dispatch logic. There is a current instruction stream dispatch buffer that is 16 instructions deep. The RS64-III has an eight deep branch buffer. The RS64-III can sustain a decode and execution rate of up to 4 instructions per cycle.

All of the arrays in the RS64-III have either redundancy and ECC or parity and retry to support the high requirements desired for customer reliability, availability and integrity. This enables full fault detection and correction coverage.

Benefits to Escala Performance

The Escala models have the following major attributes:

- The operating system can schedule and synchronize work across the available processors.
- A high-bandwidth bus is provided for access between cache and memory.
- Cache and memory are efficiently managed to provide cache consistency.

An example of how the design of the Escala servers can maximize performance follows:

- The most recently used or projected to use program elements are kept in L1 cache (fastest access).
- Programs and control objects are kept in L2 cache (next fastest).
- Directories to databases are kept in memory (next fastest to L2 cache).
- Actual databases are stored on disk drives.

3. Escala EPC Features Summary

The Bull Escala EPC offer is made of rackable nodes that can be assembled into clusters of UNIX-based Escala computers or racked together for consolidation. The main elements of this offer are nodes, interconnection, cluster or node management, disk subsystems and tapes/libraries subsystems. Whenever possible these elements can be integrated into racks.

The Escala EPC offer comprises ranges of tightly clusterable UNIX servers, scaleable up to 32 nodes in HA mode (and more without HA), which are linked by a coordinated system of standard-based networks and housed in a highly scaleable rack configuration. The clustering framework of the Escala EPC is implemented with HACMP subsystem installed on every node. Graphical console solutions provide cluster management and single point of control.

The Escala EPC family is composed of entry-level (EPC400 EPC430, EPC440 and EPC450), midrange (EPC800) and high-end (EPC1200, EPC1200A and EPC2400) systems.

3.1. Escala EPC Models and Nodes

The Escala EPC nodes are built from basic models. Each model is a basic component of an EPC Series. The need of power and scalability defines the EPC Series to choose for a Customer.

Each component of the Escala EPC is expandable by adding:

- CPU boards in the basic drawer.
- Memory boards (or banks).
- Internal disk/media devices or expansion drawers, disk subsystems (DAS and EMC) and tape library subsystems (DLT Overland).
- Adapter boards or expansion drawers.
- Nodes in the rack.

The following models are available:

3.1.1. ESCALA EPC400

- SMP rack-drawer server.
- 1- to 4-way PowerPC 604e @ 360 MHz.
- 4MB L2 cache per processor.
- Up to 3 GB ECC DRAM memory.
- Up to 218.4 GB of internal disk capacity:
  - 109.2 GB internal disks capacity in the base drawer.
  - 109.2 GB additional internal disk capacity with expansion drawer.
- 12 bays for hot swappable disks:
  - 6 bays in the base drawer.
  - 6 additional bays with expansion drawer.

- 5 bays for media:
  - 3 bays (1 for CD-ROM, 1 for floppy disk and 1 free) in the base drawer.
  - 2 additional media bays with expansion drawer.
- 18 free I/O slots:
  - 8 I/O slots in the base drawer: 5 64 bit PCI + 2 ISA/PCI + 1 ISA.
  - 2x5 additional free PCI slots with expansion drawer and expansion bus.
- Integrated Ethernet 10/100 Mb/s.
- 8117 transactions per minute.

3.1.2. ESCALA EPC430

- 64-bit SMP rack-drawer server.
- 1- to 4-way PowerPC RS64-II processors at 262 MHz.
- 4MB L2 cache per processor.
- Up to 8GB ECC SDRAM memory.
- Up to 218.4 GB of internal disk capacity:
  - 109.2 GB internal disks capacity in the base drawer.
  - 109.2 GB additional internal disk capacity with expansion drawer.
- 12 bays for hot swappable disks:
  - 6 bays in the base drawer.
  - 6 additional bays with expansion drawer. 6 bays in the base drawer.
- 5 bays for media:
  - 3 bays (1 for CD-ROM, 1 for floppy disk and 1 free) in the base drawer.
  - 2 additional media bays with expansion drawer.
- 18 I/O slots:
  - 8 I/O slots in the base drawer: 7 PCI (4*64 bit) + 1 ISA/PCI.
  - 10 additional free PCI slots with expansion drawer.
- Integrated Ethernet 10/100 Mb/s.
- 13700 transactions per minute.

3.1.3. ESCALA EPC440

- 64-bit SMP rack-drawer server.
- 1-to 4-way RS64-II processors at 340 MHz.
- 4MB L2 cache per processor.
- Up to 8GB ECC SDRAM memory.
- Up to 218.4 GB internal disks capacity.
- 12 bays for hot swappable disks.
- 3 bays for media (1 for a CD-ROM drive, 1 for a floppy disk drive and 1 free).
- 8 PCI slots (4*64 bit).
- Integrated Ethernet 10/100 Mb/s.

- 17133 transactions per minute.

3.1.4. ESCALA EPC450

- 64-bit SMP rack-drawer server.
- 1- to 4-way PowerPC RS64-III processors at 400 MHz.
- 4MB L2 cache per processor.
- Up to 8GB ECC SDRAM memory.
- Up to 218.4 GB of internal disk capacity:
  - 109.2 GB internal disks capacity in the base drawer.
  - 109.2 GB additional internal disk capacity with expansion drawer.
- 12 bays for hot swappable disks:
  - 6 bays in the base drawer.
  - 6 additional bays with expansion drawer.
- 5 bays for media:
  - 3 bays (1 for a CD-ROM drive, 1 for a floppy disk drive and 1 free) in the base drawer.
  - 2 additional media bays with expansion drawer.
- 18 I/O slots:
  - 8 I/O slots in the base drawer: 7 PCI (4*64 bit) + 1 ISA/PCI.
  - 10 additional free PCI slots with expansion drawer.
- Integrated Ethernet 10/100 Mb/s.
- More than 19000 transactions per minute.

3.1.5. ESCALA EPC800

(Discontinued: 31/12/1999)

- SMP rack-drawer server.
- 2- to 8-way PowerPC 604e @ 320 MHz.
- 4MB L2 cache per processor.
- Up to 4 GB ECC DRAM memory.
- Up to 72.8 GB of internal disk capacity:
  - 18.2 GB in the base drawer.
  - 54.6 GB additional disk capacity with the expansion disk drawer.
- 6 bays for hot swappable disk:
  - 2 bays in the base drawer.
  - 4 additional with the expansion disk drawer.
- 2 bays for media (1 for a CD-ROM drive, 1 for a floppy disk drive) in the base drawer.
- 3 bays for either disks or media:
  - 1 in the base drawer.
  - 2 additional bays with the expansion drawer.
- Up to 16 MCA slots:
  - 8 MCA in the base drawer with at least one slot used to drive media and disks.
  - 8 additional MCA slots with the expansion bus.
- Integrated Ethernet 10/100 Mb/s.

- 11400 transactions per minute.

3.1.6. ESCALA EPC1200 and EPC1200A

(EPC1200 discontinued as of 30/11/1999)

- 64-bit SMP system.
- 4-, 8-, or 12-way Power PC RS64-II@262 MHz or PowerPC RS64@125 MHz (EPC1200 only).
- 8 MB L2 cache per processor.
- Up to 32 GB memory.
- Up to 4 I/O drawers.
- Up to 873.6 GB internal disk capacity:
  - 218.4 GB per I/O drawer.
- 48 disk bays:
  - 12 bays per I/O drawer.
- 8 media bays:
  - 2 media bay per I/O drawer.
- Up to 56 PCI adapter slots:
  - One slot used for the service processor in the primary I/O drawer.
  - One slot used to drive media and disks in the primary I/O drawer.
  - 12 additional free slots in the primary I/O drawer.
  - 14 slots per additional I/O drawer.
- 34139 transactions per minute.

3.1.7. ESCALA EPC2400

- 64-bit SMP system.
- 6-, 12-, 18- or 24-way Power PC RS64-III processors at 450 MHz.
- 8 MB L2 cache per processor.
- Up to 64 GB memory.
- Up to 4 I/O drawers.
- Up to 873.6 GB internal disk capacity:
  - 218.4 GB per I/O drawer.
- 48 disk bays:
  - 12 bays per I/O drawer.
- 8 media bays:
  - 2 media bay per I/O drawer.
- Up to 56 PCI adapter slots:
  - One slot used for the service processor in the primary I/O drawer.
  - One slot used to drive media and disks in the primary I/O drawer.
  - 12 additional free slots in the primary I/O drawer.
  - 14 slots per additional I/O drawer.
- 135815 transactions per minute.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3.2. Escala EPC Models in Figures

	EPC400	EPC430	EPC440	EPC450	EPC800	EPC1200/1200A	EPC2400
Racks	1	1	1	1	1	2	
CPUs per node	1 to 4	1 to 4	1 to 4	1 to 4	2 to 8	4 to 12	6 to 24
I/O slots / node (max)	18	18	8	18	16	56	56
Memory / node (max)	3GB	8GB	8GB	8GB	4GB	32GB	64GB
Internal disk / node (max)	218.4GB	218.4GB	218.4GB	218.4GB	72.8GB	873.6GB	873.6GB
Transaction/minute per node (estimated min-max)	3325-8117 (2)	4600-13700 (3)	5700-17133 (3)	5800-19000 (3)	4100-11400 (2)	7250-18666 or 13800-34139 (1)(3)	42000-135815(3)

(1) With PowerPC RS64@125MHz or RS64-II@262MHz respectively.
(2) Sybase.
(3) Oracle.

3.3. Additional Nodes and Models

Different types of nodes can be mixed together in a configuration. Nodes can be added to a model according to the following table:

Models \ Nodes	EPC400	EPC430	EPC440	EPC450	EPC800	EPC1200	EPC1200A	EPC2400
EPC400	Y	Y	Y	Y	N	Y	Y	Y
EPC430	Y	Y	Y	Y	N	Y	Y	Y
EPC440	Y	Y	Y	Y	N	Y	Y	Y
EPC800	Y	Y	Y	Y	Y	Y	Y	Y
EPC1200	Y	Y	Y	Y	N	Y	Y	Y
EPC1200A	Y	Y	Y	Y	N	Y	Y	Y
EPC2400	Y	Y	Y	Y	N	Y	Y	Y

3.4. Racks

There are three types of racks:

- 1.8m high expansion rack for the EPC800 (usually referred as EPC800 rack).
- 1.8m high expansion rack for the EPC400, EPC430, EPC440 and EPC450 (usually referred as EPC400 rack).
- 1.6m high I/O rack for the EPC1200, EPC1200A, EPC2400 and EPC440 (usually referred as EPC1200 rack).

The EPC400 and EPC800 racks are industry-standard 19-inch racks designed to comply with the EIA-310C standard. The EPC1200 rack complies with the 19-inch EIA standard.
A rack is divided in several areas each being of a predefined height expressed in U (1U = 44.45 mm).
The EPC400 and EPC800 rack provides 36U of space to install drawers (CPUs, disks, ...), while the EPC1200 rack provides 32U of space.

An EPC400 rack unit allows to install 6 EPC400, EPC430 or EPC450 CPU drawers, or 3 EPC440 CPU drawers. An EPC800 rack unit allows to install up to 4 EPC800 CPU drawers.

The Escala EPC1200, EPC1200A and EPC2400 allow, by node, one Central Electronics Complex (CEC) rack, up to 4 I/O racks, and additional storage racks for external DAS, SSA or DLT subsystems.

A rack unit supports other drawers, depending on the rack dispatching rules in the NOEMIE configurator, to be chosen between:

- DAS drawer.
- SSA drawer.
- Disk/media drawer.

Other devices can be installed in a rack unit, such as interconnects hubs or switches and DLT4000/DLT7000. Optional rack unit(s) can be required to accommodate all drawers/devices.

Additional EPC440 nodes can be mounted in an EPC400 or EPC1200 rack unit.

Drawer \ Rack	EPC400 Rack	EPC800 Rack	EPC1200, EPC1200A or EPC2400 "CEC Rack"	EPC1200, EPC1200A or EPC2400 "I/O Rack"
EPC400	Yes	SFR	No	No
EPC430	Yes	No	No	No
EPC440	Yes	No	No	Yes
EPC450	Yes	No	No	No
EPC800	SFR	Yes	No	No
EPC1200, EPC1200A or EPC2400 CEC	No	No	Yes	No
EPC1200, EPC1200A or EPC2400 I/O drawer	No	No	No	Yes

3.5. Interconnection

Interconnect communication network is also known as back-end network or private network. An interconnect is a complete network dedicated to internode communications by application. The interconnect links a group of nodes inside the cluster. This network is dedicated and private to the cluster.

It is possible to have multiple interconnects for different purposes linking different groups of nodes.

An interconnect can be used as a high-performance network for exchanging information related to CMP mode operation (concurrent access). It can also be used to handle data exchanges in Client/Server or three tier architectures. The interconnect protocol supported is TCP-IP. A number of implementations, based on different technologies (Ethernet, Fast Ethernet, Gigabit Ethernet, FDDI), different levels of redundancy (simple or double connections), and optional network devices (hubs, switches) are possible.

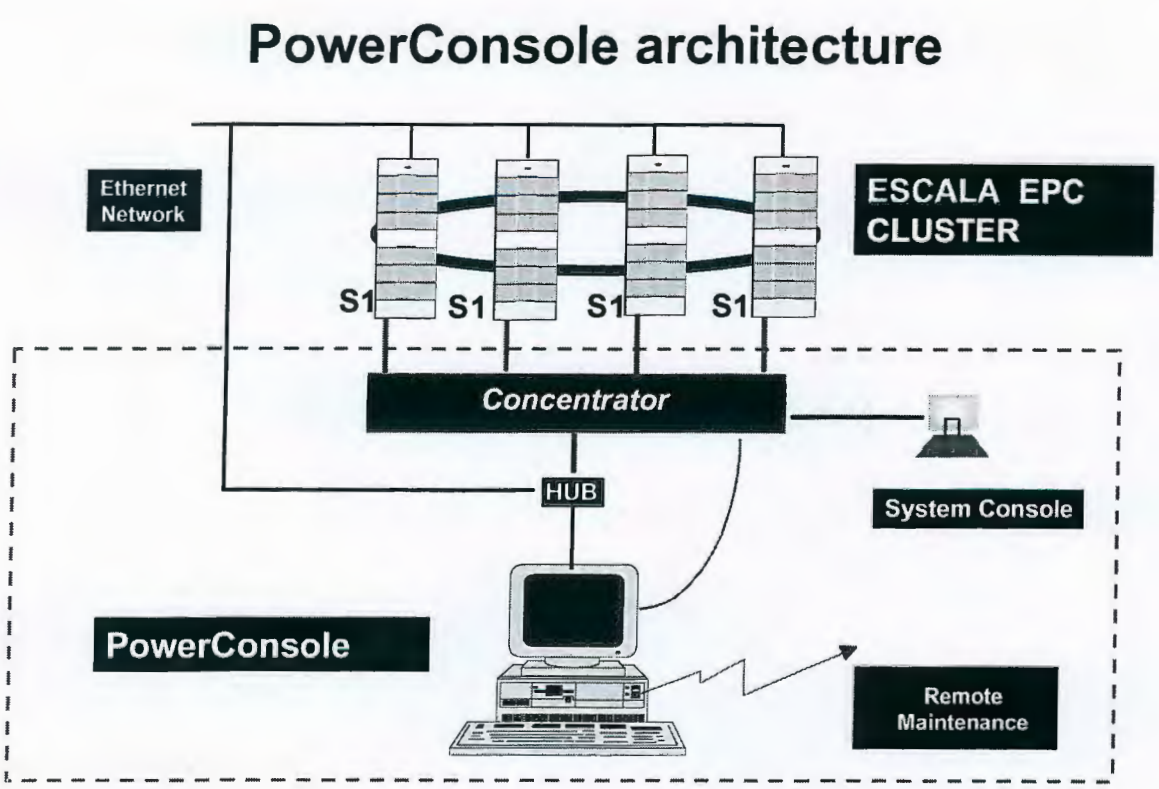
In a consolidation server configuration, it is possible to have no interconnect.

3.6. Cluster/Node Management

Main hardware components used for cluster/node management are the following:

- A PowerConsole, or an ASCII console, or a graphical console.
- A console concentrator.
- A cluster administration hub.

ASCII and graphical consoles are well suited for the management of individual nodes.
The PowerConsole is the ideal tool for cluster management.



PowerConsole

The PowerConsole is a single point of control for the simple administration of all nodes that are part of a Bull EPC cluster environment. The PowerConsole provides:

- Optimum utilization of the complete toolset delivered with AIX®, thanks to assistants and an intuitive graphic interface.
- A set of functions enabling local or remote launching of operations such as reboot, installation, configuration, upgrades, saves, and software distribution.
- A highly performing, active tool designed for the administration of HA nodes, so guaranteeing maximum operational security.
- Monitoring capability, with dynamic display of resource status, whether global for the cluster or within a node, triggering of alarms with adjustable thresholds, and manual or automatic resources

reassignment.

- Easier management of AIX® evolution thanks to the capability for co-existence of two AIX® versions on the same cluster.
- As an option, the ability to administer production applications and the SAN infrastructure, including disk subsystems, thus making the PowerConsole a real control tower of the information system.

The PowerConsole is based on the Escala S100.
If needed, more than one PowerConsole can be attached to a clustered system.

Console Concentrator

The PowerConsole is attached to the clustered system via a console concentrator (3COM CS/2600 terminal server) and an Ethernet link. The cluster administrator can access all the nodes of an Escala EPC from a multi-window system console.

Cluster Administration Hub

In addition, a private network is provided to allow secured and advanced cluster management operations. This private network is accessible through a specific cluster administration Ethernet hub also known as the management network.
For local system operations (maintenance), a system console (BQ306 terminal) is provided.

3.7. Power Distribution and Power Supply

Additional PDBs (Power Distribution Board) or PDUs (Power Distribution Unit) can be used for higher availability and redundant configurations.

3.8. Disk Subsystems

A large choice of disk subsystems is available:

- DAS disk subsystem.
- SSA disk subsystem.
- EMC Symmetrix disk subsystem.

Shared disk access to SCSI-based DAS subsystems is limited to 4 nodes (due to SCSI bus limitations) and to 8 nodes for the other subsystems (fibre channel based DAS subsystems, SSA subsystems, and EMC subsystems).

The concurrent access mode (with CRM) is supported on DAS, SSA and EMC subsystems.

SSA Subsystem

(Discontinued: 30 June 1999)

The SSA subsystem (Serial Storage Architecture) provides high performance storage facilities:

- Loop connections.
- High bandwidth, high performance.
- Disk sharing from multiple nodes (up to 8 nodes).
- Multiple device connectivity, dual access.
- Support of 4.2GB and 9.1GB disks.
- Hot plugging.
- Bypass cards to dynamically rebuild the loop in case of node failure.
- Large scalability.
- Remote connection (with optic fiber extender).

EMC² Symmetrix Subsystem

The Symmetrix 3000 family is the industry's premier open storage solution from EMC².

Main features:

- Up to 32 physical SCSI interface connections
- Up to 16 physical Fibre Channel interface connections
- 4 to 256 physical 3.5-inch disk devices
- Remote diagnostics and AutoCall feature via an integrated service processor
- Non-disruptive component repair
- Non-disruptive microcode upgrades
- Dual-initiator disk director.

Data protection features:

- Mirroring option (RAID 1)
- Dynamic Sparing option.

Software features:

- Information protection:
  - Symmetrix Remote Data Facility (SRDF™)
  - EMC TimeFinder™.
- Information sharing:
  - Symmetrix Enterprise Storage Platform (ESP)
  - EMC InfoMover™.
- Information management:

- Symmetrix Manager - Base Component
- Symmetrix Manager - SRDF / TimeFinder Component
- Symmetrix Manager - SDDR Component
- EMC PowerPath™.

Classification:

- The Symmetrix Models 3000 are classified as Electronic Data Processing Equipment intended to be installed in a data processing center environment (class 2).

DAS Subsystem

DAS subsystems, composed of DAS 1000, 2000, and 5000 series, are disk array subsystems available in rackmount configuration.

The DAS 1x00 and DAS 2x00 Series are based on SCSI, whereas the DAS 5300, DAS 5700, and DAE 5000 are based on the fibre channel standard (FC-AL, Fibre Channel Arbitrated Loop).

The fibre channel based DAS subsystems are connected through a high performance PCI fibre channel (FC-AL) adapter to all the Escala EPCs except the EPC800, which only supports SCSI-based DAS.

All these DAS subsystems provide RAID functionality, except the DAE 5000 that is a JBOD (Just a Bunch of Disks) solution.

DAS subsystems extend disk offers with a scalable storage solution for customers that need both high availability and high capacity for mission critical applications. They provide near fault tolerant storage subsystems with highly competitive performance and price.

A DAS subsystem can either be attached to one node, or be shared by several nodes inside an Escala EPC configuration.

3.9. Libraries

The same libraries are available for the Escala product range.
Using NetBackup™ high availability features a library can be shared by 2 nodes of an Escala EPC configuration.
Concurrent access is not allowed.

3.10. Attachment Facilities

Interconnects, disk subsystems and libraries can be attached to multiple nodes. The different nodes share the same resource: private network, disks and drives respectively.
The shared resource (disk subsystems and libraries) is mainly used for high available configurations.

SSA and EMC subsystems can be attached up to eight nodes belonging to the configuration.

Any type of interconnect can be attached from two to eight nodes belonging to the configuration.
Any type of library can be attached to up to two nodes.

Chapter 2: Models Description

1. Escala EPC Servers Comparison Table

Escala EPC Model	EPC400	EPC430	EPC440	EPC450	EPC800 (1)	EPC1200 (2)	EPC1200A	EPC2400
Processor	PPC-604e	PPC-RS64-II	PPC-RS64-II	PPC-RS64-III	PPC-604e	PPC-RS64 or RS64-II	PPC-RS64-II	PPC-RS64-III
Processor Speed (MHz)	360	262	340	400	320	125 or 262	262	450
Number of processors (min/max) per node	1/4	1/4	1/4	1/4	2/8	4/12	4/12	6/24
L1 cache per CPU (KB)	32/32	64/64	64/64	128/128	32/32	64/64	64/64	128/128
L2 cache per CPU (MB)	4	4	4	4	4	4 or 8	8	8
PCI/MCA bus - per node	2 PCI 64-bit	2 PCI 64-bit	4 PCI 64-bit	2 PCI 64-bit	2 MCA	4 to 16 PCI 64-bit	4 to 16 PCI 64-bit	4 to 16 PCI 64-bit
I/O Slots (max) - per node/with expansion drawer	8 / 18	8 / 18	8	8 / 18	8	14 / 56	14 / 56	14 / 56
I/O bus Transfer Rate (MB/sec) per node (1)	2x266	2x264		2x264	1x160	4x500	4x500	4x500
Memory slots - per node	4	4	32	4	4	20	20	16
Memory min - per node	64MB	256MB	256MB	256MB	64MB	512MB	1GB	2GB
Max memory per node (GB)	3	8	8	8	4	32**	32**	64
Hard disk std per node (GB)	9,1	9.1	9.1	9.1	4,2	4.5	9.1	9.1
Max disk in CPU drawer per node (GB)	109.2	109,2	218.4	109,2	18.2	209.3	218.4	218.4
Max disk capacity per node (GB)	218.4	218.4	218.4	218.4	72.8	864.5	873.6	873.6
Ultra2 SCSI Adapter	N	Y	N	Y	N	N	Y	Y
Ultra SCSI Adapter	Y	Y	Y	Y	N	Y	Y	Y
SCSI-2 Fast/Wide Adapter	Y	Y	Y	Y	Y	Y	Y	N
Fast Ethernet, Token-Ring, or FDDI Adapter	Y	Y	Y	Y	Y	Y	Y	Y
Multiport Asynchronous Adapter	Y	Y	Y	Y	Y	Y	Y	Y
X25 Adapter	Y	Y	Y	Y	Y	Y	Y	Y
Fibre Channel Adapt. (FC-AL)	Y	Y	Y	Y	N	Y	Y	Y
Serial & parallel ports	Y	Y	Y	Y	Y	Y	Y	Y
Redundant Power Supply	Y	Y	Y	Y	Optional	Y	Y	Y
Internal 3"1/2 Diskette	Y	Y	Y	Y	Y	Y	Y	Y
Internal CD-ROM	Y	Y	Y	Y	Y	Y	Y	Y
Performance **(estimated)**	1 / 2 / 3 / 4 CPUs	1 / 2 / 3 / 4 CPUs	1 / 2 / 3 / 4 CPUs	1 / 2 / 3 / 4 CPUs	2 / 4 / 8 CPUs	4 / 8 / 12 CPUs	4 / 8 / 12 CPUs	6 / 12 / 18 / 24 CPUs
TPM	3325 / 5625 / 6700 / 8117 (Sybase)	4600 / 7800 / 11000 / 13700 (Oracle)	5000 / 9600 / 13400 / 17133 (Oracle)	5800 / 11000 / 15600 / 19000 (Oracle)	4100 / 7000 / 11400 (Sybase)	7250 / 13200 / 18666 OR 13800 / 24800 / 34139 (Oracle)	13800 / 24800 / 34139 (Oracle)	42000 / 79500 / 111000 / 135815 (Oracle)
SPECint_rate95	127/249/364/480	105/210/315/419	144/287/430/573	165/329/493/655	219/425/775	-	-	-
SPECfp_rate95	73/141/200/249	12/240/350/460	191/370/534/674	-	121/227/420	-	-	-
SPECint'95-SPECfp'95 (single CPU)	14.2-8.2	11.7-14	16-21.2	18.34-xx	12.5-7.1	-	-	-
SPECweb96	-	-	-	4700 / 8600 / 12000 / 14600	-	-	-	-

* The hardware memory limit is 40 GB. AIX supports 32 GB of real memory. This limit will be raised in a later version of AIX.
(1) Discontinued: 31/12/1999.
(2) Discontinued: 30/12/1999.

2. Escala EPC400

The Escala EPC400 brings affordable entry into the world of high-end UNIX servers and solution servers.

Based on one single CPU drawer, this entry-level application server allows to expand and optimize configuration with maximum flexibility.

The EPC400 is based on an EPC400 drawer rack mounted in an EPC400 rack. An expansion drawer can be added to the EPC400 drawer to provide additional PCI slots, disks or media.

2.1. The EPC400 Drawer

The EPC400 drawer provides:

- 4 slots for single PowerPC 604e@360MHz CPU boards. Each CPU board contains one processor with 32KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
- From 128 MB to 3GB of memory provided by 4 memory slots for memory DIMMs on riser cards, each with 6 memory slots, for a total of 24 memory slots. Upgrades come in the form of quads: 4x32MB (128MB), 4x64MB (256MB) or 4x128MB (512MB).
- 1 internal dual 64bit PCI bus with a throughput of 2x266MB/s.
- 2 x 3 disk bays (1" high) or 2 x 2 disk bays (1"6 high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operation.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  - 5 64-bit PCI
  - 2 combo (PCI or ISA)
  - 1 ISA.
- Two native Ultra SCSI busses on the motherboard.
- One native 10/100Mb/s Ethernet bus with 3 connectors: 10Mb/s, 100Mb/s and AUI.
- One native SVGA graphics controller with 1MB video memory.
- Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Redundant power supply.

The EPC400 drawer is 4U high.

2.2. The EPC400 Expansion Drawer

The EPC400 expansion drawer provides:

- 2 x 3 disk bays (1" high) for 9.1GB or 18.2 GB hot-swappable disks.
- 2 media bays (CDROM, DAT, VDAT, or QIC).
- 6 additional PCI slots.

6 additional PCI slots can be added to the EPC400 expansion drawer installing the EPC400 Bus Expansion.

The EPC400 expansion drawer occupies 4U.

2.3. Extensions and Options

- Ultra SCSI RAID adapter for internal disks.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communication adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- DLT tape library (Overland) with SCSI interface.

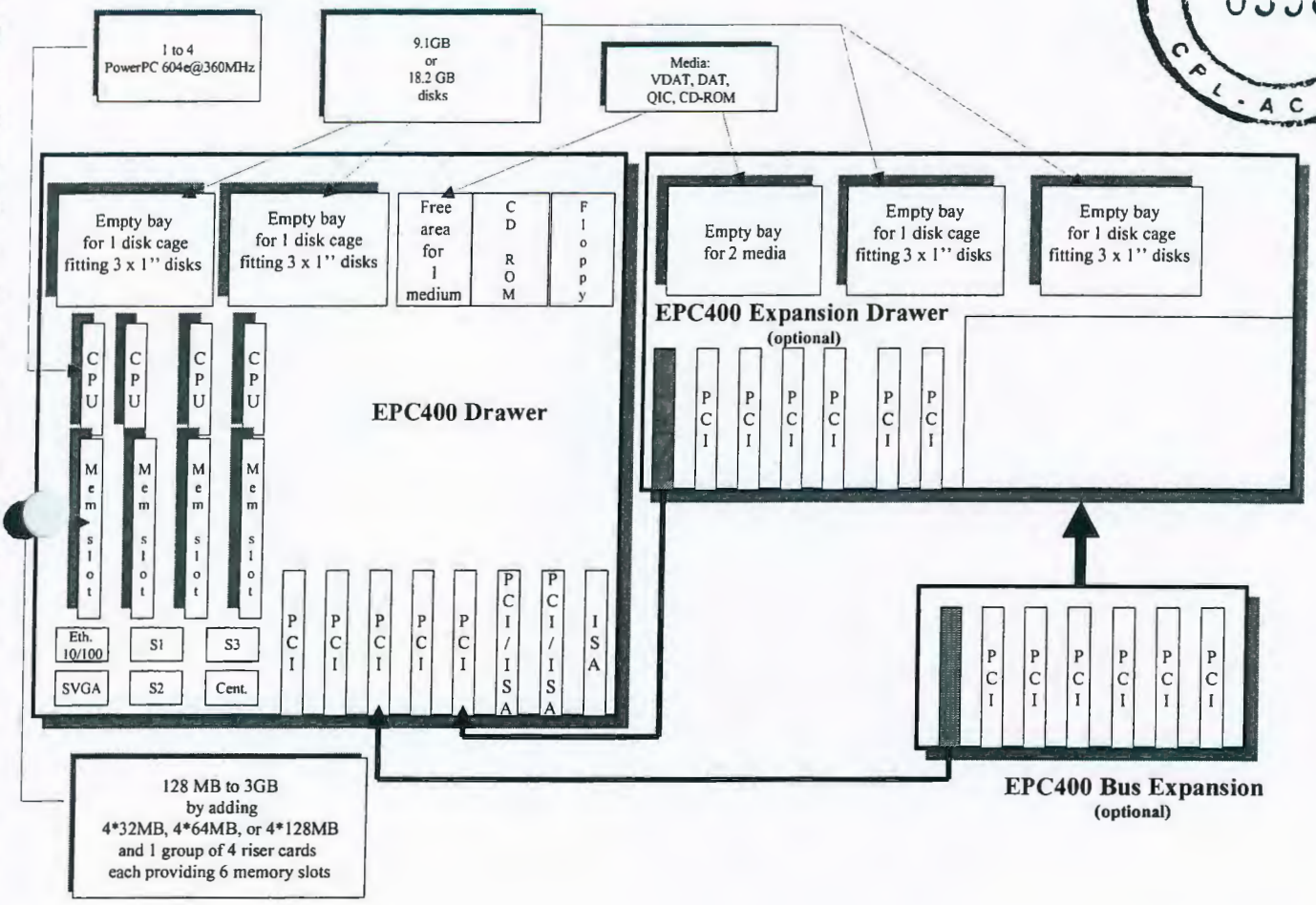
2.4. Maximum Configuration

- 4 CPUs.
- 3 GB of memory.
- 218.4 GB of disks with expansion drawer (109.2GB in the base drawer).
- 18 slots for adapters 15 PCI, 2 PCI/ISA, 1 ISA with the expansion drawer (8 slots: 5 PCI, 2 PCI/ISA, and 1 ISA in the base drawer).

2.5. Operational Requirements

- AIX 4.2 or later.

EPC400 Description



2.6. Power Kits for the EPC400

2.6.1. Power Kit 604e@360MHz CPU - 4MB L2 Cache

The power kit contains the following items:

- 1 CPU module PowerPC 604e@360MHz - 4MB L2 cache.

Operational Requirements

- Any EPC400 (one CPU slot available - 4 CPU slots maximum).
- No mix of PowerPC 604e and PowerPC 620 is allowed on the same node.

2.6.2. Power Kit 620@180MHz CPU - 4MB L2 Cache

This Power Kit is available under controlled commercialization only. It contains the following items:

- 1 CPU module PowerPC 620@180MHz - 4MB L2 cache.

Operational Requirements

- Any EPC400 (one CPU slot available - 4 CPU slots maximum).
- No mix of PowerPC 604e and PowerPC 620 is allowed on the same node.

2.7. Upgrade Kits from the EPC400 to the EPC430

Discontinued: 31/05/2000

This upgrade kit allows to upgrade an EPC400 to an EPC430 reconnecting the existing disks, media, disk adapters and communication adapters. The upgraded EPC400 will have the same memory and CPU capability as an EPC430. The system's serial number remains unchanged.

From 256MB to 8 GB of memory.
- Up to 4 PowerPC RS64-II@262MHz processors with 4MB of L2 cache.
- 7 PCI slots and 1 PCI/ISA slot in the CPU drawer.
- Expansion drawer with 12 additional slots making a total of 18 slots available.
- 109.2GB disk capacity in the CPU drawer and 218.4GB with an expansion drawer.
- Native 10/100 Mb/s Ethernet.
- Native SVGA with 2MB of video memory.
- Keyboard and mouse port.
- Three asynchronous ports and one Centronics port.
- One Ultra2 SCSI bus for disks.
- One Ultra SCSI bus for Fast Wide SCSI media.

This upgrade kit is composed of:

At least one basic upgrade kit from EPC400 to EPC430.
- A "swap kit" that allows you to swap each additional single 604e/620 CPU board with an RS64-II-based CPU board.

2.7.1. Basic Upgrade Kit from the EPC400 to the EPC430

The basic kit includes:

- 1 Escala EPC430 basic drawer.
- 1 single CPU board with an RS64-II processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- EPC400 basic drawer.

- 1 single PowerPC 604e or 620 CPU board.
- Memory on the EPC400. The client has to acquire new memory for the upgraded machine.

2.7.2. Swap Kit for Additional Single 604e/620 CPU Boards

This kit contains the following items:

- 1 single CPU board with an RS64-II@262 MHz processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
  1 single PowerPC 620 CPU board.

System Requirements

- Escala EPC400.
- AIX 4.3.2 or later.

2.8. Upgrade Kits from the EPC400 to the EPC450

This upgrade kit allows to upgrade an EPC400 to an EPC450 reconnecting the existing disks, media, disk adapters and communication adapters. The upgraded EPC400 will have the same memory and CPU capability as an EPC450. The system's serial number remains unchanged.

- From 256MB to 8 GB of memory.
- Up to 4 PowerPC RS64-III@400 MHz processors with 4MB of L2 cache.
- PCI slots and 1 PCI/ISA slot in the CPU drawer.
- Expansion drawer with 12 additional slots making a total of 18 slots available.
- 109.2GB disk capacity in the CPU drawer and 218.4GB with an expansion drawer.
- Native 10/100 Mb/s Ethernet.
- Native SVGA with 2MB of video memory.
- Keyboard and mouse port.
- Three asynchronous ports and one Centronics port.
- One Ultra2 SCSI bus for disks.
- One Ultra SCSI bus for Fast Wide SCSI media.

This upgrade kit is composed of:

- At least one basic upgrade kit from EPC400 to EPC450.
- A "swap kit" that allows you to swap each additional single 604e/620 CPU board with an RS64-III-

based CPU board.

2.8.1. Basic Upgrade Kit from the EPC400 to the EPC450

The basic kit includes:

- 1 Escala EPC450 basic drawer.
- 1 single CPU board with an RS64-III processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- EPC400 basic drawer.
- 1 single PowerPC 604e or 620 CPU board.
- Memory on the EPC400. The client has to acquire new memory for the upgraded machine.

2.8.2. Swap Kit for Additional Single 604e/620 CPU Boards

This kit contains the following items:

- 1 single CPU board with an RS64-III@400 MHz processor and 4MB of L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 single PowerPC 604e CPU board.
  or
- 1 single PowerPC 620 CPU board.

System Requirements

- Escala EPC400.
- AIX 4.3.3 or later.

3. Escala EPC430

The EPC430 is based on an EPC430 drawer racked in an EPC400 rack. An expansion drawer can be added to the EPC430 drawer to provide additional PCI slots, disks or media.
Based on one single CPU drawer, this mid-size application server offers configuration flexibility for multi-purpose workloads.

3.1. The EPC430 Drawer

The EPC430 drawer provides:

- 4 slots for single PowerPC RS64-II@262MHz CPU boards. Each CPU board contains one processor with 64KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
  From 256 MB to 8GB of memory provided by 4 slots fitting 4 riser cards, each with 8 memory slots for a total of 32 memory slots. Upgrades come in quads: 4*64MB (256MB), 4*128MB (512MB) or 4*256MB (1GB).
- 1 internal dual 64-bit PCI bus with a throughput of 2x264 MB/s.
- 2 x 3 disk bays (1" high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operations.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  - 4 64-bit PCI
  - 3 32-bit PCI
  - 1 combo (PCI or ISA).
- One native Ultra2 SCSI bus and one native Ultra SCSI bus on the motherboard.
- One native 10/100Mb/s Ethernet bus with one connector.
- One native SVGA graphics controller with 2MB video memory.
  Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Redundant power supply.

The EPC430 drawer occupies 4U.

3.2. The EPC430 Expansion Drawer

The EPC430 expansion drawer provides:

- 2 x 3 disk bays (1" high) for 9.1GB or 18.2 GB hot-swappable disks.
- 2 media bays (CDROM, DAT, VDAT, or QIC).
- 12 additional PCI slots.

The EPC430 expansion drawer occupies 4U.

3.3. Extensions and options

- Ultra SCSI RAID adapter for internal disks.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
- EMC Disk Subsystems with SCSI or FC-AL interface.
- DLT Tape Library (Overland) with SCSI interface.

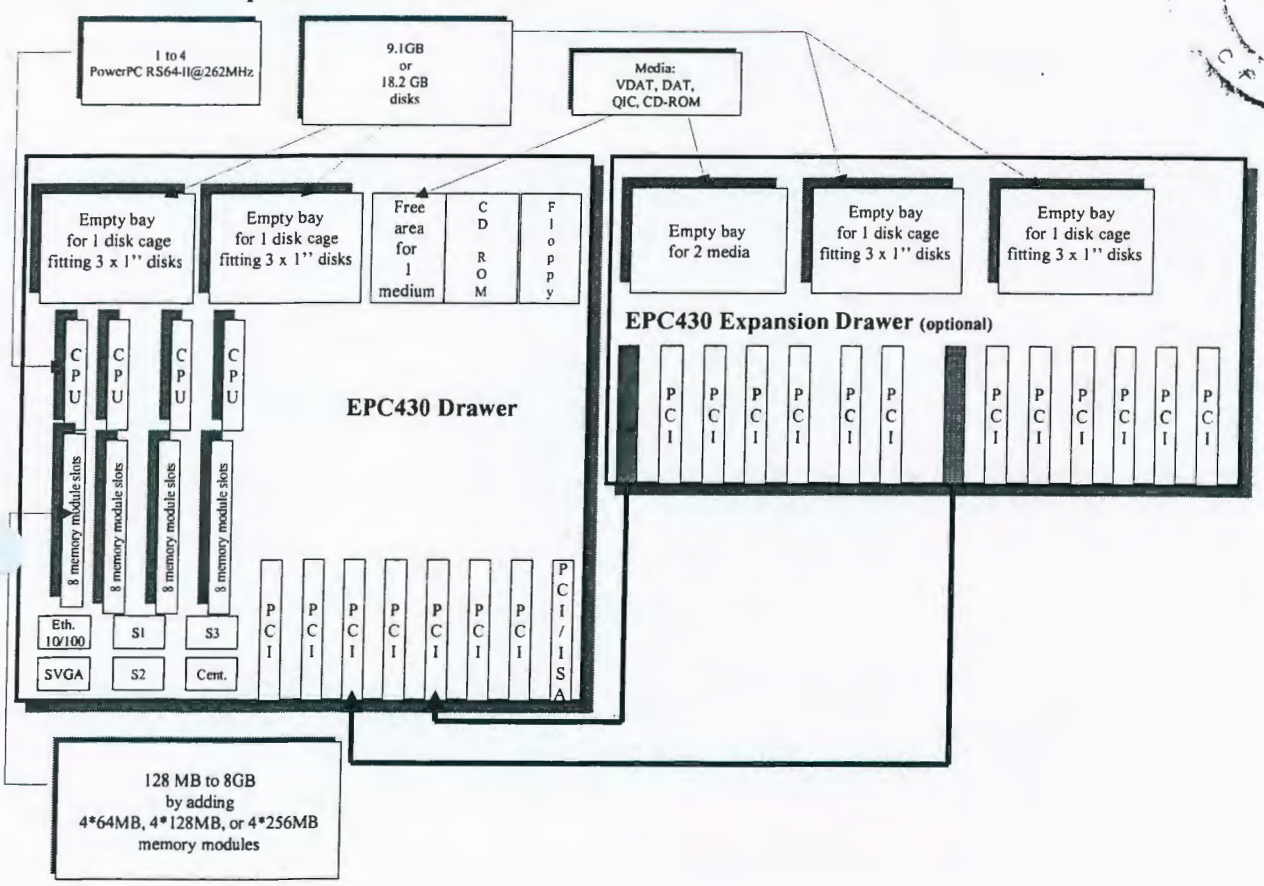
3.4. Maximum Configuration

- 4 CPUs.
- 3 GB of memory.
- 218.4 GB of disks with expansion drawer (109.2GB in the base drawer).
- 18 slots for adapters (17 PCI, 1 PCI/ISA) with the expansion drawer (8 slots: 7 PCI, 1 PCI/ISA).

3.5. Operational Requirements

- AIX 4.3.2 or later.

EPC430 Description



3.6. Power Kits for the EPC430

3.6.1. Power Kit RS64-II@262MHz CPU - 4MB L2 Cache

The Power Kit contains the following items:

- 1 CPU module PowerPC RS64-II@262MHz, 4MB L2 cache.

Operational Requirements

- Any EPC430 with a CPU slot available.

3.7. Upgrade Kit from EPC430 to EPC450

This upgrade kit contains the following items:

- 1 CPU module PowerPC RS64-III@400MHz, 4MB L2 cache.
- Installation instructions.

Parts removed becoming property of Bull

- 1 CPU module PowerPC RS64-II@262MHz, 4MB L2 cache.

4. Escala EPC440

The EPC440 is based on an EPC440 drawer racked in an EPC400 rack. The EPC440 can also be racked in an EPC1200 rack when ordered as an additional node in a configuration.
Based on one single CPU drawer, this general-purpose server is ideally suited to well-balanced workloads.

4.1. The EPC440 Drawer

The EPC440 drawer provides:

- 2 slots for single or dual PowerPC RS64-II@340MHz CPU boards for a total of 4 CPUs. Each CPU board contains one processor with 64KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
- From 256 MB to 8GB of memory provided by 2 slots fitting 2 riser cards, each providing 16 memory slots, for a total of 32 memory slots. Upgrades come in pairs: 2*128MB (256MB) or 2*256MB (512MB) memory modules.
- Four 64-bit PCI busses.
- 12 disk bays (1" high) or 6 disk bays (1"6 high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operations.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  4 32-bit PCI
  2 64-bit@33MHz PCI
  2 64-bit@33/50 MHz PCI.
- Two native Ultra SCSI busses on the motherboard.
- One native 10/100Mb/s Ethernet bus with 3 connectors: 10Mb/s, 100Mb/s, AUI.
- One native SVGA graphics controller with 2MB video memory.
- Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Two power supply units.

The EPC440 drawer occupies 8U.

4.2. Extensions and Options

- Ultra SCSI RAID adapter for up to 6 internal disks
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM,

Asynchronous and X25).

- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- DLT tape library (Overland) with SCSI interface.

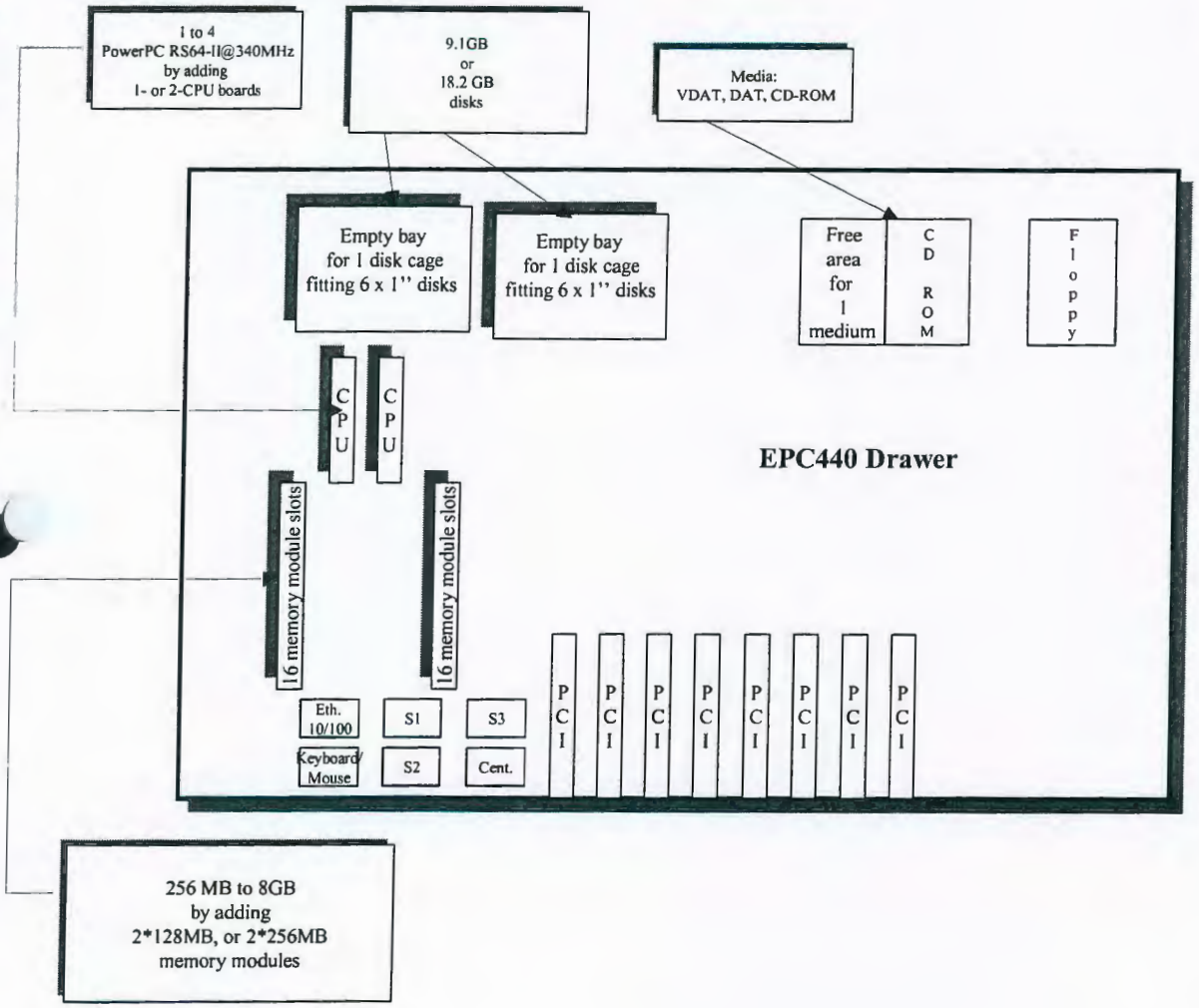
4.3. Maximum Configuration

- 4 CPUs.
- 8 GB of memory.
- 218.4 GB of disk space.
- 8 PCI slots.

4. Operational Requirements

- AIX 4.3.2 or later.

EPC440 Description



4.5. Power Kits for the EPC440

4.5.1. Power Kit RS64-II@340MHz CPU - 4MB L2 Cache

The Power Kit contains the following items:

- 1 CPU board PowerPC RS64-II@340MHz, 1 way, 4MB L2 cache.

Operational Requirements

- Any EPC440 with a CPU slot available.

4.5.2. Power Kit 2*RS64-II@340MHz CPU - 4MB L2 Cache

The Power Kit contains the following items:

- 1 CPU board PowerPC RS64-II@340MHz, 2-way, 4MB L2 cache per way.

Operational Requirements

- Any EPC440 with a CPU slot available.

5. Escala EPC450

The EPC450 is based on an EPC450 drawer racked in an EPC400 rack. An expansion drawer can be added to the EPC450 drawer to provide additional PCI slots, disks or media.
Based on one single CPU drawer, this mid-size application server offers configuration flexibility for multi-purpose workloads.

5.1. The EPC450 Drawer

The EPC450 drawer provides:

- 4 slots for single PowerPC RS64-III@400MHz CPU boards. Each CPU board contains one processor with 64KB internal cache and 4MB L2 cache for fast data transfer between the processor and memory for balanced system performance; at least one CPU is mandatory.
- From 256 MB to 8GB of memory provided by 4 slots fitting 4 riser cards, each with 8 memory slots for a total of 32 memory slots. Upgrades come in quads: 4*64MB (256MB), 4*128MB (512MB) or 4*256MB (1GB).
- 1 internal dual 64bit PCI bus with a throughput of 2x264 MB/s.
- 2 x 3 disk bays (1" high) for 9.1 GB or 18.2 GB hot-pluggable Ultra SCSI disks; at least one disk is required for system operations.
- 2 media bays (one occupied by a CD-ROM drive and one free).
- 1 floppy disk drive.
- 8 slots for adapters:
  - 4 64-bit PCI
  - 3 32-bit PCI
  - 1 combo (PCI or ISA).
- One native Ultra2 SCSI bus and one native Ultra SCSI bus on the motherboard.
- One native 10/100Mb/s Ethernet bus with one connector.
- One native SVGA graphics controller with 2MB video memory.
- Three RS232 serial ports.
- One parallel port.
- One mouse and one keyboard port.
- Redundant power supply.

The EPC450 drawer occupies 4U.

5.2. The EPC450 Expansion Drawer

The EPC450 expansion drawer provides:

- 2 x 3 disk bays (1" high) for 9.1GB or 18.2 GB hot-swappable disks.
- 2 media bays (CDROM, DAT, VDAT, or QIC).
- 12 additional PCI slots.

The EPC450 expansion drawer occupies 4U.

5.3. Extensions and options

- Ultra SCSI RAID adapter for internal disks.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DA5700 and EMC disk subsystem (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300 and DAS5700) interface.
- DAE 5000 JBOD subsystems with FC-AL interface.
- EMC Disk Subsystems with SCSI or FC-AL interface.
- DLT Tape Library (Overland) with SCSI interface.

5.4. Maximum Configuration

- 4 CPUs.
- 3 GB of memory.
- 218.4 GB of disks with expansion drawer (109.2GB in the base drawer).
- 18 slots for adapters (17 PCI, 1 PCI/ISA) with the expansion drawer (8 slots: 7 PCI, 1 PCI/ISA).

5.5. Operational Requirements

- AIX 4.3.3 or later.

5.6. Power Kits for the EPC450

5.6.1. Power Kit RS64-III@400 MHz CPU - 4MB L2 Cache

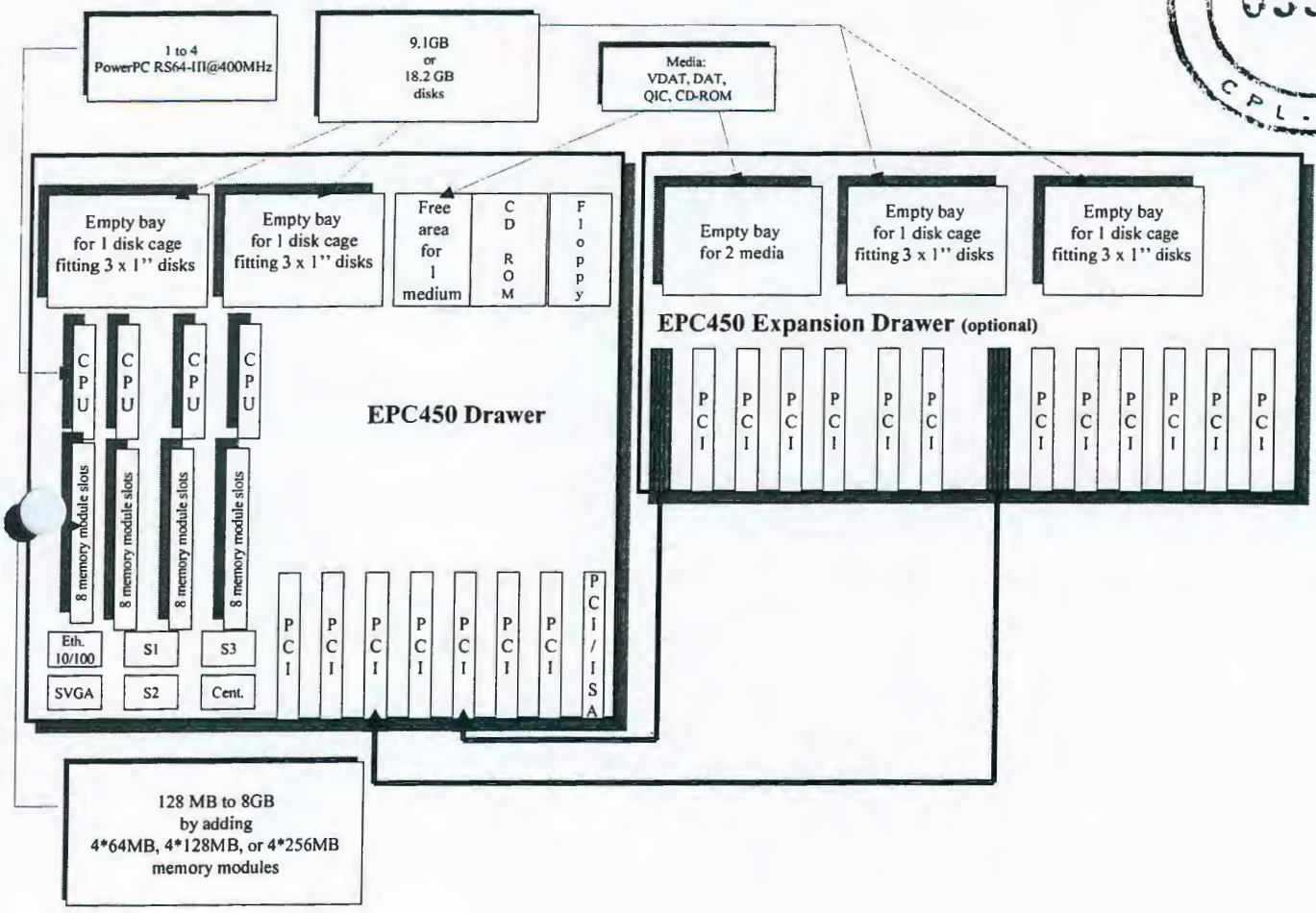
The Power Kit contains the following items:

- 1 CPU board PowerPC RS64-III@400MHz, 4MB L2 cache.

Operational Requirements

- Any EPC450 with a CPU slot available.

EPC450 Description



6. Escala EPC800

Initial Nodes Discontinued: 31/12/1999. Still available as addtionnal nodes

The Escala EPC800 model brings affordable entry into the world of high-end UNIX servers and high-end solution servers. This model offers configuration flexibility for building optimized "à la carte" servers.

The Escala EPC800 is a 19-inch rack-mounted model. It is a configuration based on one Escala [36U] rack including one 604e Escala CPU node drawer [6U].

The EPC800 basic model features two 200 MHz or 320 MHz PowerPC 604e RISC processors (maximum eight processors with 4 dual CPU boards).
Each CPU board contains two processors with 64 KB internal cache and 2MB L2 cache (or 4MB L2 cache with the 320 MHz processor) on each processor for fast data transfer between the processor and memory for balanced system performance.

Each EPC800 basic model also includes one (upgradable to two) high speed 160 MB/sec MCA bus with 8 (up to 16) total and 6 (up to 14) open slots, and comes at minimum with 128 MB of memory (upgradable to 4096MB), 4.2GB internal disk and an internal CD-ROM.

Two bays for internal disk (1" high) are available in the EPC800 basic model.
Two 5.25" bays for internal media/disk are available in the EPC800 basic model.
The 5.25" bays for media/disk can be only used for additional media.

The basic Rack can hold up to 4 drawers and up to six expansion racks can also be linked to the basic model, with a capacity of four drawers each.

6.1. Configuration

The Escala EPC800 basic model configuration provides the following features:

- One 36U rack
- One EPC800 drawer [6U] containing:
  - 1 dual CPU module PowerPC 604e@200MHz - 2MB L2 cache, or 1 dual CPU module PowerPC 604e@320MHz - 4MB L2 cache.
  - 3 additional CPU slots for other dual CPU modules.
  - 128 MB minimum memory.
  - 4 memory slots, each supporting up to 1GB memory board for a total of 4GB memory.
  - One LAN/SCSI SE adapter featuring:
    - One SCSI-2 SE port used to connect the standard internal disk and media devices.
    - One Ethernet IEEE 802.3 port, with a communication rate of 10Mbps. A thick-Ethernet (10Base-5) connector and a twisted pair (10Base-T) connector are standard on the system. This adapter is dedicated to the back-end network. The front-end network must be defined separately with the configuration tool. The front-end network is based on two Ethernet

adapters or two FDDI adapters depending on Customer requirements.

- Three serial RS232 ports reserved for the system console, the remote maintenance and services, and UPS connections.
- One parallel printer port.
- At least a 4.2 GB SCSI-2 internal disk.
- One 1.44MB 3.5-inch Diskette Drive.
- Six open MCA slots, with a total of 8 slots.
- Two bays for SCSI disk device (1" high).
- Two 5.25" bays for SCSI media device.
- One Redundant Power Supply.
- One 8 RS232-C asynchronous adapters.
- One Power Distribution Bus [1U].

Operational Requirements

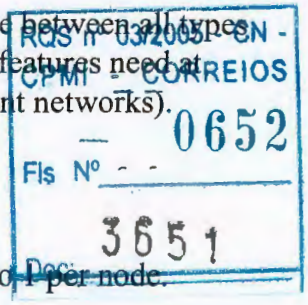
- AIX 4.2 or later.
- One internal 600MB CD-ROM high performance drive.

6.3. Factory Installable Select Options

- 2 MCA buses (instead of 1 MCA bus) featuring 14 free MCA slots (instead of 6 free MCA slots).

6.4. Extensions and Options

- External disk storage and media devices, including:
  - External tape drive drawers.
  - SSA disk subsystem (multiple host allowing to be shared by up to 8 nodes - *discontinued*).
  - DAS1300, DAS2900 RAID drawers (SCSI interface allowing to share a DAS by up to 4 nodes).
  - EMC disk subsystem (SCSI interface allowing to share a CDA by up to 8 nodes depending on disk capacity and performance required).
- System memory expansion up to 4096MB per node.
- Upgrade kit to PowerPC 604e@320MHz.
- Internal disk expansion up to 18.2GB (2x9.1GB) per node.
- One redundant or non-redundant Public Network Adapter per node, with a choice between all types of Ethernet, FDDI, Token Ring and ATM Adapters. Public network availability features need at least 2 network accesses per node (i.e. 2 adapters per node connected to 2 different networks).
- 2 MCA buses per node (instead of 1 MCA bus) on-site option.
  - 14 free MCA slots (instead of 6 free MCA slots).
- Internal media devices (tape drives).
- Disk/media drawer (4 open bays disk 1" or 1"6, 2 open bays media/disk 1"); up to 1 per node.
- LAN, WAN and asynchronous communications adapters.



- Power kit to upgrade the system to up to eight processors per node.
- Redundant fans and power supplies per node.

EPC800 Rack Options

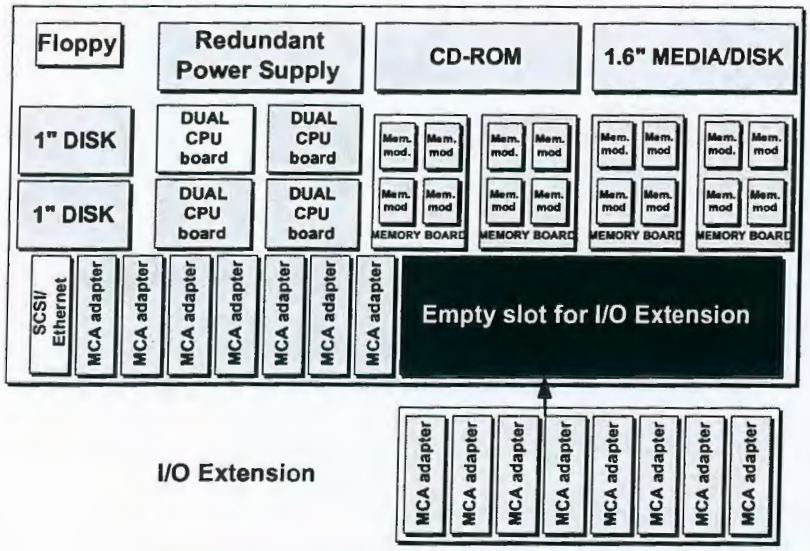
- One redundant Power Distribution Bus per rack.
- One UPS 3KVA per rack.

6.5. Power Distribution Bus

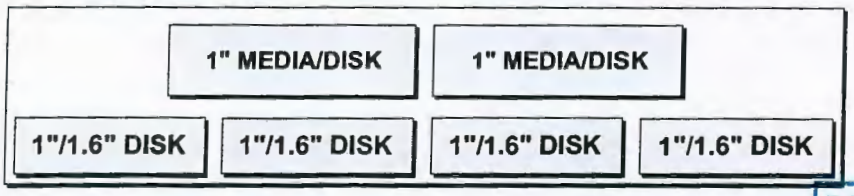
The Power Distribution Bus (PDB) provides up to 8 AC outlets: 6 to the drawers, 1 for a modem, 1 for the CPC in a 19" rack.

The PDB occupies 1 EIA unit of vertical mounting space in the rack.

EPC800 Description



Optional Media/Disk Expansion Drawer for EPC800



Requires 1 SCSI SE adapter

6.6. Power Kits for the EPC800

6.6.1. Power Kit 2*604e@200MHz CPU - 2MB L2 cache

The Power Kit contains the following items:

- 1 Dual CPU module PowerPC 604e@200MHz - 2MB L2 cache.

Operational Requirements

- Any EPC800 (no mix of PowerPC 604e@200MHz and PowerPC 604e@320MHz in the same node).

6.6.2. Power Kit 2*604e@320MHz CPU - 4MB L2 cache

The Power Kit contains the following items:

- 1 Dual CPU module PowerPC 604e@320MHz - 4MB L2 cache.

Operational Requirements

- Any EPC800 (processors must be of the same type).

6.7. Upgrade Kits for the EPC800

6.7.1. Upgrade Kit from PowerPC 604e@200MHz to PowerPC 604e@320MHz

This Upgrade Kit contains the following items:

- 1 Dual CPU module PowerPC 604e@320MHz - 4MB L2 cache.
- Installations instructions.

Parts removed becoming property of Bull

- 1 Dual CPU module PowerPC 604e@200MHz - 2MB L2 cache

6.8. Extension Kits for the EPC800

6.8.1. MCA Buses Upgrade

This Extension Kit allows to extend an 8 MCA Slots EPC800 with a second high speed 160 MB/sec MCA Bus, upgrading the number of slots up to 16.

Operational Requirements

- Any 8 MCA Slots EPC800.

7. Escala EPC1200

Discontinued: 30/11/1999.

The Escala EPC1200 brings an attractive and expandable full 64-bit platform into the world of high-end UNIX servers and solution servers.
It is a large database server with huge storage capacity and throughput for I/O-intensive tasks.

The Escala EPC1200 is composed of a Central Electronics Complex (CEC) and one to four I/O drawers. The CEC is packaged inside a dedicated 19-inch 32U Rack called the CEC Rack. The I/O drawers must be racked in a 19-inch I/O Rack.

A service processor provides all the features for maintenance (tests, survey, alarm) and is included in an I/O drawer. This I/O drawer also contains the system disk and will be referred to as the primary I/O drawer. Additional I/O drawers are called secondary I/O drawers.

7.1. The EPC1200 CEC

The CEC contains:

- One, two, or three 4-way processor cards (for a total of 4, 8, or 12 processors).
- From 512 MB to 32 GB of memory provided by 5 slots fitting quad-memory boards of 512 MB (4x128MB), 1GB (4x256MB), 2GB (4x512MB), 4GB (4x1024MB) or 8GB (4x2048MB). (Although the system can house 40GB of memory, 32GB are supported.)
- One Remote I/O (RIO) controller supporting 4 connections at 500MB/s. These are used to connect the I/O drawers.

The EPC1200 supports two 64-bit processors: PowerPC RS64@125MHz and RS64-II@262MHz. Each processor card contains four processors with 64 KB internal cache and 4MB (for the RS64) or 8MB (for the RS64-II) L2 associative cache on each processor.

7.2. The EPC1200 Primary I/O Drawer

- 12 disk bays: 11 for 9.1GB or 18.2 GB hot-pluggable Fast Wide SCSI internal disksand one for a mandatory 4.5 GB or 9.1 GB disk.
- 2 media bays for internal media devices: one is occupied by a CD-ROM drive and one is free for additional media (DAT, VDAT, or CD-ROM).
- One floppy disk drive

- 14 PCI slots (11 free slots) on 4 PCI busses
  - One PCI slot is dedicated to the service processor (PowerPC 603).
  - One PCI slot is dedicated to a SCSI controller to drive the drawer's internal disks.
  - One PCI slot is dedicated to a SCSI controller to drive the drawer's internal media.
- 2 RS232 serial ports.
- 1 parallel port.
- 1 keyboard port and 1 mouse port.
- One dual Ultra2 SCSI PCI adapter.
- Dual redundant hot-swappable power supplies for enhanced reliability.

The EPC1200 I/O drawer occupies 7 Units of vertical space.

7.3. The EPC1200 Secondary I/O Drawer

- 2 areas of 6 disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks. Each area must be driven by a dedicated SCSI bus.
- 2 media bays for internal media devices (DAT, VDAT, or CD-ROM).
- 14 PCI slots (5*64 bit and 9*32 bit).

7.4. Options and Extensions

- External modem for remote monitoring and maintenance allowing the service processor to call out and alert the Bull Maintenance Center.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5700, DAE5000 and for EMC disk subsystem connection (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25)
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5700) interface.
- DAE5000 JBOD enclosures with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- Overland DLT tape library (DLT4000 or DLT7000) with SCSI interface.

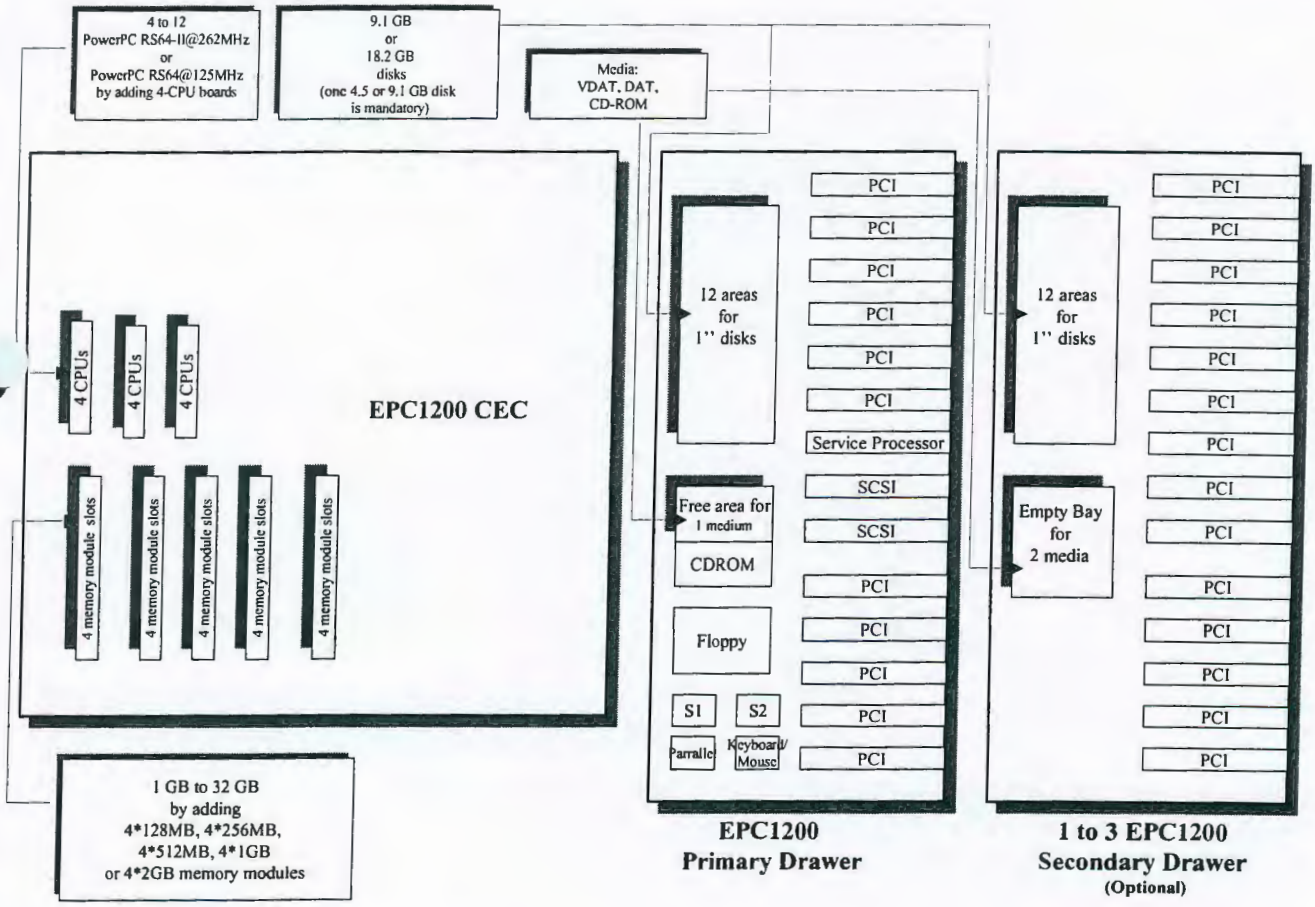
7.5. Maximum Configuration

- Internal disk storage:
  - 1x9.1GB + (11x18.2GB)=209.3GB with one I/O drawer.
  - 209.3GB+(3x218.4GB)=864.5GB with 4 I/O drawers.
- 32 GB of memory.
- Up to 3 quad-CPU boards (i.e. 12-way).
- Up to 14 PCI slots per I/O drawer.
- Up to 56 PCI slots with four I/O drawers.

7.6. Operational Requirements

- AIX 4.3 or later.

EPC1200 Description



7.7. Power Kits for the EPC1200

7.7.1. Power Kit Quad-CPU RS64@125MHz - 4MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 quad-PowerPC RS64@125MHz CPU board - 4MB L2 cache per CPU.

Operational Requirements

- Any EPC1200 (a CPU slot available - 4 CPU slots maximum).

Remarks

- There are two different boards to upgrade the EPC1200 from 4 CPU to 8 CPU and to upgrade from 8 CPU to 12 CPU.

7.7.2. Power Kit Quad-CPU RS64-II@262MHz - 8MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 quad-PowerPC RS64-II@262MHz CPU board - 8MB L2 cache per CPU.

Operational Requirements

- Any EPC1200 (a CPU slot available - 4 CPU slots maximum).

Remarks

- There are two different boards to upgrade the EPC1200 from 4 CPU to 8 CPU and to upgrade from 8 CPU to 12 CPU.

7.8. Upgrade Kits for the EPC1200

7.8.1. Upgrade Kit from PowerPC RS64@125MHz to PowerPC RS64-II@262MHz

This Upgrade Kit contains the following items:

- 1 quad-PowerPC RS64-II@262MHz CPU board - 8MB L2 cache.
- Installations instructions.

Parts removed becoming property of Bull

- 1 quad-PowerPC RS64@125MHz CPU board - 4MB L2 cache.

8. Escala EPC1200A

The Escala EPC1200A brings an attractive and expandable full 64-bit platform into the world of high-end UNIX servers and solution servers.
The EPC1200A is a large database server with huge storage capacity and throughput for I/O-intensive tasks.

The Escala EPC1200A is composed of a Central Electronics Complex (CEC) and one to four I/O drawers. The CEC is packaged inside a dedicated 19-inch 32U rack called the CEC rack. The I/O drawer must be racked in a 19-inch I/O rack.

A service processor provides all the features for maintenance (tests, survey, alarm) and is included in an I/O drawer. This I/O drawer also contains the system disk and will be referred to as the primary I/O drawer. Additional I/O drawers are called secondary I/O drawers.

8.1. The EPC1200A CEC

The CEC contains:

- One, two, or three 4-way processor cards (for a total of 4, 8, or 12 processors).
- From 512 MB to 32 GB of memory provided by 5 slots fitting quad-memory boards of 512 MB (4x128MB), 1GB (4x256MB), 2GB (4x512MB), 4GB (4x1024MB) or 8GB (4x2048MB). (Although the system can house 40GB of memory, 32GB are supported.)
- One Remote I/O (RIO) controller supporting 4 connections at 500MB/s. These are used to connect the I/O drawers.

The EPC1200A supports the PowerPC RS64-II@262MHz 64-bit processors.
Each processor card contains four processors with 64KB internal cache and 8MB L2 associative cache on each processor.

8.2. The EPC1200A Primary I/O Drawer

- 2 areas of 6 Disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks; each area must be driven by a dedicated SCSI bus; at least one disk is necessary
- 2 media bays for internal media devices: one is occupied by a CD-ROM drive and one is free for additional media (DAT, VDAT, or CD-ROM).
- One floppy disk drive
- 14 PCI slots (11 or 12 free slots depending on the disk areas configuration) on 4 PCI busses
  - One PCI slot is dedicated to the service processor (PowerPC 603).
  - One or two other PCI slots are dedicated to SCSI controllers, as explained below:
    For configurations using only one area of disk bays (all disks are connected to the same SCSI bus) one dual Ultra2 SCSI controller is used to drive the media devices and the disks. The first bus is used for disks and the second bus for media.
    For configurations using both areas of disk bays, the Ultra2 SCSI controller is used to connect

each area to a different SCSI bus. The first bus is used for the first area and the second bus for the second area. An additional Ultra SCSI controller is required to connect media devices.

- 2 RS232 serial ports.
- 1 parallel port.
- 1 keyboard and 1 mouse port.
- One dual Ultra2 SCSI PCI adapter.
- Dual redundant hot-swappable power supplies for enhanced reliability.

The EPC1200A I/O drawer occupies 10 Units of vertical space.

8.3. The EPC1200A Secondary I/O Drawer

- 2 areas of 6 disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks. Each area must be driven by a dedicated SCSI bus.
- 2 media bays for internal media devices (DAT, VDAT, or CD-ROM).
- 14 PCI slots (5*64 bit and 9*32 bit).

8.4. Options and Extensions

- External modem for remote monitoring and maintenance allowing the service processor to call out and alert the Bull Maintenance Center.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5300, DAS5700, DAE5000 and for EMC disk subsystem connection (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5300, DAS5700) interface.
- DAE5000 JBOD enclosures with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- Overland DLT tape library (DLT4000 or DLT7000) with SCSI interface.

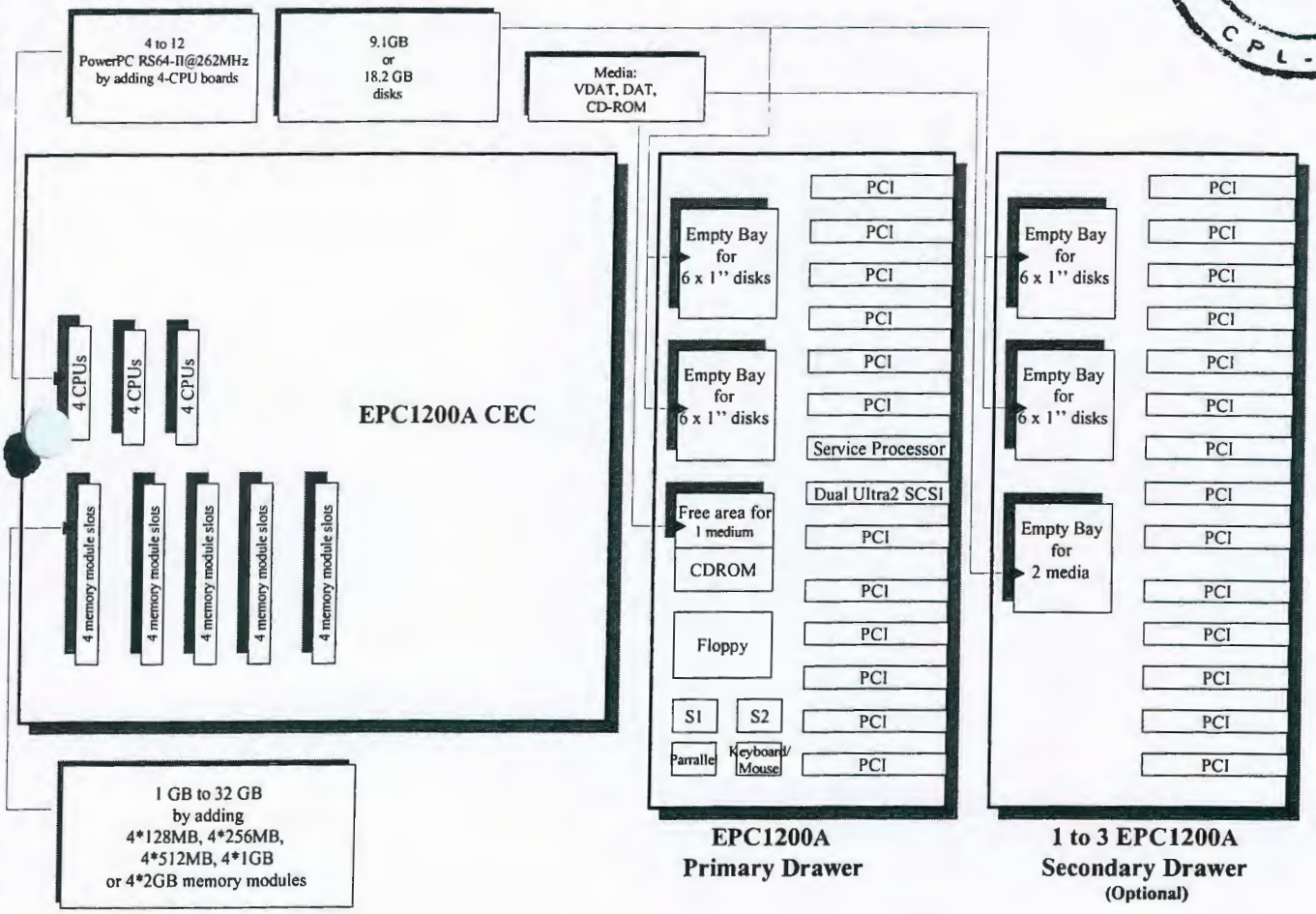
8.5. Maximum Configuration

- Internal disk storage:
  - 12x18.2GB=218.4GB with one I/O drawer.
  - 4x218.4GB=873.6GB with 4 I/O drawers.
- 32 GB of memory.
- Up to 3 quad-CPU boards (i.e. 12-way).
- Up to 14 PCI slots per I/O drawer.
- Up to 56 PCI slots with four I/O drawers.

8.6. Operational Requirements

- AIX 4.3 or later.

EPC1200A Description



ower Kits for the EPC1200A

8.7.1. Power Kit Quad-CPU RS64-II@262MHz - 8MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 quad-PowerPC RS64-II@262MHz CPU board - 8MB L2 cache per CPU.

Operational Requirements

- Any EPC1200A (a CPU slot available - 4 CPU slots maximum).

Remarks

- There are two different boards to upgrade the EPC1200A from 4 CPU to 8 CPU and to upgrade

from 8 CPU to 12 CPU.

8.8. Upgrade Kits from the EPC1200A to the EPC2400

This upgrade kit allows to upgrade an EPC1200A to an EPC2400 reconnecting the existing I/O drawers including disks, media, disk adapters and communication adapters. The upgraded EPC1200A will have the same memory and CPU capability as an EPC2400.

This upgrade kit is composed of:

- At least one basic upgrade kit from EPC1200A to EPC2400
- A "swap kit" that allows you to swap each additional quad-RS64-II@262MHz CPU board with a six-way RS64-III@450MHz CPU board.

8.8.1. Basic Upgrade Kit from EPC1200A to EPC2400

The basic kit includes:

- 1 Escala EPC2400 CEC.
- 1 six-way RS64-III@450MHz CPU board with 8MB of L2 cache.
- 1 service processor.
- A cabling set for the primary I/O drawer.
- 1 remote I/O hub - dual loop.
- AIX 4.3.3 operating system CD-ROMs.
- Installation instructions.

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- EPC1200A CEC.
- 1 quad PowerPC RS64-II@262MHz CPU board.
- 1 service processor.
- Replaced cables.
- 1 remote I/O hub - dual loop.
- Memory on the EPC1200A. The client has to acquire new memory for the upgraded machine.

8.8.2. Swap Kit for Additional Quad RS64-II@262MHz CPU Boards

This kit contains the following items:

- 1 six-way RS64-III@450MHz CPU board.
- Installation instructions.

Parts removed becoming property of Bull

- 1 quad-PowerPC RS64-II@262MHz CPU board.

9. Escala EPC2400

The Escala EPC2400 brings an attractive and expandable full 64-bit platform into the world of high-end UNIX servers and solution servers.
The EPC2400 is a high range server ideally tailored for e-center and for consolidation.

The Escala EPC2400 is composed of the Central Electronics Complex (CEC) and one to four I/O drawers. The CEC is packaged inside a dedicated 19-inch 32U rack called the CEC rack. The I/O drawer must be racked in a 19-inch I/O Rack.

A service processor provides all the features for maintenance (tests, survey, alarm) and is included in an I/O drawer. This I/O drawer also contains the system disk and will be referred to as the primary I/O drawer. Additional I/O drawers are called secondary I/O drawers.

1. The EPC2400 CEC

The CEC contains:

- One, two, three or four 6-way processor cards (for a total of 6, 12, 18 or 24 processors).
- From 2GB to 64GB of memory provided by 5 slots fitting quad-memory boards of 1GB (4x256MB), 2GB (4x512MB), 4GB (4x1024MB), 8GB (4x2048MB) or 16GB (4x16348MB).
- One Remote I/O (RIO) controller supporting 4 connections at 500MB/s. These are used to connect the I/O drawers.
- Redundant power and redundant cooling.

The EPC2400 supports the PowerPC RS64-III@450MHz 64-bit processors.
Each processor card contains six processors with 128KB internal cache and 8MB L2 associative cache on each processor.

2. The EPC2400 Primary I/O Drawer

- 2 areas of 6 Disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks; each area must be driven by a dedicated SCSI bus; at least one disk is necessary.
- 2 media bays for internal media devices: one is occupied by a CD-ROM drive and one is free for additional media (DAT, VDAT, or CD-ROM).
- One floppy disk drive
- 14 PCI slots (11 or 12 free slots depending on the disk areas configuration) on 4 PCI busses
  - One PCI slot is dedicated to the service processor (PowerPC 603).
  - One or two other PCI slots are dedicated to SCSI controllers, as explained below:
    For configurations using only one area of disk bays (all disks are connected to the same SCSI bus) one dual Ultra2 SCSI controller is used to drive the media devices and the disks. The first bus is used for disks and the second bus for media.
    For configurations using both areas of disk bays, the Ultra2 SCSI controller is used to connect each area to a different SCSI bus. The first bus is used for the first area and the second bus for

the second area. An additional Ultra SCSI controller is required to connect media devices.

- 2 RS232 serial ports.
- 1 parallel port.
- 1 keyboard and 1 mouse port.
- One dual Ultra2 SCSI PCI adapter.
- Dual hot-swappable power supplies for enhanced reliability.

The EPC2400 I/O drawer occupies 10 Units of vertical space.

9.3. The EPC2400 Secondary I/O Drawer

- 2 areas of 6 disk bays (total of 12 disk bays) for 9.1GB or 18.2GB hot-pluggable Ultra2 SCSI internal disks. Each area must be driven by a dedicated SCSI bus.
- 2 media bays for internal media devices (DAT, VDAT, or CD-ROM).
- 14 PCI slots (5*64 bit and 9*32 bit).

9.4. Options and Extensions

- External modem for remote monitoring and maintenance allowing the service processor to call out and alert the Bull Maintenance Center.
- Fibre Channel Adapter (FC-AL - 1Gb/s) for DAS5700, DAE5000 and for EMC disk subsystem connection (Max distance: 10Km).
- Communications adapters (FDDI, Ethernet 10/100Mb/s, Gigabit Ethernet, Token Ring, ATM, Asynchronous and X25).
- DAS RAID disk subsystems with SCSI (DAS2900) and FC-AL (DAS5700) interface.
- DAE5000 JBOD enclosures with FC-AL interface.
- EMC disk subsystems with SCSI or FC-AL interface.
- Overland DLT tape library (DLT4000 or DLT7000) with SCSI interface.

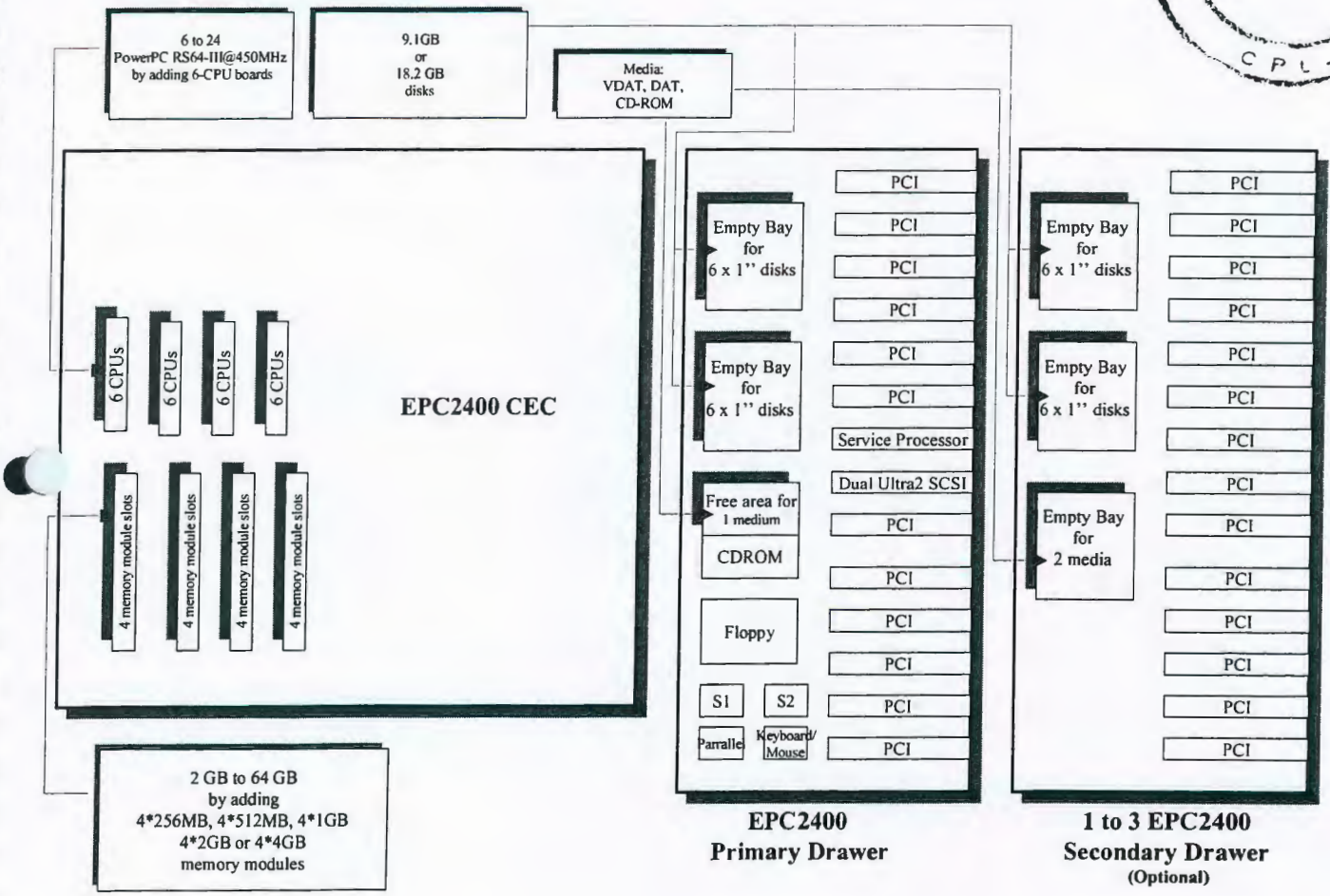
9.5. Maximum Configuration

- Internal disk storage:
  - 12x18.2GB=218.4GB with one I/O drawer.
  - 4x218.4GB=873.6GB with 4 I/O drawers.
- 64 GB of memory.
- Up to 3 quad-CPU boards (i.e. 12-way).
- Up to 14 PCI slots per I/O drawer.
- Up to 56 PCI slots with four I/O drawers.

9.6. Operational Requirements

- AIX 4.3.3 or later.

EPC2400 Description



9.7. Power Kits for the EPC2400

9.7.1. Power Kit Six-CPU RS64-III@450MHz - 8MB L2 Associative Cache per CPU

The Power Kit contains the following items:

- 1 six-CPU board PowerPC RS64-III@450MHz - 8MB L2 cache per CPU.

Operational Requirements

- Any EPC2400 (one CPU slot available - 4 CPU slots maximum).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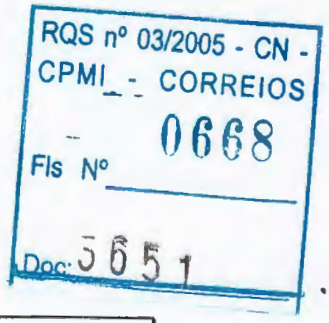
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Chapter 3: Disks, Media, Subsystems and Libraries

This chapter describes the disk devices, associated controllers, media devices (such as tapes and CD-ROM drives) and other subsystems and libraries available on the Escala EPC models.

1. Adapters

1.1. SCSI Adapters for EPC400 EPC430 and EPC450

1.1.1. PCI SCSI-3 LVD/Wide Adapter

The PCI SCSI-3 LVD/Wide Adapter is a single ported Ultra2 (40 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 80 MB per second.

The PCI SCSI-3 LVD /Wide Adapter provides high performance attachment to both internal and external SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 LVD /Wide Adapter has one external VHDCI connector (68p) and one high-density internal connector (68p). The Adapter is capable of addressing up to 15 LVD/SE devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The adapter supports either 8-bit or 16-bit devices.

Characteristics:

- Ultra2 and wide (16-bit wide) SCSI PCI Adapter
- One external 68p VHDCI connector
- One internal 68p HD connector
- Controller conforms to SCSI-SPI2
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 80 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible (version 2.0 and 2.1)
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)
- Automatic switching to LVD or SE mode.

Operational requirements

- Supported on the Escala EPC430 and EPC450 only.
- One free PCI slot.
- AIX version 4.3.2, or later.

1.1.2. PCI SCSI-3 Ultra Wide SE Adapter

The PCI SCSI-3 Ultra Wide SE Adapter is a single ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 MB per second. The PCI SCSI-3 Ultra Wide SE Adapter provides high performance attachment to both internal and external Single Ended SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra Wide SE Adapter has one external connector (68p) and two internal connectors (1 narrow 50p and 1 wide 68p). The Adapter is capable of addressing up to 15 Single Ended devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The adapter supports either 8-bit or 16-bit devices.

Characteristics:

- Ultra and wide (16-bit wide) SCSI PCI Adapter
- One external 68p connector
- Two internal (50p & 68p) connectors
- Controller conforms to ANSI Doc X3T9.2/86-109 Rev 10h
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator).

Operational requirements

- One free PCI slot.
- AIX version 4.2.1, or later.

SYMBOLSYMBOL**1.1.3. PCI SCSI-3 Ultra Wide RAID SE Adapter - DPT**

The PCI SCSI-3 Ultra Wide SE Adapter is a Dual ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 MB per second on each port.
The PCI SCSI-3 Ultra Wide SE Adapter provides high performance attachment to internal Single Ended SCSI disks. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra Wide SE Adapter has two internal Single Ended ports. One of these ports is also available on the external connector. Each port is capable of addressing up to 15 Single Ended devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The external port of this adapter supports 8-bit or 16-bit devices via a 16-bit connector.

The PCI SCSI-3 Ultra Wide SE Adapter supports RAID functionality (RAID 0, RAID 1 and RAID 5 mode) and is designed with 16 MB cache upgradable to 64 MB.
The PCI-SCSI-3 Ultra Wide SE Adapter provides SAF-TE and "Storage Works" capabilities (fault detection and management).
This adapter is used with the internal disks.

Key features:

- Bus mastering, with on-board processor for reduced SCSI and host CPU overhead
- Supports simultaneous operation of Wide and Narrow devices
- Scatter/Gather transfer support
- SCSI-1, SCSI-2, SCSI-3, Fast Wide (W) or Fast-20/Wide (UW) SCSI support with active termination
- Overlapped I/O and tagged command queuing.

Characteristics

- Ultra and wide (16-bit wide) PCI SCSI RAID Adapter
- Two ports (1 internal/external and 1 internal)
- Controller conforms to ANSI Doc X3T9.2/86-109 Rev 10h
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)
- SAF-TE and "Storage Works" capabilities
- RAID functionality
- Hot spare disk and hot-plugging disks
- Array configuration graphic support
- No jumper - Automatic configuration by Software.

Operational requirements

- One free PCI slot.
- AIX version 4.2.1, or later.

Caution: PCI SCSI-3 Ultra-Wide RAID Adapter - DPT can't be used for Native HA.

SYMBOLSYMBOL1.1.4. PCI SCSI-3 Ultra Wide DE Adapter

The PCI SCSI-3 Ultra Wide DE Adapter is a single ported Ultra (20 MHz) and wide (16-bit wide) SCSI PCI Adapter that can provide synchronous SCSI bus data rates of up to 40 MB per second. The PCI SCSI-3 Ultra Wide DE Adapter provides high performance attachment to external Differential SCSI disks, disk subsystems, tape devices. The maximum data rate depends on the maximum data rate of the attached devices.

The PCI SCSI-3 Ultra Wide DE Adapter has one external Differential port. The external port is capable of addressing up to fifteen Differential devices. The number of physical devices attached is limited by SCSI bus cabling restrictions. The external port of this adapter supports either 8-bit or 16-bit devices via a 16-bit connector. The external Differential SCSI bus is capable of supporting cable lengths of 25 meters (82 feet).

Characteristics:

- Ultra wide (16-bit wide) PCI Adapter
- One external Differential 16-bit bus
- Controller conforms to ANSI Doc X3T9.2/86-109 Rev 10h
- Accepts multiple commands per device from system
- SCSI-3 data rate of up to 40 MB per second (synchronous protocol)
- Acts as SCSI initiator (command issuer)
- SCSI parity support
- PCI Interface
  - 32-bit PCI bus compatible
  - PCI bus data transfer rates up to 132MB/sec
- Supports Command Tagged Queuing (as SCSI initiator)

Operational requirements

- One free PCI slot.
- AIX version 4.2.1, or later.

SYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOL**1.2. SCSI Adapters for EPC440, EPC1200, EPC1200A and EPC2400**

1.2.1. PCI Dual Channel Ultra2 SCSI Adapter

The PCI Dual Channel Ultra2 SCSI Adapter is a 64 bit adapter and is an excellent solution for high performance SCSI applications. The PCI Dual Channel Ultra2 SCSI Adapter provides 2 SCSI channels (busses). Each SCSI bus can either be internal or external and is designed to support a data rate of up to 80 MB per second, up to twice the maximum data transfer rate of previous Ultra SCSI adapters (40 MB per second).

In order to achieve an Ultra2 SCSI bus data rate of up to 80 MB per second, and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. In order to utilize this Ultra2 80 MB per second performance, all attaching devices or subsystems must also be Ultra2 LVD devices. If any device is not Ultra2 LVD, the adapter will switch its SCSI bus to single-ended (SE) performance and interface at the lower SE SCSI bus data rate of the device.

Two industry standard VHDCI 68 pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A .3 meter converter cable, VHDCI to P, Mini-68 pin to 68 pin, can be used with older external SE subsystems to allow connection to the VHDCI connector on the PCI Dual Channel Ultra2 SCSI Adapter.

Operational Requirements

- Supported on the EPC1200A and EPC2400 only.
- One free PCI slot.
- AIX 4.3.3 or later.

1.2.2. PCI Single-Ended Ultra SCSI Adapter

The PCI Single-Ended Ultra SCSI Adapter is an ideal solution for applications requiring large block data transfers (more than 64K block size) in a multi disk drive environment utilizing SCSI-2 protocol. The PCI Single-Ended Ultra SCSI Adapter has a maximum data transfer rate of 40 MB per second, which is twice the maximum data transfer rate of SCSI-2 Fast Wide adapters (20 MB per second).

The PCI Single-Ended Ultra SCSI Adapter conforms to the SCSI-2 standard and Fast-20 (Ultra) documentation. Industry standard 68 pin connectors are incorporated (SCSI "P" connector definition of X3T9.2/90-048).

Operational Requirements

- One free PCI slot.
- AIX 4.3 or later.

1.2.3. PCI Differential Ultra SCSI Adapter

The PCI Differential Ultra SCSI Adapter is the next generation of SCSI-2 performance with maximum data transfer rates of 40 MB per second. The PCI Differential Ultra SCSI Adapter allows connection to external differential SCSI-2 F/W or Ultra SCSI type devices up to 25 meters away.
The PCI Differential Ultra SCSI Adapter will negotiate with each external device and transfer data at the fastest SCSI data transfer rate capable by the external device.

The adapter conforms to SCSI-2 standard and the Fast-20 (Ultra) documentation. Industry standard 68 pin connectors are incorporated (SCSI "P" connector definition of X3T9.2/90-048).

Operational Requirements

- Supported on the EPC440, EPC1200 and EPC1200A. Discontinued on the EPC2400.
- One free PCI slot.
- AIX 4.3 or later.

1.2.4. PCI Universal Differential Ultra SCSI Adapter

The PCI Universal Differential Ultra SCSI Adapter is the latest technology advancement of a SCSI-2 differential adapter with a maximum data transfer rate of 40 MB per second.

This adapter has the capability to be plugged into the newer +3.3 volt PCI slots as well as the older +5 volt PCI slots. It allows connection to external differential SCSI-2 F/W or Ultra SCSI type devices up to 25 meters away.

The PCI Universal Differential Ultra SCSI Adapter will negotiate with each external device and transfer data at the fastest SCSI data transfer rate capable by the external device.

The adapter conforms to SCSI-2 standard and the Fast-20 (Ultra) documentation. Industry standard 68 connectors are incorporated (SCSI "P" connector definition of X3T9.2/90-048).

Operational Requirements

- Supported on the EPC2400 only.
- One free PCI slot.
- AIX 4.3 or later.

1.2.5. PCI SCSI-2 Fast Wide Single-ended Adapter

The PCI SCSI-2 Fast Wide Single-Ended Adapter provides a single-ended SCSI-2 Fast Wide interface that can burst data to devices on the SCSI bus at 20MB/s. This feature can provide both internal and external device support, connected to the same SCSI bus.

Operational Requirements

- Supported on the EPC1200 only.
- One free PCI slot.
- AIX 4.3 or later.

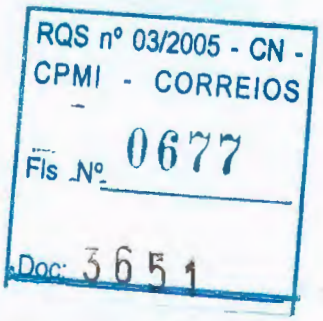
1.2.6. PCI 3-Channel Ultra SCSI RAID Adapter

The PCI 3-Channel Ultra SCSI RAID Adapter is a non-bootable high performance Ultra SCSI RAID Adapter providing RAID 0,1,or 5 capability and can address up to forty-five 16-bit SCSI-2 physical disk drives on three independent SCSI buses. To increase the data writing performance, a 32 MB fast-write cache is provided as a resident part of this adapter. The 32 MB fast-write cache is a resident feature of the PCI 3-Channel Ultra SCSI RAID Adapter that utilizes non-volatile RAM.

During the unlikely event of an PCI 3-Channel Ultra SCSI RAID Adapter failure, a replacement PCI 3-Channel Ultra SCSI RAID Adapter can be installed and the fast-write cache can be removed from the failing adapter and installed in the new adapter insuring data integrity. The 32 MB fast-write cache can provide a significant improvement in data throughput and response time during certain sequence write operations compared to SCSI RAID adapters without the fast-write cache. The response time and data transfer improvement will vary depending upon the data block sizes, the percentage of sequential writes, machine type/model, and application parameters. The PCI 3-Channel Ultra SCSI RAID adapter has one internal and two external independent Ultra SCSI buses. The internal port can be used to provide an internal RAID solution. Systems with internal 6-pack disks can attach one PCI 3-Channel Ultra SCSI RAID Adapter per internal 6-pack.

Operational Requirements

- Supported on the EPC440 only.
- One free PCI slot .
- AIX 4.3 or later.



1.3. SCSI Adapters for EPC800

1.3.1. WSA - SCSI-2 F/W SE Adapter

The WSA/SCSI-2 SE Adapter is based on the same electronic design than the LAN/SCSI-2 Adapter (Ethernet part removed)

The WSA/SCSI SE Adapter feature:

- One SCSI-2 SE port used for the connection of the standard internal disk and media devices.
- New POS register to identify the board (0200 instead of 8F9D)
- PCB size reduced
- External SCSI connector only (68-position 16 bits)
- Single Ended connection
- Adapter SCSI ID from 0 to 7 (default 7)
- Performance improvement of about 20%.

Attachment

- The adapter fits into a single MCA slot.

SYMBOL1.3.2. WSA - SCSI-2 F/W DE Adapter

The WSA/SCSI-2 DE Adapter is based on the same electronic design than the LAN/SCSI-2 Adapter (Ethernet part removed)

The WSA/SCSI DE Adapter feature:

- One SCSI-2 DE port used for the connection of the standard internal disk and media devices.
- New POS register to identify the board (0200 instead of 8F9D)
- PCB size reduced
- External SCSI connector only (68-position 16 bits)
- Differential Ended connection
- Adapter SCSI ID from 0 to 7 (default 7)
- Performance improvement of about 20%.

Attachment

- The adapter fits into a single MCA slot.

1.3.3. LSA - SCSI-2 F/W SE Adapter

The LSA SCSI-2 Fast Wide SE Adapter features:

- One SCSI-2 Fast Wide SE port used for the connection of the standard internal disk and media devices.
- One Ethernet IEEE 802.3 port, with a communication rate of 10Mbps. A thick (10Base5) connector and a twisted pair (10BaseT) connector are standard on the system.

SCSI-2 Fast Wide SE Port Description

The LSA SCSI-2 Fast Wide SE Adapter provides one 16-bit Single-Ended external bus featuring with data rate of up to 20 MB/sec.

Main Characteristics:

- Fast and wide MCA Adapter
- One external Single-Ended 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to Single-Ended SCSI Disks, Media Drives and Storage Subsystems.

Main features of the external Single-Ended bus are:

- Supports either 8-bit or 16-bit single-ended devices
- The number of physical devices attached to the bus is limited by SCSI bus cabling restrictions (up to 4-meter length)
- External cabling can be up to 2.4-meter when attaching SCSI-2 SE Deskside Cabinets/Drawers

SYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOLSYMBOL**1.3.4. LSA - SCSI-2 F/W DE Adapter**

The LAN/SCSI Fast Wide DE Adapter features:

- One SCSI-2 Fast Wide DE port used for the connection of the standard internal disk and media devices.
- One Ethernet IEEE 802.3 port with a communication rate of 10Mbps. A thick (10Base5) connector and a twisted pair (10BaseT) connector are standard on the system.

SCSI-2 Fast Wide DE Port Description

The LSA SCSI-2 Fast Wide DE Adapter providing one 16-bit Differential external bus featuring with data rate of up to 20 MB/sec.

Main Characteristics:

- Fast and wide MCA Adapter
- One external Differential 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to external Differential SCSI Disks and Storage Subsystems.

Main features of the external Differential bus are:

- Supports 16-bit differential devices
- Maximum cable length is 25 meter.

1.3.5. SCSI-2 Fast Wide SE/SE Adapter

Discontinued: 31/03/2000.

The SCSI-2 Fast Wide SE/SE Adapter provides one 8- or 16-bit internal Single-Ended bus and one 16-bit Single-Ended external bus featuring both data rate of up to 20 MB/sec.

Main Characteristics:

- Dual ported fast and wide (16-bit wide) short MCA Adapter
- One internal 8 or 16-bit Single-Ended bus
- One external Single-Ended 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to Single-Ended SCSI Disks, Media Drives and Storage Subsystems.

Main features of the internal Single-Ended bus are:

- Supports either 8-bit or 16-bit devices
- Only one of these two connectors can be used at a time
- 8-bit bus and 16-bit bus can not be connected and used at the same time
- Each SE bus is able to support up to seven devices

Main features of the external Single-Ended bus are:

- Supports either 8-bit or 16-bit single-ended devices
- A maximum of four external SE bridge boxes devices can be connected
- The number of physical devices attached to each bus is limited by SCSI bus cabling restrictions (up to 4-meter length)
- External cabling can be up to 2.4-meter when attaching SCSI-2 SE Deskside Cabinets/Drawers

Operational requirements

One free MCA slot.

1.3.6. SCSI-2 Fast Wide SE/DE Adapter

The SCSI-2 Fast Wide SE/DE Adapter providing one 8 or 16-bit internal Single-Ended bus and one 16-bit Differential external bus featuring both data rate of up to 20 MB/sec.

Main Characteristics:

- Dual ported fast and wide (16-bit wide) MCA Adapter
- One internal 8 or 16-bit Single-Ended bus
- One external Differential 16-bit bus
- Provides synchronous SCSI bus data rates of up to 20 MB/sec
- Allows attachment to internal Single-Ended SCSI Disks and Media Drives and to external Differential SCSI Disks and Storage Subsystems.

Main features of the internal Single-Ended bus are:

- Supports either 8-bit or 16-bit devices
- Only one of these two connectors can be used at one time
- 8-bit bus and 16-bit bus can not be connected and used at the same time
- Each SE bus is able to support up to seven devices.

Main features of the external Differential bus are:

- Supports 16-bit differential devices
- A maximum of seven external bridge boxes devices can be connected
- A maximum of two SCSI-2 DE Deskside Cabinets can be connected
- Maximum cable length is 25 meters (including internal length).

Additional DPX/20, Serial or SCSI Subsystems and High Availability connections are also available with the differential system-to-system and Y-cable features.

Operational requirements

- One free MCA slot.

1.4. SSA Adapters for EPC400

(Discontinued: 30 June 1999)
Note: Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

1.4.1. PCI SSA 4-port Multi-Initiator/RAID EL Adapter

The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA).
The SSA 4-Port Multi-Initiator/RAID EL Adapter enables attachment of SSA technology disks and subsystems.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 [illegible]ces (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA 4-Port Multi-Initiator/RAID EL Adapter allows connection of up to two hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

[illegible]: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Eight-initiator non-RAID, or two-initiator RAID configurations support
- RAID 5 support
- Optional 4MB Fast-Write Cache Card available for one-initiator RAID or one-initiator non-RAID SSA configurations
- Address and data parity support

- Streaming data transfer at 40MB/sec or 80MB/sec
- Two-way, high-availability configurations using HACMP Version 4.1.1 or Version 4.2.2 in modes 1, 2, and 3 on AIX 4.1.5 and higher.
- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- Interoperability of PCI and Micro Channel SSA Multi-Initiator/RAID EL Adapters.

Limitations

- Will not operate in SSA configurations supporting high-performance 4-Port SSA Adapter or Enhanced 4-Port SSA Serial Adapter on Micro Channel.
- No IPL/Boot support from SSA disk drives
  RAID arrays must have all array members in same SSA loop
- PCI system interface only.

Operational requirements

- One free PCI slot.

Fast-Write Cache Option Card

The SSA Fast-Write Cache Option Card is a 4MB fast-write optional feature that plugs into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache. The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes and application parameters.

1.5. SSA Adapters for EPC800

(Discontinued: 30 June 1999)

1.5.1. SSA Enhanced 4-Port Adapter

- High-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA).
- Enables attachment of SSA technology disks and subsystems.
- Provides a cost-effective solution for packaging large numbers of disk drives.
- Allows to cluster up to eight nodes, to access large databases stored in SSA Disk Subsystem.

The SSA Enhanced 4-Port Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA Enhanced 4-Port Adapter allows connection of up to eight hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Conform to SSA, Level 1
- 8-byte bus master
- Address and data parity support
- Streaming data transfer at 40MB/sec or 80MB/sec
- Eight-way, high-availability configurations using HACMP Version 4.1 in modes 1, 2, and 3 on AIX 4.1.4
- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives per adapter

- Micro Channel Type 5 form factor card.

Operational requirements

- One free MCA slot.

SYMBOL**1.5.2. Micro Channel SSA 4-port Multi-Initiator/RAID EL Adapter**

The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA). It enables attachment of SSA technology disks and subsystems.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA 4-Port Multi-Initiator/RAID EL Adapter allows connection of up to two hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Eight-initiator non-RAID, or two-initiator RAID configurations support
- RAID 5 support
- Optional 4MB Fast-Write Cache Card available for one-initiator RAID or one-initiator non-RAID SSA configurations
- Address and data parity support
- Streaming data transfer at 40MB/sec or 80MB/sec
- Two-way, high-availability configurations using HACMP Version 4.1.1 or Version 4.2.2 in modes 1, 2, and 3 on AIX 4.1.5 and later

- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations
- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- Interoperability of PCI and Micro Channel SSA Multi-Initiator/RAID EL Adapters.

Limitations

- Will not operate in SSA configurations supporting high-performance 4-Port SSA Adapter or Enhanced 4-Port SSA Serial Adapter on Micro Channel.
- RAID arrays must have all array members in same SSA loop
- Micro Channel system interface only.

Operational requirements

- One free MCA slot.

Fast-Write Cache Option Card

The SSA Fast-Write Cache Option Card is a 4MB fast-write optional feature that plugs into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache. The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes and application parameters.

1.6. SSA Adapters for EPC1200 and EPC1200A

(Discontinued: 30 June 1999)

1.6.1. PCI SSA 4-port Multi-Initiator/RAID EL Adapter

The SSA 4-Port Multi-Initiator/RAID EL Adapter is a high-performance, high-connectivity adapter that conforms to the Serial Storage Architecture (SSA). The SSA 4-Port Multi-Initiator/RAID EL Adapter enables attachment of SSA technology disks and subsystems.

The SSA 4-Port Multi-Initiator/RAID EL Adapter provides two pairs of serial ports that can be configured to provide two SSA loops. Each of the two pairs supports the attachment of up to 48 devices (96 devices per adapter) in a closed loop. If the loop is broken by a fault, the two ports continue to access the devices using the remaining connections as a string. However, it is not intended that the devices should be initially configured as a string. These features support fault-tolerant applications. Each adapter supports attachment of up to 6 maximum configuration SSA Disk Subsystems (96 drives) for a total disk drive capacity of 873GB, using 9.1GB disk drives.

Each port operates at 20MB/sec full duplex, using point-to-point copper cables up to 25 meters long. Transmissions to several destinations are multiplexed, and the effective bandwidth is further increased by spatial reuse of the individual links. This means that disk commands to a disk in a subsystem are automatically sent from disk to disk on the loop until the target disk receives the command. While this is occurring, another disk command can be issued before any acknowledgement is received.

The SSA 4-Port Multi-Initiator/RAID EL Adapter allows connection of up to two hosts or nodes. This enables multiple hosts to access the same data with the high performance and availability features of SSA.

Note: SSA is a proposed industry-standard interface that retains the SCSI-2 commands, queuing model, status, and sense bytes.

Main Characteristics:

- Four SSA ports configurable as two external loops
- Eight-initiator non-RAID, or two-initiator RAID configurations support
- RAID 5 support
- Optional 4MB Fast-Write Cache Card available for one-initiator RAID or one-initiator non-RAID SSA configurations
- Address and data parity support
- Streaming data transfer at 40MB/sec or 80MB/sec
- Two-way, high-availability configurations using HACMP Version 4.1.1 and Version 4.2.2 in modes 1, 2, and 3 on AIX 4.1.5 and higher
- Support for up to 3,000 I/O operations/sec
- Load balancing on loop configurations

- Attachment of up to 48 SSA disk drives per loop (2-SSA loops per adapter) or a total of 96 SSA disk drives
- Interoperability of PCI and Micro Channel SSA Multi-Initiator/RAID EL Adapters.

Limitations

- Will not operate in SSA configurations supporting high-performance 4-Port SSA Adapter or Enhanced 4-Port SSA Serial Adapter on Micro Channel.
- No IPL/Boot support from SSA disk drives
- RAID arrays must have all array members in same SSA loop
- PCI system interface only.

Operational requirements

One free PCI slot.

Fast-Write Cache Option Card

The SSA Fast-Write Cache Option Card is a 4MB fast-write optional feature that plugs into either SSA Multi-Initiator/RAID EL Adapter. It utilizes non-volatile RAM and has a data memory retention of over seven years.

The SSA Fast-Write Cache Option Card can provide as much as a 10-times improvement of data throughput and response time during certain sequence write operations compared to SSA RAID adapters without the SSA Fast-Write Cache. The response time and data transfer improvement using the option card will vary depending upon the data block sizes, the percentage of sequential writes and application parameters.

1.7. PCI 64 bits Fibre Channel Adapters (DCCG147-0000, DCCG148-0000) for the EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

The PCI 64 bits Fibre Channel Host Bus Adapters deliver exceptional performance through the use of Emulex's new Dragonfly ASIC, a 266 MIPs on-board processor, and state of the art dual ported buffer memory. These adapters include sophisticated capabilities such as full-duplex data transfers, full fabric support, parity protection and large data buffers.

The LP8000 delivers point-to-point, arbitrated loop and switch fabric connections as well as both Class 2 and 3 frame formats. Support for both copper and fiber optic cabling is provided through embedded interfaces.

Host Support

The PCI Fibre Channel Host Adapter provides simultaneous and concurrent multiple protocols (IP and SCSI) support.

Specifications

- Simultaneous full duplex fibre channel 1.0625 GB/s transfers
- 64-bit PCI data and addressing
- On-board high speed 266 MIPs RISC processor
- Large on-board buffers
- Application Programming Interface (API)
- All fibre channel topologies: point-to-point, arbitrated loop and switch topologies
- Full fabric support using F Port and FL Port connections (FL port in a future product release)
- Full support for both FC service Class 2 and 3
- Supports both network and storage protocols simultaneously (IP and FCP)
- 2 physical interfaces: embedded copper or embedded optical fiber.

Architecture

- Emulex developed ASIC technology up to 33 MHz PCI bus master DMA
- 512 KB FLASH memory
- 1 MB code RAM
- 256 KB buffer RAM.

Benefits

- Industry's best I/O performance
- Single interface for network and storage applications
- Designed to support mission critical enterprise SAN applications.

Standards

- ANSI Fibre Channel FC-PH
- ANSI Fibre Channel FC-AL
- ANSI Fibre Channel FC-PLDA
- ANSI Fibre Channel FC-FLA
- PCI Local Bus Revision 2.2
- Fibre Channel Class 2, 3

Copper

Data Rate:	1.0625 GB/s
Cable Type:	Dual Twinax
Connector Type:	DB9
Distance:	98' (30 meters)

Optical

Data Rates: 1.0625 GB/s
Optics: short wave laser
50/125 µm multimode fiber
Connector Type: dual SC

Physical Dimensions

Short PCI form factor 6.88 inch X 4.20 inch.

Power Requirements

Volts: +5 VDC
Power: 10 watts

Environmental Conditions

Operating Temperature: 32° to 113° F (0° to 45° C)
Storage Temperature: 14° to 131° F (-10° to 55° C)
Relative Humidity: 5% to 95% non-condensing

Agency Approvals

- Class 1 Laser Product per DHHS 21CFR (J) and EN60825
- UL Recognized to UL 1950
- CUR Recognized to CSA22.2, No. 950
- TUV Certified to EN60950
- FCC Rules, Part 15, Class B (Embedded copper Fibre Channel adapter is Class A)
- ICES-003, Class B (Embedded copper Fibre Channel adapter is Class A)
- EMC Directive 89/336/EEC (CE Mark)
  - EN55022, Class B*
  - EN50082-1
- Australian EMC Framework (C-Tick Mark)
  - AS/NZS 3548, Class B (Embedded copper Fibre Channel adapter is Class A)
- VCCI, Class B (Embedded copper Fibre Channel adapter is Class A).

Operating System requirement

AIX 4.3.2 or later.

Machines/number of adapters

Escala	EPC400	EPC430	EPC440	EPC450	EPC1200/A	EPC2400
Nb adapters	4	4	4	4	8	8

1.8. PCI Fibre Channel Adapter for EPC400, EPC430, EPC440, EPC1200, and EPC1200A

Discontinued: 30/11/1999.

The Fibre Channel PCI Host Bus Adapter utilizes a state of the art dual ported on-board memory architecture to provide high-performance I/O solutions for applications like client/server, database I/O, multimedia, imaging and clustering which require sustained high throughput coupled with low latency characteristics.

Architecture

The Fibre Channel PCI Host Adapter is designed using custom ASIC technology from Emulex. This integrated design, including both chip level technology and Emulex developed firmware, reduces host requirements, while simplifying the driver interface.

Emulex developed ASIC technology up to 33 MHz PCI bus master DMA

- 512 KB FLASH memory
- 512 KB - 512 KB context RAM
- 512 KB - 512 KB buffer RAM

Host Support

The PCI Fibre Channel Host Adapter provides simultaneous and concurrent multiple protocols (IP and SCSI) support.

Specifications

- Supports Fibre Channel rate of 1 Gbits/sec
- Support point-to-point and arbitrated loop Fibre Channel topologies
- Supports both network and storage protocols simultaneously (IP and FCP)
- Direct interface to copper cables through standard 80-pin GLM
- Built-in protocol engine with an integrated RISC processor.

Benefits

- Industry's best I/O performance
- Single interface for network and storage applications
- Eliminate distributed application bottlenecks.

Standards

- ANSI Fibre Channel FC-PH Revision 4.3
- ANSI Fibre Channel FC-AL Revision 4.5
- FCSI 301 Rev 1.0 Gigabaud Link Module
- PCI Local Bus Revision 2.0/2.1
- Fibre Channel Class 3.

Hardware Interface

80-pin GLM (Gigabit Link Modules) connector for copper interface.

Copper GLMs

Data Rate	1062.5 Mbits/s
Cable Type	Dual Twinax or Quad Axial
Connector Type	DB9
Distance	30 meters

Distance Supported

Up to 30m with copper cables.
Up to 175m with 62.5/125µm multimode fiber.
Up to 500m with 50/125µm multimode fiber.
Up to 10km with optical link extenders.

MIAs, Hubs and Link Extenders

- Hubs to provide up to nine copper ports (DB9 Female) with re-generated signals. The hubs can be chained. (External hubs or rack-mount hubs are available.)
- MIAs to convert copper (DB9 Male) to multimode fiber (DSC) and to provide distant connections. The MIA is directly connected to the copper interface (DBB9 Female) of the equipment.
- Link Extenders to offer a distant connection up to 10km from a copper interface (DB9) to a single mode fiber (9/125µm - optical ST)

Agency Approvals

- Class 1 Laser Product per DHHS 21 CFR (J) and EN60825
- UL Recognized to UL1950
- CUR Recognized to CSA22.2, No. 950
- TUV Certified to EN60950
- FCC Rules, Part 15, Class A
- DOC Rules, Class A
- EMC Directive 89/336/EEC (CE Mark)
  - EN55022, DISPR22/85, Class A
  - EN50082-1.

Operating System requirement

- AIX 4.3 or later.

2. Disk Drives

2.1. Disk Drives Comparison Table

	4.2 GB	4.5 GB	9.1 GB	9.1 GB	9.1 GB	9.1 GB	9,1 GB	9,1 GB	18.2 GB	18.2 GB	18.2 GB
Form Factor	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½	3"½
Size (Low Profile, Half Height or Full Height)	1"	1"	1"	1"	1.6"	1.6"	1"	1"	1"	1"	1"
Average Seek Time (ms)	7.5	7.5	6.9	6.7	8.2	8.2	5.1	5.2	7.2 *	5.2	6.9
Average Latency (ms)	4.17	4.17	4.17	4.17	4.17	4.17	2,99	2,99	4.17	2,99	4.17
Rotational Speed (RPM)	7200	7200	7200	7200	7200	7200	10000	10000	7200	10000	7200
Data Transfer Rate:											
Media (MB/sec - max)	15	15	28.3	22	10	15	44.3	36	32	36	28.3
Supported on System											
EPC400	Y		Y		Y						Y
EPC430	Y (1)		Y (1)		Y (1)			Y		Y	Y (1)
EPC440				Y			Y		Y		
EPC450	Y (1)		Y (1)		Y (1)			Y		Y	Y (1)
EPC800	Y		Y		Y						
EPC1200		Y		Y		Y			Y		
EPC1200A		Y		Y		Y	Y		Y		
EPC2400				Y			Y		Y		
Interface	SCSI-2	SCSI-2	SCSI-2	SCSI-2	SCSI-2	SCSI-2	Ultra2 SCSI	Ultra2 SCSI	Ultra SCSI	Ultra2 SCSI	SCSI-2
SE High Speed	Y	Y	Y	Y	Y	Y	LVD/SE	LVD/SE	Y	LVD/SE	Y
DE High Speed	N	N	N	N	N	N	N	N	N	N	N
Internal	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
External	-	-	-	-	-	-	-	-	-	-	-

* Based on 4 reads to 1 write.

(1) Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

(2) Read/Write.

2.2. 4.2 GB Ultra SCSI Disks for EPC400

(Discontinued: 30/10/1999)
Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "Hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	7.5
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15 (max)

3. 4.2 GB SCSI-2 High Speed Disks EPC800

Internal (SE High Speed) - "CRU"

Form factor	3"1/2
Size	1"
Average seek time (ms)	7.5
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15 (max)

2.4. 4.5 GB Ultra SCSI High Speed Disks for EPC1200 and EPC1200A

Internal (SCSI-2 or Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	7.5
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15 (max)

2.5. 9.1 GB Ultra SCSI Disks for EPC400

Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1.6"
Average seek time (ms)	8.2
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	10 (max)

2.6. 9.1 GB Ultra SCSI Disks for EPC400

Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.9
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	28.3 (max)

2.7. 9.1 GB SCSI-2 High Speed Disks for EPC800

Internal (SE High Speed)

Form factor	3"1/2
Size	1.6"
Average seek time (ms)	8.2
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	10 (max)

2.8. 9.1 GB SCSI-2 High Speed Disks for EPC800

Internal (SE High Speed)

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.9
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	28.3 (max)

2.9. 9.1 GB Ultra SCSI Disks for EPC1200 and EPC1200A

Internal (SCSI-2 or Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1.6"
Average seek time (ms)	8.2
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	15.5 (max)

2.10. 9.1 GB Ultra SCSI Disks for EPC440, EPC1200, EPC1200A and EPC2400

Internal (SCSI-2 or Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.7
Average Latency (ms)	4.17
.ational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	22 (max)

2.11. 9.1 GB Ultra2 SCSI LVD/SE Disks for Escala EPC440, EPC1200A and EPC2400

Internal (Ultra2 SCSI - LVD/SE) hot swappable disk

Form factor	3"1/2
Size	1"
Average seek time (ms)	5.1
Average Latency (ms)	2.99
Rotational speed (RPM)	10,000
Data Transfer Rate Media (MB/s)	44.3 (max)

2.12. 9.1 GB Ultra2 SCSI LVD/SE Disks for Escala EPC430 and EPC450

Internal (Ultra2 SCSI - LVD/SE) hot swappable disk

Form factor	3"1/2
Size	1"
Average seek time (ms)	5.2
Average Latency (ms)	2.99
Rotational speed (RPM)	10,000
Data Transfer Rate Media (MB/s)	36 (max)

2.13. 18.2 GB Ultra Wide SCSI Disks for EPC400

Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	3"1/2
Size	1"
Average seek time (ms)	6.9
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	28.3 (max)

2.14. 18.2 GB Ultra SCSI Disks for EPC440, EPC1200, EPC1200A and EPC2400

Internal (Ultra SCSI) - "hot-swappable disk"

Form factor	4"
Size	1"
Average seek time (ms)	7.2 (based on 4 reads to 1 write)
Average Latency (ms)	4.17
Rotational speed (RPM)	7200
Data Transfer Rate Media (MB/s)	32 (max)

2.15. 18.2 GB Ultra2 SCSI LVD/SE Disks for Escala EPC430 and EPC450

AUTONUMLGLAUTONUMLGLAUTONUMLGLAUTONUMLGLInternal (Ultra2 SCSI - LVD/SE) hot swappable disk

Form factor	3"1/2
Size	1"
Average seek time (ms)	5.2
Average Latency (ms)	2.99
Rotational speed (RPM)	10,000
Data Transfer Rate Media (MB/s)	36 (max)

3. Media

3.1. Media Usage Summary Table

S: Standard **O:** Internal Option **E:** External Option

	Current Offer	EPC400	EPC430	EPC440	EPC450	EPC800	EPC1200 & EPC1200A	EPC2400	Save/ Restore	Media Interchange
3"1/2 Floppy	1.44MB	S	S	S	S	S	S	S	Y	Y
1/4" Tape	16/32 GB	O/E	O/E (1)	N	O/E (1)	O/E	N	N	Y	Y
1/4" Tape	25/50 GB	O	O	N	O	E	N	N	Y	Y
8mm VDAT	7/14 GB	O	O	O	O	O	O	O	Y	Y
8mm VDAT	20/40 GB	E	E	E	E	E	O	O	Y	Y
mm DAT	12/24 GB	O	O	O	O	O	O	O	Y	Y
LT4000	20/40 GB	E	E	E	E	E	N	N	Y	Y
DLT7000	35/70 GB	E	E	E	E	E	E	E	Y	Y
1/2" Tape	STK	E	E (1)	N	E (1)	E	N	N	Y	Y
CD-ROM	600 MB	S	S	S	S	S/O	S	S	N	N

(1) Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

3.2. Diskette Drives

3.2.1. 3.5-Inch 1.44MB Diskette Drive

A 1.44 MB 3-1/2 inch diskette drive is standard on all ESCALA system units. It supports also the 720 KB format.

Attachment

The drive attaches to the system using an internal cable to the diskette controller in the system unit.

3.3. Tape Drives

3.3.1. QIC 16/32 GB MLR1 1/4-Inch Cartridge Tape Drive (MTUG032)

(Discontinued: 30/10/1999)
Note: Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

The QIC 16/32 GB MLR1 (Multi Channel Linear Recording 1) 1/4 inch Cartridge Tape Drive operates in a streaming mode and provides data interchange and save/restore capabilities with preformatted data cartridges.
The cartridge loading in QIC 16/32 GB MLR1 Tape Drive is motorized.

The drive supports the following standards:

Format	Maximum Capacity	Operation	Bull Express Reference	Imation Reference
QIC 5010	16/32 GB	R/W - ECC	43473	16.0 GB
QIC 5010	13/26 GB	R/W - ECC	47023	13.0 GB
QIC-2 GB	2.5/5 GB	R/W - ECC	3236	MAGNUS 2.5
QIC 1000	1.2 GB	R/W - ECC	3217	MAGNUS 1.2
QIC 525	525 MB	R/W - ECC	3215	DC 6525
QIC 150	150 MB	R/W	3209	DC 6150

The QIC 24 format is not available anymore.

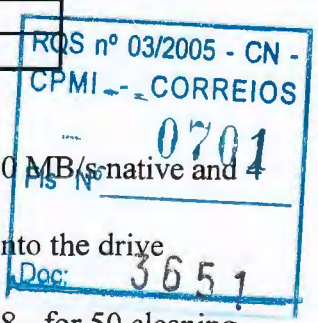
* SCSI Bus transfer rate: 18 MB/s
User average Data Transfer rate, streaming mode: 1.5 MB/s native and 3 MB/s compressed (assuming an average Data Compression ratio of 2:1).
Warning: Capacity and transfer rate using the HW Data Compression embedded into the drive depends on the pattern of the transferred data.
Need of a special "Dry Process" cleaning cartridge - Bull Express Reference: 05678 - for 50 cleaning.

3.3.2. QIC 25/50 GB MLR3 1/4-Inch Cartridge Tape Drive (MTUG036)

The QIC 25/50 GB MLR3 (Multi Channel Linear Recording 3) 1/4 inch Cartridge Tape Drive operates in a streaming mode and provides data interchange and save/restore capabilities with preformatted data cartridges.
The cartridge loading in QIC 25/50 GB MLR3 Tape Drive is motorized.

The drive supports the following standards:

Format	Maximum Capacity	Operation	Bull Express Reference	Imation Reference
MLR3-25GB	25/50 GB	R/W ECC	43498	MLR3 25 GB
QIC 5010	16/32 GB	R/W - ECC	43473	16.0 GB
QIC-4 GB	4/8 GB	R only - ECC	43474	MAGNUS 4.0
QIC-2 GB	2.5/5 GB	R only - ECC	3236	MAGNUS 2.5
QIC 1000	1.2 GB	Not Supported		
QIC 525	525 MB	Not Supported		
QIC 150	150 MB	Not Supported		
QIC 24	60 MB	Not Supported		



User average Data Transfer rate, streaming mode with MLR3 25 GB cartridges: 2.0 MB/s native and 4 MB/s compressed (assuming an average Data Compression ratio of 2:1).
Warning: Capacity and Transfer rate using the HW Data Compression embedded into the drive depends on the pattern of the transferred data.
Need of a special "Dry Process" cleaning cartridge - Bull Express Reference: 05678 - for 50 cleaning.

3.3.3. 5/10 GB 8 mm Tape Drive (or VDAT 5/10 GB) (MTUG037)

(Discontinued)

The 5 GB 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 500 KB per second.

The 5 GB 8 mm tape drive features data compression hardware using an adaptation of IBM's IDRC algorithm This provides an effective capacity of up to 10 GB of data per cartridge and an increased effective data rate of 1 MB per second, assuming an average data compression 2:1 and depending on the type of data transferred.

3.3.4. 7/14 GB 8 mm Tape Drive (or VDAT 7/14 GB) "Eliant" (MTUG029)

The 7 GB 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 1 MB per second.

The 7 GB 8 mm tape drive features data compression hardware using an adaptation of IBM's IDRC algorithm. This provides an effective capacity of up to 14 GB of data per cartridge and an increased effective data rate of 2 MB per second, assuming an average data compression 2:1 and depending on the type of data transferred.

Caution:	The 8200 format is **"Read only"**. When using this format the cartridge **MUST** be write protected.

3.3.5. Internal/External 20/40 GB 16-bit 8 mm Tape Drive (or VDAT 20/40 GB)

The 20 GB 16-bit 8 mm Tape Drive is a SCSI streaming tape drive that uses 8 mm data cartridges. The sustained data transfer rate is 3 MB per second.

The 20 GB 16-bit 8mm Tape Drive features a Liquid Crystal Display (LCD) to provide operating and error messages.

The 20 GB 16-bit 8 mm tape drive features data compression hardware using an adaptation of IBM's IDRC algorithm. This provides an effective capacity of up to 40 GB of data per cartridge and an increased effective data rate of 6 MB per second, assuming an average data compression 2:1 and depending on the type of data transferred.

The 20 GB 16-bit 8mm tape drive reads the 8mm tape cartridges in capacities of 2.3GB, 5GB, 7GB and 20GB in native mode or 10GB, 14GB and 40GB in compressed mode.
The 20GB 16-bit 8mm tape drive writes the 8mm tape cartridges in capacities of 20GB in native mode and 40GB in compressed mode when using Advanced Metal Evaporated (AME) media.

Characteristics:

- Capacity: 20GB native mode, 40GB (typical) compression mode
- Form Factor: 5.25-inch half-high
- Media: 8mm Advanced Metal Evaporated media on Write/Read 20GB format, 8mm Metal Particle (MP) media on Read 2.3GB, 5GB, 7GB format
- Technology: Helical scan, rotating head, Liquid Crystal Display (LCD) for messages
- Operation: Streaming
- Data Transfer Rate: 3MB/s native mode, 6MB/s (typical) compression mode
- Interface: SCSI-2 (single-ended) asynchronous/synchronous
- Physical Specifications: 250mm (Width), 275mm (Depth), 55mm (Height), 5Kg (Weight)

EMC Conformance Classification:

- USA: FCC Class B
- Japan: VCCI-2
- Europe: CISPR 22 Class B

Product Safety/Country Testing/Certification:

- USA: UL
- Canada: CNL (CSA or cUL)
- Germany/Europe: CE Mark (Safety, TUV, EN60 950).

Warning: The 8mm Metal Particle media (2.3GB, 5GB and 7GB) is "Read only".

Limitations:

If this tape drive is used for reading Metal Particle media (2.3GB, 5GB or 7GB), the drive must be cleaned with a cleaning cartridge prior to using an Advanced Metal Evaporated media (20GB).
Cleaning Tape: Ref 315250 (Bull Express) for 18 cleanings.

3.3.6. 12/24 GB 4 mm Tape Drive (MTUG028)

The 4mm tape drive features IPL capability and up to 24GB of storage capacity with compression in a 3.5" full high enclosure that attaches via the SCSI interface.

The main characteristics of the 4mm tape drive are:

- Non-data grade media rejection (will not write on audio grade media)
- DDS, DDS2 and DDS3-data compression format
- SCSI2 command support with SCSI-2 SE interface
- Synchronous and asynchronous SCSI data transfers, streaming operation
- Average file search speed:
  - 40 second (125m tape)
- 12GB capacity per cartridge, 24GB with data compression (typical)

- Data transfer rate:
  - Max. Sustained Native: 1 MB/s
  - Max Burst Asynchronous: 3 MB/s
  - Max. Burst Synchronous: 10 MB/s
- Data Buffer 2 MB
- Rewind Speed 1m/s.

	Cartridge Types			
	DDS-1 (60m)	DDS-1 (90m)	DDS-2 (120m)	DDS-3 (125m)
Characteristics	Read and write in DDS-1	Read and write in DDS-1	Read and write in DDS-2	Read and write in DDS-3
Data capacity *	1.3GB/2.6GB	2GB/4GB	4GB/8GB	12GB/24GB
Bull Express Reference cartridge	3226	3227	3228	3230

SYMBOL * in Not Compressed/Compressed mode

3.3.7. DLT 4000 Tape Drive

The DLT 4000 tape drive is a high-performance, high capacity, streaming 1/2" cartridge tape product designed for use on midrange and high-end systems.

The main characteristics of the DLT 4000 tape Drive are:

- External Table Top - 5"1/4 form factor - 1/2" tape drive
- 20GB capacity per cartridge, 40GB typical with 2:1 data compression ratio
- Differential interface (up to 25m connection)
- Tape cartridge available
  - CompacTape IV (up to 20GB native formatted data)
  - CompacTape III (2.6, 6.0 and 10GB native formatted data depending on selection)
- SCSI-2 differential interface - wide connection
- Data transfer rate: 1.5MB/second native, 3.0MB/s in compression mode (with 2:1 ratio)
- Dual channel read/write
- Maximum block size of 16MB
- Read/write data cache of 2MB
- Tape mark directory to maximize throughput and to minimize data access tie
- Timing characteristics:
  - Tape speed: 110 inches/sec on read/write - 150 inches/sec on search
  - Average rewind time: 45 sec
  - Average access time: 45 sec
  - Load to BOT : 48 sec for tape already used
  - Unload from BOT: 17 sec.

Warning: The CompacTape III (2.6GB, 6GB and 10GB) can be only "on read".

The CompacTape IV (20GB) can be "on read" or "on write".
The CompacTape (40GB) cannot be "on read".

3.3.8. DLT 7000 Tape Drive

The DLT 7000 Tape Drive is a high-performance, high capacity, streaming 1/2" cartridge tape product designed for use on midrange and high-end systems.

The main characteristics of the DLT 7000 Tape Drive are:

- External Table Top - 5"1/4 form factor - 1/2" tape drive
- 35 GB capacity per cartridge, 70 GB typical with 2:1 data compression ratio
- Differential interface (up to 25m connection)
- Tape cartridge available
  - CompacTape IV (20GB and 35GB native formatted data)
  - CompacTape III (2.6, 6.0 and 10GB native formatted data depending on selection)
- SCSI-2 differential interface - wide connection
- Data transfer rate: 5.0 MB/second native, 10 MB/s in compression mode (with 2:1 ratio)
- Quad channel read/write
- Maximum block size of 16 MB
- Read/write data cache of 8 MB
- Tape mark directory to maximize throughput and to minimize data access tie
- Timing characteristics:
  - Tape speed: 160 inches/sec on read/write - 175 inches/sec on search and on rewind
  - Average rewind time: 60 sec
  - Average access time: 60 sec
  - Load to BOT : 47 sec for tape already used
  - Unload from BOT: 17 sec.

Warning: The CompacTape III (2.6GB, 6GB and 10GB) and the CompacTape IV (20GB) can be only "on read". The CompacTape IV (40GB) can be "on read" or "on write".

3.4. CD-ROM Drives

3.4.1. 14-32 Speed Tray-Loading CD-ROM Drive for EPC400 and EPC800

The 14-32 Speed Tray-Loading CD-ROM is a 600MB SCSI-2 CD-ROM drive that provides from 14 up to 32x speed performance with the convenience of loading a CD without a caddy.

The speed is on Constant Angular Velocity. The speed is depending on the location of the "read head".

Main characteristics are:

Form factor:	5"¼ in Half High
Height:	42 mm
External Interface:	SCSI-2 8-bit Single Ended
Interface Speed:	10 Mb/sec max. burst
Access Time:	90 ms average
Data Rate:	from 2300 Kb/sec to 5400 Kb/s average

3.4.2. Twenty Speed Tray-Loading CD-ROM Drive for EPC440, EPC1200 and EPC1200A

The Twenty Speed Tray-Loading CD-ROM is a 600MB SCSI-2 CD-ROM drive that provides more speed performance.

Main characteristics are:

Form factor:	5"¼ in Half High
Height:	43 mm
External Interface:	SCSI-2 8-bit Single Ended
Interface Speed:	10 Mb/sec max. burst
Buffer memory:	512KB
Access Time:	95 ms average
Data Rate:	3000 Kb/sec maximum

Multisession capable (Reads CDR and CDRW media)
Loading tray supports 12-cm and 8-cm disks

4. Escala EPC Expansion Racks

The Escala EPC400 and EPC800 Expansion Rack Unit is a 1.8m high expansion rack. The rack is an industry-standard 19-inch rack designed to comply with the EIA-310C standard. It contains 36 EIA units of vertical mounting space.

A power distribution bus, which provides 8 AC power outlets (6 to the drawers, 1 for a modem, 1 for the CPC), occupies one EIA unit. The rack has an immediate power-off switch.

The Escala EPC1200 Expansion Rack Unit is a 1.6m high expansion rack. The rack is an industry-standard 19-inch rack designed to comply with the EIA-310C standard. It contains 32 EIA units of vertical mounting space.

Available drawers with their own U height:

EPC400-N Drawer	4U
EPC430-N Drawer	4U
EPC440 Drawer	8U
EPC450-N Drawer	4U
EPC800-N Drawer	6U
EPC1200A I/O Drawer	10U
EPC1200 I/O Drawer	7U
EPC2400 Drawer	10U
EPC400 Expansion PCI Drawer	4U
EXB440/480 Drawer	12U
Disk/Media Drawer	5U
DAS5700 DPE enclosure rackmount (*)	8U
DAS5700 DAE enclosure rackmount	4U
DAS5300 iDAE enclosure rackmount (*)	5U
DAS5300 DAE enclosure rackmount	4U
DAE5000 DAE enclosure rackmount	4U
DAS3200/DAS3500 Drawer	12U
DAS2900 Drawer	8U
DAS1300 Drawer	6U
STK9914 Drawer	5U
SSA Drawer	4U
DLT4000/7000 Drawer	4U
Console Concentrator with Cluster Administration Hub drawer	4U
FDDI Hub kit Drawer	8U
FDDI Switch Kit Drawer	6U
Fibre Channel (FC-AL) Hub Drawer	1U
UPS 3KVA Drawer	4U
Additional Power Distribution Board Drawer	2U

(*) Including 1U space for one or two SPS.

5. Disk Subsystems

5.1. Escala External Additional Disk/Media Drawer for EPC800

The Escala External Additional Disk/media Drawer is the Escala Mini Tower Disk Cabinet designed in a Drawer; it provides additional disk storage to Escala EPC800 model.

The Escala External Additional Disk/media Drawer features:

4 bays for 1-inch disks (2.1GB, 4.2GB, 9.1GB) or 1.6-inch disks (9.1GB)
2 bays for 1-inch media / disks

The Escala External Additional Disk/media Drawer can contain maximum of six SCSI-2 SE 2.1/4.2/9.1GB internal drives for a maximum total disk storage per cabinet of 54.6GB.
ıe Escala External Additional Disk/media Drawer comes without disk.

Two Media bays are available for the attachment of the following combinations of media devices:

One 7/14 GB internal 8-mm Tape Drive
One 12/24 GB internal 4-mm Tape Drive
One 13/26 GB internal 1/4-inch Cartridge Tape Drive

If the Media bays are used, the maximum disk capacity is: 4x9.1 = 36.4GB

Attachment

An Escala EPC800 is required to support External Additional Disk/media Drawers.
Maximum four Escala External Additional Disk/media Drawer can be attached (Noemie allows one Additional Disk/Media Drawer per node).

5.2. Common features of the fibre DAE/DAS5000 Series

5.2.1. Highlights

The 5000 Series constitutes a powerful, highly scalable, family of fibre channel storage solutions. It provides JBOD or RAID capabilities, terabytes of disk storage capacity, high transfer rates, flexible configurations, and high availability. These storage systems are ideal solutions for today's sophisticated enterprise.

The main customer benefits are:

- high performance
- scalability and flexibility
- low foot print with capability to mix servers and storage in the same packaging (rack only)
- capability to build high availability solutions with AIX servers
- easy to use management tools

This line of disk subsystems is based on a common modular architecture, reusing the same components across the complete range. These basic building blocks are:

disks	dual-ported fibre channel disks.
DAE enclosure	a 10 disk module, which can be chained to provide the required capacity.
iDAE	Intelligent DAE, a DAE module with one or two RAID Storage Processors (SP) designed for mid-range disk
DPE	a high end single or dual RAID Storage Processors with up to 10 disks.

5.2.2. Disks

5.2.2.1. Overview

The disk drives integrated in the 5000 Series are fibre channel, dual-ported drives. The disk size is 9 GB, 18GB and 36 GB (DAS 5000 Series only).

5.2.2.2.Disk formatting

The disk formatting depends on the disk subsystem in which they are integrated: it is either 520 bytes per sector (for RAID subsystems), or 512 bytes per sectors (JBOD). Thus, it is not possible to move disks from a JBOD subsystem to RAID subsystem. Reformatting is required. (And could be proposed in SFR). Changing disks formatting is not possible with the tools shipped with the disk subsystems, and can not be performed at customer site.

5.2.2.3.Technical specifications

	9 GB – 10 K rpm	18 GB – 10K rpm	36 GB – 10K rpm (1)
Capacity (RAID formatting)	8.839 GB	17.554 GB	35.458 GB
Capacity (JBOD formatting)	9.1 GB	18.2 GB	36 GB
Form factor	3.5"	3.5"	3.5"
Height	1.0"	1.0"	40.6 mm
Rotational speed	10 000 rpm	10 000 rpm	10 000 rpm
Interface	Fibre Channel	Fibre Channel	Fibre Channel
Data buffer	1 MB	1 MB	1 MB
# of segments	up to 16	up to 16	
Transfer rates			
Buffer to/from media	17.2 – 25.3 MB/s	17.2 – 25.6 MB/s	18 – 28 MB/s
SP or HBA to/from buffer (2)	100 MB/s (max)	100 MB/s (max)	100 MB/s (max)
ccess time			
average seek	5.2 ms read	5.7 ms read	5.7 ms read
	6.0 ms write	6.5 ms write	6.5 ms write
Rotational latency	2.99 ms	2.99 ms	2.99 ms
Connector	40-pin, FC-SCA-2	40-pin, FC-SCA-2	40-pin, FC-SCA-2
Monitoring protocol	SES/SFF-8067	SES/SFF-8067	

(1) DAS 5000 Series only.

MTBF

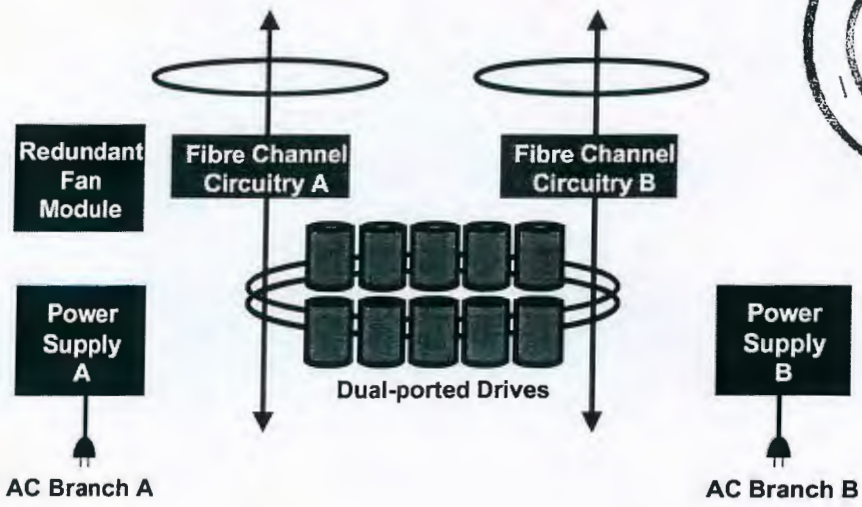
9 GB, 10K rpm 1,000,000 h
18 GB, 10K rpm 1,000,000 h
36 GB, 10K rpm 1,000,000 h

SYMBOLSYMBOL**5.2.3. AUTONUMLGLDAE enclosure**

5.2.3.1. Overview

The **DAE** (Disk-Array Enclosure) is a 10-slot enclosure without RAID capabilities (no SPs), playing the role of the capacity building block. This enclosure is the base of the modular. Several enclosures can be chained to create larger configurations.

The figure below summarizes the hardware architecture of a DAE enclosure. A DAE contains at least one Fibre Channel loop. The hardware to implement the second FC-AL loop is optional. Individual hardware components are discussed later in this document.



The DAE components include:

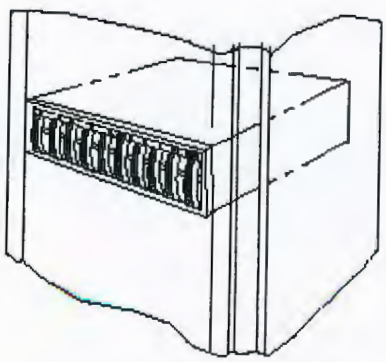
- One or two LCCs (Link Controller Cards, shown as "fibre channel circuitry" in the figure above) to implement one or two FC-AL loops.
- Up to 10 fibre channel dual ported disk modules.
- One or two power supplies each with its own power cord.
- One redundant fan module to cool the disks.

All these components can be replaced under power.

5.2.3.2. Rack packaging:

The DAE enclosure is available as a rackmount (4U) unit.

Rackmount



5.2.3.3. Host connectivity and management

The DAE offers one Fibre Channel DB/9 copper connectors per LCC for the connection to servers, hubs, converters, and other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

The DAE is unmanaged equipment.

5.2.3.4. Architecture: SP, LCC, disks, memory

5.2.3.4.1. LCC (Link Control Cards)

DAE enclosures can be equipped with one or two LCCs. The LCC receives and electrically terminates the incoming FC-AL signal from the host or other kind up "up stream" devices. The LCC passes the input signal to its disk drives and then conducts the output signal, via cables, to an LCC of the next DAE in the loop (if any). In addition, each LCC monitors the environmental status of the enclosure.

When enclosures are equipped with two LCCs, two distinct internal fibre channel loops can be implemented, and in the event of an LCC failure, access remains possible through the other LCC.

Each LCC contains two connectors. One is reserved for the connection to another DAE. The other can be used to connect another DAE or other type of devices, like servers, iDAE enclosures or DPE enclosures. Technically, the number of DAE enclosures that can be chained is limited to 12, resulting in a 120 disks configuration, compatible with the limitations of the Fibre Channel loop.
The distance between chained DAE enclosures is limited to 10m with copper cables.

5.2.3.4.2. Power Supplies

DAE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if one is present. Each supply is equipped with its own power cord, making the connection to two different power sources possible.

5.2.3.4.3. Cooling Fans

DAE enclosures are equipped with a drive fan pack that cools the disk modules. The fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increase to compensate. If needed (for example to change a failed power supply), a fan pack can be removed for exchange operation while the storage system continues to operate. The exchange operation, however, must not exceed two minutes, otherwise disks will shut down.

5.2.3.4.4. Disk drives

The DAE enclosures use the same disks than the other enclosures of the 5000 Series. Only the formatting differs. The minimum number of disks per DAE enclosure depends on the number of LCCs. The maximum is always 10 disks:

	Minimum	Maximum
1 LCC	2	10
2 LCC	4	10

5.2.3.5. Summary of high availability features

- Dual port disks
- Dual loops / LCCs
- Dual Power supply with independent power cords
- Redundant fans
- No electronics in the chassis or back plane
- All active components are hot pluggable.

5.2.3.6. Performance figures

The performance of the DAE enclosure are the performance of the individual disks which are in the enclosure.

5.2.3.7. Technical specifications

Interface to host

Fibre Channel interfaces of 100 MB/s (1 LCC) or 200 MB/s (2 LCCs).
9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA).

Dimensions (approximate)

DAE rackmount:

- Height - 6.07 in. (15.4 cm), 3.5 EIA units (occupies 4 units of rack space)
- Width - 17.5 in. (44.5 cm) (Standard NEMA 19-inch rack)
- Depth - 24 in. (60.9 cm)
- Weight - 78 lb. (35.4 kg) max.

Power requirements

- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies).

Rack:

- Current Draw: At 100 v ac input – 10-slot DAE: 4A
- Power consumption: 10-slot DAE: 400VA.

Operating environment

Temperature:	50 - 104 degrees F (10 - 40 degrees C)
Temperature Gradient:	10 degrees C/hr
Relative Humidity:	20% - 80% (non-condensing)
Elevation:	10,000 ft (3048m) @ 37°C.
Operating Shock:	3 G @ 11 ms, ½ sine pulse
Operating Vibration:	.25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC Class A, EN55022 Class A, CE Mark, VCCI Class 1
- Safety: UL 1950, CSA C22.2-950, EN 60950.

MTBF

Drive Fan pack:	667 000 h
DAE LCC:	781 000 h
DAE power supply	162 000 h
DAE midplane:	4 761 000 h

SYMBOLSYMBOLSYMBOLSYMBOL

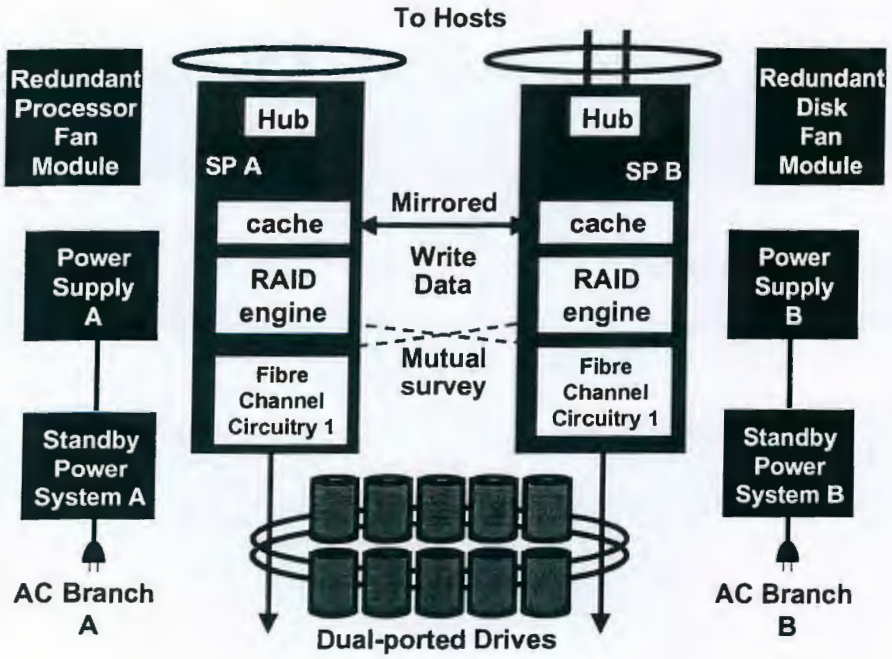
5.2.4. iDAE enclosure

5.2.4.1. Overview

The **iDAE** (Intelligent DAE) is a 10-slots enclosure DAE with RAID functionality provided by one or two SPs (Storage Processors), which replace the LCC cards of the basic DAE. It has been designed to build mid range disk subsystems, with up to 30 disks. It is a "full Fibre Channel" RAID subsystem, using Fibre Channel for both host connect (i.e. font-end) and internal disks connection (i.e. back-end).

Entry price configurations can be defined with the minimum of hardware redundancy, to enable cost attractive solutions. Upgrade to a fully redundant high availability configuration is a simple matter of adding redundant hardware components (described below). All these components are designed for non-disruptive removal and insertion, and can be replaced under power.

The figure below summarizes the hardware architecture of an iDAE enclosure. An iDAE contains at least one SP. The second SP is optional. Individual hardware components are discussed later in this document.



The iDAE components include:

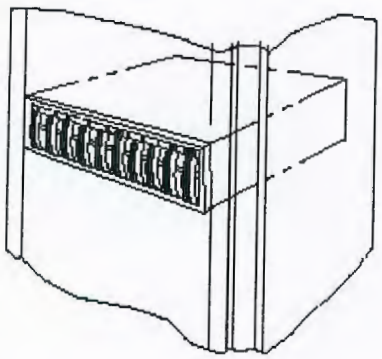
- One or two SPs (Storage Processors), with Fibre Channel circuitry, to manage the internal loops of the RAID subsystem.
- Up to 10 fibre channel dual ported disks.
- One or two power supplies each with its own power cord.
- One redundant fan module to cool the disks and another to cool the SPs.
- To implement write caching, one or two SPSs (Standby Power Supplies – also called BBUs, i.e. Battery Backup Units).

All these components can be replaced under power.

5.2.4.2. Rack packaging:

The iDAE enclosure is available as a rackmount (4U) unit.

Rackmount



Note: for rackmount systems, the SPS is placed in a tray directly beneath the iDAE (one or two SPS units fit in a 1 U space, one beside the other)

5.2.4.3. Host connectivity and management

The iDAE offers two Fibre Channel DB/9 copper connectors per Storage processors for the connection to servers, hubs, converters, and other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

The two ports correspond to a single fibre channel loop. The typical usage is the direct connection of two servers on a single SP. The use of the two connectors to chain multiple devices (servers, SPs or other disk subsystems, …) is not recommended.

The iDAE can be managed in-band, (i.e. through the host fibre channel interfaces), from any server connected to the iDAE, using the Navisphere software. This mode of management is manageable as long as the server can access to a LUN.

A RS232 with RJ11 connector is also available. It allows iDAE management with Navisphere when, in consequence of administrator errors (or of highly improbable failures), there is no more LUN reachable. RJ11/DB9M, plus DB9F/DB25M converters and a RS232 6m DB25F/DB25F cable are shipped with each iDAE.

5.2.4.4. Architecture: SP, LCC, disks, memory

5.2.4.4.1. SPs (Storage Processors) and host interface

The SP provides the following features to the disk subsystem:

- RAID processing
- host interface management
- backend management
- memory
- built-in hub for external connection
- Fibre Channel circuitry for backend.

Each SP has 3 fibre channel connectors.

Port A and port B connectors correspond to a built-in hub, offering a 100 MB/s logical connection. Using these connectors, 2 devices (like HBA within servers) can be connected to the same SP, without any external devices. They share the 100 MB/s of bandwidth. Above two devices, an external hub must be used.

The host interface offers DB9 / copper connections up to 30m. MIAs are supported, to enable longer distances using multimode optical fibers.
The host interface implements the FCP-SCSI-3 protocol. Command tag queuing is implemented.

The third connector is a DB9 expansion connector (EXP) which enables the connection to an additional DAE enclosure. It is not possible to chain more than 2 DAEs. When iDAE is equipped with two SPs, two distinct internal fibre channel loops are available, and the chained DAEs must be equipped with dual LCCs. In the event of a failure, disk access remains possible through the other SP. The distance between iDAE and DAE or between chained DAE enclosures is limited to 10m with copper cables.

5.2.4.4.2. Power Supplies (and PDUs)

iDAE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if present. Each power supply is equipped with its own power cord, making the connection to two different power sources possible.

5.2.4.4.3. Standby Power Supply (SPS)

The SPS protects the iDAE against external power supply failures, and enables to properly stop a disk subsystem in case of power outage.

SPS are optional, but at least one SPS must be installed to use the write cache. Optionally, a second SPS can be installed to provide higher availability.

The SPS is also named BBU (Battery Backup Units).

5.2.4.4.4. Cooling Fans

iDAE enclosures are equipped with a drive fan pack that cools the disks and the SPs. The fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increases to compensate. If needed, a fan pack can be removed for exchange operation while the storage system continues to operate (the exchange operation, however, must not exceed two minutes, otherwise disks and SPs shut down).

5.2.4.4.5. Disk drives

The iDAE enclosures use the same disk than the other enclosures of the 5000 Series. The minimum number of disks per iDAE enclosure depends on the number of SP. The maximum is always 10 disks:

	Minimum	Maximum
1 SP	3	10
2 SP	5	10

Disks are formatted with 620 bytes per sectors.

5.2.4.4.6. Memory

Each SP can have 64 or 128 MB of memory.

The Flare (micro code running on the SP) requires 15 to 18 MB. The remaining 110 MB of memory can be used as a read cache, or write cache, or a mixture of both, to improve the subsystem performance.

To ensure data consistency in case of failure, **the write cache is always mirrored**, and the following hardware configuration must be used:

- Two SPs per iDAE
- Two power supplies and two LCCs in the iDAE and in each DAE
- Disk slots 0 through 4 of the iDAE enclosure must be populated.
- One SPS with a fully charged battery (two SPSs provide higher availability)
- Identical cache memory in both SPs (64 or 128 MB per SP).

It is not possible to use write caching without mirroring across SPs, and without the hardware configuration described above. For example, it is not possible to configure a write cache on an iDAE with a single SP.

The usable cache size is computed as described in the next table:

	1 SP	2 SP
Raw memory per SP (64 MB or 128 MB)	M	M
Write cache	0	W < M
Read cache	M	2 x (M – W)
Total	M	W + 2 x (M – W)

M is the amount of available raw memory per SP
W is the value configured for the write cache size.

Because of the mirroring, the usable write cache is not multiplied by the number of SPs.

5.2.4.5. Summary of high availability features

- dual port disks
- dual loops / LCCs
- dual Power supply with independent power cords
- redundant fans.
- no electronics in the chassis or back plain
- all active components are hot pluggable
- RAID protection
- redundant SP
- mirrored write cache.

5.2.4.6. Supported Fibre Channel topologies

The Fibre channel host interfaces of the iDAE supports the following topologies:

- Private loops (using the internal hub of the SPs or external hubs)

5.2.4.7. RAID features

The RAID features of the iDAE are:

- supports of RAID 0, RAID 1, RAID 1/0, RAID 3, RAID 5 and "individual disk" modes
  LUN type: Possible number of disks in the LUN:
  RAID 0: 3 to 16 disks
  RAID 1: 2 disks
  RAID 1/0: 4 to 16 disks (must be an even number)
  RAID5: 3 to 16 disks
  each disk module in a LUN must have the same capacity (otherwise, disk storage space is wasted)
- any combination of RAID levels can exist in the same subsystem
- up to 32 LUNs configurable (either individual disks or RAID volumes)

- 2 global hot spares, with rebuild priority adjustment (configurable threshold for the minimum number of IO reserved for server use during rebuild). The capacity of a hot spare disk must be at least as great as the capacity of the largest disk module that it might replace.

Caution:
The RAID groups, LUN expansion defragmentation features announced by Clariion on NT are not yet supported on AIX.

5.2.4.8. Performance figures

- 8400 IO/s from SP cache, with dual SP
- 120 MB/s with dual SP

These values are measured from SP cache to servers. They represent the processing power of the SP, and the maximum performance that could be obtained with optimal configuration. In real configurations, performance is lower, and mainly depends on the number of disks: few disks means low throughput and low read/write IO rates.

5.2.4.9. Technical specifications

Interface to host
Fibre Channel interfaces of 100 MB/s (1 SP) or 200 MB/s (2 SPs).
9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA).

Fibre Channel related standards:
- FC-PH, Rev 4.4
- FC-AL Rev 4.5
- Private Loop Direct Attach PLDA Rev 1.10
- SCSI Enclosure Services (SES) Rev 8a

Dimensions (approximate)

iDAE rackmount:
- Height - 6.07 in. (15.4 cm), 3.5 EIA units (occupies 4 units of rack space)
- Width - 17.5 in. (44.5 cm) (Standard NEMA 19-inch rack)
- Depth - 24 in. (60.9 cm)
- Weight - 80 lb. (36 kg) max.

Power requirements
- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies)

Rack:
- Current Draw: At 100 v ac input: 4A

- Power consumption: 400VA (fully configured)

Operating environment

Temperature:	50 - 104 degrees F (10 - 40 degrees C)
Temperature Gradient:	10 degrees C/hr
Relative Humidity:	20% - 80% (non-condensing)
Elevation:	10,000 ft (3048m)
Operating Shock:	3 G @ 11 ms, ½ sine pulse
Operating Vibration:	.25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC part 15 Class A and B, EN55022 Class A and B, CE Mark, VCCI Class 1 and 2
- Safety: UL 1950, CSA C22.2-950, EN 60950

MTBF

SP:	125 000 h
Drive Fan pack:	667 000 h
SP FAN pack:	162 000 h
iDAE power supply	4 761 000 h
iDAE midplane:	4 761 000 h
SPS:	100 000 h

5.2.5. DPE enclosure

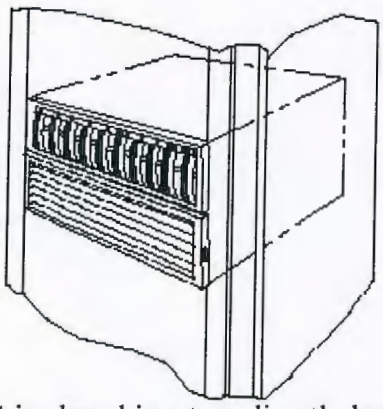
5.2.5.1. Overview

The **DPE** (Disk-Array Processor Enclosure) is a 10-slots enclosure with RAID functionality provided by one or two SPs (Storage Processors). It has been designed to build high-end disk subsystems, with up to 120 disks. It is a "full Fibre Channel" RAID subsystem, using Fibre Channel for both host connect (i.e. front-end) and internal disks connection (i.e. back-end).

Configurations can be defined with the minimum of hardware redundancy, to enable cost attractive solutions with high end SPs. Upgrade to a fully redundant high availability configuration is a simple matter of adding redundant hardware components (described below). All these components are designed for non-disruptive removal and insertion, and can be replaced under power.

5.2.5.2. Rack packaging

The DPE enclosure is available as a 7U rackmount unit (shown below).



Note: for rackmount systems, the SPS is placed in a tray directly beneath the DPE (one or two SPS units fit in a 1 U space, one beside the other)

5.2.5.3. Host connectivity and management

The DPE offers two Fibre Channel DB/9 copper connectors per Storage processors for the connection to servers, hubs, switches, converters, and other kind of fibre channel devices. MIA are supported to provide optical interface for the connection of 50 µm multimode optical fibers. 62.5 µm fibers may also be acceptable.

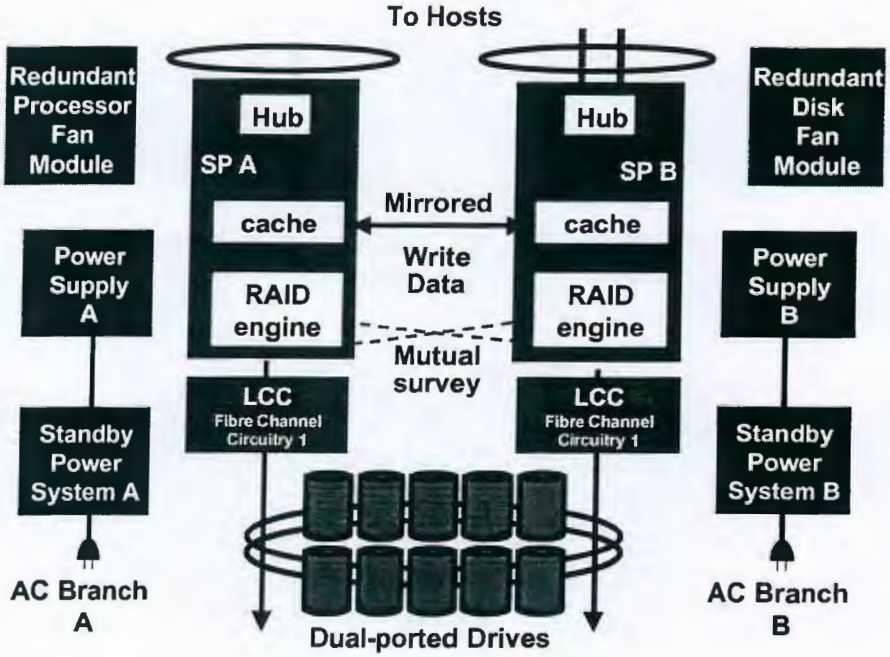
The two ports correspond to a single fibre channel loop. When connecting to a switch, a single connector must be used. In other circumstances, both connectors are usable. The typical usage is the direct connection of two servers on a single SP. The use of the two connectors to chain multiple devices (servers, SPs or other disk subsystems, ...) is not recommended.

The DPE can be managed in-band, (i.e. through the host fibre channel interfaces), from any server connected to the DPE, using the Navisphere software. This mode of management is manageable as long as the server can access to a LUN.

A RS232 with DB9 connector is also available. It allows DPE management with Navisphere when, in consequence of administrator errors (or of highly improbable failures), there is no more LUN reachable. A DB9/DB25M converter and a RS232 6m DB25F/DB25F cable are shipped with each DPE.

5.2.5.4. Architecture: SP, LCC, disks, memory

The figure below summarizes the hardware architecture of a DPE enclosure. A DPE contains at least one SP and one LCC. The hardware to implement the second FC-AL loop is optional. Individual hardware components are discussed later in this document.



The DPE components include:

- One or two SPs (Storage Processors)
- One or two LCCs (Link Controller Cards, shown as "fibre channel circuitry" in the figure above) to implement one or two FC-AL loops
- Up to 10 fibre channel dual ported disk modules
- One or two power supplies each with its own power cord
- One redundant fan module to cool the disks and another to cool the SPs
- To implement write caching, one or two SPSs (Standby Power Supplies – also called BBUs, i.e. Battery Backup Units).

5.2.5.4.1. SPs (Storage Processors) and host interface

The SP provides the following features to the disk subsystem:

- RAID processing
- host interface management
- backend management
- memory
- built-in hub for external connection.

Each SP has 2 fibre channel connectors. Port A and port B connectors correspond to a built-in hub, offering a 100 MB/s logical connection. Using these connectors, 2 devices (like HBA within servers) can be connected to the same SP, without any external devices. They share the 100 MB/s of bandwidth. Above two devices, an external hub or switch must be used.

The host interface offers DB9 / copper connections up to 30m. MIAs are supported, to enable longer distances using multimode optical fibers.
The host interface implements the FCP-SCSI-3 protocol. Command tag queuing is implemented, with up to 256 tags.

5.2.5.4.2. LCC (Link Control Cards)

DPE enclosures can be equipped with one or two LCCs (depending on the number of SP). The LCC receives and electrically terminates the incoming FC-AL signal from the host or other kind up "up stream" devices. The LCC passes the input signal to its disk drives and then conducts the output signal, via cables, to an LCC of the next DAE in the loop (if any). In addition, each LCC monitors the environmental status of the enclosure.

There is a one-to-one relation between SPs and LCCs. Either the DPE enclosure has one SP and one LCC, or the DPE has 2 SPs and 2 LCCs. When enclosures are equipped with two LCCs, two distinct internal fibre channel loops can be implemented, and all the DAE enclosures chained in the backend must have 2 LCCs each. In the event of a failure, disk access remains possible through the other SP/LCC.

The connector of the LCC of the DPE enclosure is reserved for the connection to another DAE. Technically, up to 11 DAE enclosures can be chained to create a RAID subsystem with 120 disks capacity (10 in PDE plus 11x10 in DAE enclosures). Interconnection is made with copper cables. The distance between DPE and DAE or between chained DAE enclosures is limited to 10m with copper cables.

5.2.5.4.3. Power Supplies (and PDUs)

DPE enclosures can be equipped with one or two power supplies. Each power supply supports a fully configured enclosure and shares power with the other power supply if is present. Each supply is equipped with its own power cord, making the connection to two different power sources possible.

5.2.5.4.4. Standby Power Supply (SPS)

The SPS protects the DPE against external power supply failures, an enable to properly stop a disk subsystem in case of power outage.

SPS are optional, but at least one SPS must be installed to use the write cache. Optionally, a second SPS can be installed to provide higher availability.

The SPS is also named BBU (Battery Backup Units).

5.2.5.4.5. Cooling Fans

DPE enclosures are equipped with a drive fan pack that cools the disk modules. DPE enclosures also include an SP fan pack that cools the SPs. Any type of fan pack contains 3 fans. If a fan fails, the speed of the remaining fans increase to compensate. If needed, a fan pack can be removed for exchange operation while the storage system continues to operate (the exchange operation, however, must not exceed two minutes, otherwise disks and SPs shut down).

5.2.5.4.6. Disk drives

The DPE enclosures use the same disk than the other enclosures of the 5000 Series. The minimum number of disks per DPE enclosure depends on the number of LLCs and SP. The maximum is always 10 disks:

	Minimum	Maximum
1 SP / 1 LCC	3	10
2 SP / 2 LCC	10	10

Disk are formatted with 520 bytes per sectors.

5.2.5.4.7. Memory

Each SP can have 64, 128, 256 or 512 MB of memory.

A few amount is reserved to store the LIC (Licensed Internal Code) running on SPs. The exact size depends on version, and is around 12 MB. The rest of the cache is available for read cache, or write, or a mixture of both, to improve performances of the subsystem. To ensure data consistency in case of failure, **the write cache is always mirrored**, and the following hardware configuration must be used:

- Two SPs per DPE
- Two power supplies and two LCCs in the DPE and in each DAE
- Disk slots 0 through 8 of the DPE enclosure must be populated.
- One SPS with a fully charged battery (two SPSs provide higher availability)
- Identical cache memory in both SPs (64, 128, 256 or 512MB per SP).

It is not possible to use write caching without mirroring across SPs, and without the hardware configuration described above. For example, it is not possible to configure a write cache on a DPE with a single SP.

The usable cache size is computed as described in the next table:

	1 SP	2 SP
Raw memory per SP (64 MB, 128 MB, 256 MB or 512 MB)	M	M
Write cache	0	W < M
Read cache	M	2 x (M – W)
Total	M	W + 2 x (M – W)

M is the amount of available raw memory per SP
W is the value configured for the write cache size.

Because of the mirroring, the usable write cache is not multiplied by the number of SPs.

5.2.5.5. Summary of high availability features

- dual port disks
- dual loops / LCCs
- dual Power supply with independent power cords
- redundant fans.
- no electronics in the chassis or back plain
- all active components are hot pluggable
- RAID protection
- redundant SP
- mirrored write cache.

5.2.5.6. Supported Fibre Channel topologies

.e Fibre channel host interfaces of the DPE supports the following topologies:

- Fabric, with point to point connection to the switch
- Private loops (using the internal hub of the SPs or external hubs)

5.2.5.7. RAID features

The RAID features of the DPE are:

- Supports of RAID 0, RAID 1, RAID 1/0, RAID 3, RAID 5 and "individual disk" modes

  LUN type: Possible number of disks in the LUN:
  RAID 0: 3 to 16 disks
  RAID 1: 2 disks
  RAID 1/0: 4 to 16 disks (must be an even number)
  RAID5: 3 to 16 disks
  each disk module in a LUN must have the same capacity (otherwise, disk storage space is wasted)
- Any combination of RAID levels can exist in the same subsystem

- Up to 32 LUNs configurable (either individual disks or RAID volumes)

- 2 global hot spares, with rebuild priority adjustment (configurable threshold for the minimum number of IO reserved for server use during rebuild). The capacity of a hot spare disk must be at least as great as the capacity of the largest disk module that it might replace.

5.2.5.8. Performance figures

- 22000 IO/s from SP cache, with dual SP
- 120 MB/s with dual SP.

These values are measured from SP cache to servers. They represent the processing power of the SP, and the maximum performances that could be obtained with optimal configuration. In real configurations, performances are lower, and mainly depends on the number of disks: few disks means low throughput and low read/write IO rates.

5.2.5.9. Technical specifications

Interface to host

- SPs (Storage Processors): Provide two Fibre Channel interfaces of 100 MB/s each, with a total of 200 MB/s.
- 9-pin, DB9 shielded connector, compatible with copper/optical (Media Interface Adapters (MIA)).
- Two ports per SP.

Dimensions (approximate)

DPE rackmount enclosure (10 slots):

- Height - 11.25 in. (28.6 cm), 6.5 EIA units (occupies 7 units of rack space)
- Width - 17.5 in. (44.5 cm) (Standard NEMA 19-inch rack)
- Depth - 27.2 in. (69.2cm)
- Weight - 115 lb. (52 kg) max. With 2 SPSs: 163 lb. (74 kg) max.

Power requirements

- Frequency: 47-63 Hz
- AC Voltage: 90-264 Vrms, single phase (auto-ranging power supplies).

Rackmount (10 disks):

- Current Draw: At 100 v ac input: 8A max; SPS 1A max per unit during charge
- Power consumption DPE: 800VA max 400VA; SPS 100VA max per unit during charge.

Operating environment

Temperature:	50 - 104 degrees F (10 - 40 degrees C)
Temperature Gradient:	10 degrees C/hr
Relative Humidity:	20% - 80% (non-condensing)
Elevation:	10,000 ft (3048m) @ 37°C
Operating Shock:	3 G @ 11 ms, ½ sine pulse

Operating Vibration: .25 G @ 5 - 500 Hz

Other

- Electromagnetic emissions: FCC Class A, EN55022 Class A, CE Mark, VCCI Class 1
- Safety: UL 1950, CSA C22.2-950, EN 60950

MTBF

SP:	125 000 h
Drive Fan pack:	667 000 h
SP FAN pack:	667 000 h
DPE power supply	162 000 h
DPE power supply	162 000 h
DPE LCC:	750 000 h
DPE midplane:	3 200 000 h
SPS:	100 000 h

5.2.6. Companion Software

5.2.6.1. Navisphere for AIX

DPE-and iDAE based storage systems are shipped with the Navisphere manager for AIX application. It provides a graphical facility for configuring, managing and monitoring the RAID subsystems. It is based on the standard AIX WebSM (Web-Based System Manager) framework. A graphical console, or display, or an X-terminal, must be available at the customer site, or must be ordered to use WEB. Navisphere use the fibre channel connections to manage the subsystems. It may optionally use a serial line.

If a Web server is installed on the AIX server, any web browser able to execute Java applets can be used to access to WebSM applications, including Navisphere.

Another mode of operations requires only a Navisphere agent on the AIX server. The manager is located on another server, and cooperates with the agent using TCP/IP protocols through Ethernet or other kind of LAN or WAN networks. This mode of operation require specific licenses to be installed on the same server than the Navisphere manager for AIX. They can be ordered with the Noemie software configurator.

5.2.6.2. ATF

RAID subsystems equipped with two SPs can take advantage of the optional ATF (Application Transparent Failover) software for AIX. ATF lets applications continue to run after an SP, adapter or cable or interconnection failure. Without human intervention, ATF can reconfigure the RAID subsystem (e.g. bind the LUNs to the surviving SP), retrieve IOs in the mirrored write cache and complete them, and finally, on the server it self, route the I/O through a secondary path to the surviving (provided that the server is equipped with two fibre channel adapters).

5.3. DAE5000 (Full Fibre JBOD Disk Array Subsystems)

5.3.1. Highlights

The DAE5000 Series constitutes a powerful, JBOD fibre channel storage solutions. It is based on a DAE enclosure and contains up to 10 disks.

The direct access from servers to the Fibre Channel disks offers very high transfer rates, enabling to operate near full Fibre Channel speed (around 95 MB/s), with a single DAE5000.

The DAE5000 is ideal to increase the storage capacity of AIX servers, without investing in more expensive RAID subsystems. Use of AIX software RAID 1 brings protection against disk failures. Protection against HBA, connection or DAE failures can be obtained using 2 DAE5000 per server.

The DAE5000 is also proposed as an entry range shared storage solution for dual node clusters, using AIX mirroring and redundant DAE5000 for complete data protection.

5.3.2. Configurability and Packaging

The DAE5000 is based on DAE enclosures with a single LCC. A DAE5000 can host from 2 to 10 disks. Two DAE5000 can be connected per server.

There is no hardware option available for DAE5000.

DAE drawers are shipped for the connection to Escala EPC servers.

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.3.3. SAN features

Each DAE5000 is connected to a dedicated fibre channel adapter on the AIX server, or to a hub for sharing by 2 servers. Interconnection of DAE5000 is not proposed, due to the high level of performances obtained with the 10 disks enclosure, and the risk of saturation of the fibre channel loop.

The connection to hubs or servers is made with copper cables. Connection to switches has not been qualified.

For configuration problems, please refer to the SAN Help Desk.

5.4. DAS5300 (Full Fibre RAID Disk Subsystems)

5.4.1. Highlights

The DAS5300 constitutes an entry-level RAID subsystem, offering up to 30 disks slot and 1080 GB of capacity (with 36 GB disks). It is based on iDAE and DAE enclosures. The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP).

The basic packaging, containing 1 SP, and a single power supply, can be upgraded with optional hardware to offer a fully redundant disk subsystem. Several packaging and capacity options allow to build the most suited configuration, while preserving the evolutivity up to 30 disks.

The DAS5300 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes.

5.4.2. Configurability and Packaging

5.4.2.1. Rack packaging

The configurability is summarized in the next table.

	basic configuration 1 SP	**high availability configuration 2 SP**
base drawer(s)	1 iDAE – 10 slots 5 U drawer including a 1U tray for one or two additional SPS	1 iDAE – 10 slots 5 U drawer including one 1 U tray to fit one or two SPS
additional DAE – 4 U / 10 disks drawer	0..2 single LCC/PS DAEs	0..2 dual LCC/PS DAEs
minimum number of disks	3	5
minimum number of disks per additional DAE	2	4
maximum number of disks	30	30
memory (MB)	64 or 128	64 or 128 same value on both SPs
write cache	not supported	yes
power supply	1 PS - No dual PS option	2
SPS	0	1 additional SPS optional for higher availability
ATF	not applicable	yes

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.4.3. SAN features

One or multiple servers can be connected to a DAS5300, using the connectors of the SP (2 connector per SP). External hubs can be used to increase the connectivity. Connection to switches is not supported. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5300 can be connected to a single HBA on a server using external hubs.

For configuration problems, please refer to the SAN Help Desk.

5.5. DAS5700 (Full Fibre RAID Disk Subsystems)

5.5.1. Highlights

The DAS5700 is the high end of the 5000 Series. It is a highly flexible disk subsystem, with high performance levels, up to 60 or 70 disks slots (depending on the packaging option) and more than 2 TB of capacity (with 36 GB disks). Higher capacities (up to 120 disks, 4 TB) can be proposed in SFR.

The DAS5700 is based on DPE and DAE enclosures. The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP). With the DPE design, optimized for OLTP and RAID 5 processing, and the high number of disk, it is able to sustain a very high IO rate, supporting heavy transactional applications.

The basic packaging, containing 1 SP, and a single power supply, can be upgraded with optional hardware to offer a fully redundant disk subsystem. Several packaging and capacity options allow to build the most suited configuration, while preserving the evolutivity up to 120 disks.

The DAS5700 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes. It is well suited for environments requiring high volumes of storage, and high levels of IO performances.

Note: the performances are directly tied to the number of disk within the subsystem. Up to 30 disks, DAS5700 and DAS5300 have comparable performance results.

5.5.2. Configurability and Packaging

5.5.2.1. Rack packaging

The configurability is summarized in the next table.

	basic configuration 1 SP	high availability configuration 2 SP
base drawer(s)	1 DPE – 10 slots 8 U drawer including a 1U tray for one or two additional SPS	1 DPE – 10 slots 8 U drawer including one 1 U tray to fit one or two SPS
additional DAE – 4 U / 10 disks drawer	0..6 in the EPC 400 rack 0..5 in the EPC 1200 rack single LCC/PS DAEs	0..6 in the EPC 400 rack 0..5 in the EPC 1200 rack dual LCC/PS DAEs
minimum number of disks	3	10
minimum number of disks per additional DAE	2	4
maximum number of disks	70 for the EPC 400 rack 60 for the EPC1200 rack	70 for the EPC 400 rack 60 for the EPC1200 rack
memory (MB)	64, 128, 256, 512	64, 128, 256, 512 same value on both SPs
write cache	not supported	yes
power supply	1 PS - No dual PS option	2
SPS	0	1 additional SPS optional for higher availability
ATF	not applicable	yes

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.5.3. SAN features

One or multiple servers can be connected to a DAS5700, using the connectors of the SP (2 connector per SP). External hubs or switches can be used to increase the connectivity. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5700 can be connected to a single HBA on a server using external hubs.

For configuration problems, please refer to the SAN Help Desk.

5.6. DAS5720 (Full Fibre RAID Disk Array Subsystems)

Discontinued: December 1999.

5.6.1. Highlights

The DAS5720 is a bundled product based on a dual SP DPE enclosure and a single DAE. It is configured to offer a very attractive price for high availability configurations, with medium storage resource requirement (20 disks). The Fibre Channel technology used for the host connection brings an optimal cabling flexibility, and high transfer rates (up to 120 MB/s with dual SP).

The DAS5720 offers an excellent data protection solution for use with standalone servers, or as a shared storage between multiple AIX servers and/or cluster nodes.

5.6.2. Configurability and Packaging

5.6.2.1. Rack packaging

The rack packaging is the default option shipped with EPC servers. Nevertheless, AIX deskside servers like E and T Series can be connected to a DAS5720 packaged in a rack.

The configurability is summarized in the next table.

	high availability configuration 2 SP
base drawer(s)	1 DPE – 10 slots 8 U drawer including one 1 U tray to fit one or two SPS
additional DAE – 4 U / 10 disks drawer	0..1 dual LCC/PS DAEs
minimum number of disks	9
minimum number of disks per additional DAE	4
maximum number of disks	20
memory (MB)	64, not upgradable
write cache	yes
power supply	2
SPS	1 additional SPS optional for higher availability
ATF	yes

For more information, refer to *Common features of the fibre DAE/DAS 5000 Series*, earlier in this chapter.

5.6.3. SAN features

One or multiple servers can be connected to a DAS5720, using the connectors of the SP (2 connector per SP). External hubs or switches can be used to increase the connectivity. MIA can be plugged on the DAS connectors to enable longer distances with multimode optical fibers, or to connect to devices with native optical interfaces. Disaster recovery configurations can be setup with external copper to single mode converters. Several DAS5720 can be connected to a single HBA on a server using external hubs.

For configuration problems, please refer to the SAN Help Desk.

5.7. DAS 1000, 2000 and 3000 Series Disk Array Subsystems

(Note: DAS3500 discontinued as of 30 June 1999.
DAS3200 discontinued as of 30 September 1999.)

Highlights

The DAS 1000, 2000 and 3000 Series, are standalone SCSI-2 based disk array subsystems available in both rackmounted and deskside configurations (DAS3500 subsystems use SCSI disks but provides FC-AL fibre channel attachment to servers). The DAS 1000, 2000 and 3000 Series extend Bull's ESCALA disk offering with a scaleable, "worry free" storage solution, for customers who need both high availability and high capacity for mission critical applications.

The DAS 2000 and 3000 Series consist of model DAS2900 and DAS3200/DAS3500, near fault tolerant storage subsystems with highly competitive performance and price. DAS2x00 and DAS3x00 are recommended for high availability software applications requiring large capacity disk storage. The new DAS2900 and DAS3200/DAS3500 models, based on Power PC technology provide 50% more performance. The DAS 1000 Series consists of model DAS1300, a redundant subsystem providing half of the DAS2900 maximum capacity.

The DAS3200/DAS3500 provide 50% more disk capacity than the DAS2900.

The **DAS1300, DAS2900** and **DAS3200/DAS3500** are new generation subsystems that provide availability, and high performance with caching options.

	DAS1300	DAS2900	DAS3200/DAS3500
Disk modules	10	20	30
Embedded memory per SP Cache and buffers	Yes (optional) 32, or 64 MB	Yes (optional) 32 or 64 MB	Yes (optional) 32 or 64 MB
RAID levels	0, 1, 3, 5, 1/0	0, 1, 3, 5, 1/0	0, 1, 3, 5, 1/0
Global spare	Yes	Yes	Yes
HW Redundancy	Yes	Yes (near fault tolerant)	Yes (near fault tolerant)

Major features of the 1000, 2000 and 3000 Series models include:

- High availability design
- RAID technology based storage subsystems
- Write cache memory for high performance needs
- Scalable host connectivity with the Fibre Channel connectivity on DAS3500
- Scaleable storage subsystems (capacity and performance)
- Small footprint
- Low cost of ownership

The major components of the 1000, 2000 and 3000 Series are:

- Storage-Control Processor (SP) with optional single or mirrored cache memory
- Disks modules (3.5" SCSI-2, high performance, single ended drives)
- Disk array cabinet (10 drives chassis for DAS1300, 20 drives chassis for DAS2900, and 30 drives chassis for DAS3200/DAS3500)
- Redundant power subsystem
- Redundant cooling subsystem
- Battery Backup Unit for cache security

The Storage Control Processor (SP)

The Storage Control Processors (SP) are the main components of the DAS1300, DAS2900 and DAS3200/DAS3500. One or two SPs can be configured in a disk array cabinet. The DAS1300 Storage Processor design is based on a 25MHz AMD 29000 RISC processor, 4MB of instruction and data memory, three or six SCSI-2 interface controllers, power regulator, and RS232 interface. The new DAS2900 and DAS3200/DAS3500 Storage Processor is based on Power PC technology, with a basic 8 MB memory.

e Storage Control Processor serves a number of functions including the RAID 0, 1, 1/0, 3, and 5 modes of operation, as well as individual disk operation. The SP continuously monitors the status of the other major components concurrently with the temperature within the storage subsystem and notifies the host in the event of a failure.

The DAS 1000, 2000 and 3000 Series are optimized to provide high I/O throughput in server environments. They can support two Storage Control Processors (dual active) within the same cabinet. Dual active SPs induce higher overall I/O performance by minimizing bus contention and paralleling data access.

The two SPs can be interfaced directly to a host resident SCSI-2 adapter (or Fibre Channel Adapter for the DAS3500) or daisy chained on the SCSI bus. Each SP is configured as a unique SCSI ID and can support up to 32 logical units (LUNs) each. A LUN would be equivalent to a RAID stripe. The disk drives within the array can be logically connected to any of the Storage-Control Processors. However, dynamically shared access to a drive group is not supported.

In the event of an SP failure, access to data is insured due to the dual-ported subsystem architecture with active dual initiator.

The SP can house a modular memory for write cache option.

The 3.5" SCSI-2 Disk Modules

All DAS models support high performance 4.2GB (7200RPM), 8.8GB (7200RPM) and 17.8GB disk drives. Up to 30 Winchester disk units can be configured in the 3000 Series, up to 20 disk units in the 2000 Series, up to 10 disk units in the DAS 1000 Series. The disks within the storage system can be configured as either individual disks, RAID 0 groups, RAID 1 or RAID 1/0 pairs, RAID 3 or RAID 5 groups. Any or all of these modes of operation can be configured concurrently. This allows the tuning of the DAS 1000, 2000 and 3000 Series to adapt to specific attributes of a given application.

A small amount of disk capacity will be used to save the write cache when a power failure occurs.

Each disk drive is housed in a hot pluggable disk module. Each module consists of a disk drive, a drive carrier, and a regulator PCB. In redundant RAID configurations, when a disk failure occurs, any module can be removed from a logical group without halting operation of the array. When drive replacement is done, data is automatically rebuilt on the new disk.

On redundant RAID configurations global sparing is another area where the DAS 1000, 2000 and 3000 Series offers significant benefit. Global sparing allows the user to designate one or more spares which will satisfy the requirements of any redundant logical group within the subsystem. By initiating a rebuild on the global spare, the disk array essentially heals itself; thereby re-establishing disk level redundancy, minimizing the impact of degraded mode operation, and minimizing exposure to double failures within a single group.

Manufacturers specify disk capacities in GB. One gigabyte (GB) is 1,000,000,000 bytes (ten to the ninth). Under AIX, volume sizes are given in MB (two to the twentieth) with the convention: one MB is 1024 x 1024 bytes. A 5-percent difference in size appears between both measurements of the same space. For example a 4.2 GB disk (4.2 x 10**9 bytes) will be viewed as a 4,091 MB volume at AIX level.

The DAS 3000 Series Cabinet

(Note: DAS3500 discontinued as of 30 June 1999.
DAS3200 discontinued as of 30 September 1999.)

It is a 14-inch high rackmounted chassis and is available in deskside or rackmounted configurations. It includes space for 5 to 30 replace-under-power (hot plug) disk drives, two Storage Control Processors, one mid-plane, three DC power supplies, and one cooling assembly to support the array's operation and replace-under-power features. DAS3200/DAS3500 cabinets manage room for a Battery Backup Unit for write cache security.
Hot plug technology results in dynamic expansion ability. Users can expand capacity or add any other component while the system remains on line and operating.

There is no difference between the cabinet models.

The DAS3500 subsystems is connected to the host either via a copper connection (limited to 30 meters) or via an optic fiber connection using an Media Interface Adapter (MIA) depending on the distance between the Host and the DAS3500.
The distance is up to 10Km by using Link Extender box and suited optic fiber connection (9µ).

The DAS 2000 Series Cabinet

It is a 14-inch high rackmounted chassis and is available in deskside or rackmounted configurations. It includes space for 5 to 20 replace-under-power (hot plug) disk drives, two SP, one mid-plane, three DC power supplies, and one cooling assembly to support the array's operation and replace-under-power features. DAS2900 cabinets manage room for a Battery Backup Unit for write cache security.
Hot plug technology results in dynamic expansion ability. Users can expand capacity or add any other component while the system remains on line and operating.
There is no difference between the cabinet models.

The DAS 1000 Series Cabinet

In the DAS 1000 Series cabinet 3 to 10 hot-plug disk modules and two Power Modules can be housed. All other features of the 2000 Series cabinet are supported.

The Power Subsystem

It includes power supplies (VSCs) (three for the DAS 2000 and 3000 Series or up to two for the DAS 1000 Series), AC input and AC circuit breaker. The subsystem supports n+1 DC power supply configuration to allow for automatic failover in the event of a single supply failure. Each DC power supply is contained in a replace-under-power module and can be replaced without disrupting subsystem operation. Power fault design ensures data integrity even in the event of power loss during a write operation.
The third Power Module is automatically configured with every DAS 2000 and 3000 Series.

The Cooling Subsystem

Like the power subsystem, the DAS 1000, 2000 and 3000 Series incorporate an n+1 cooling design. Two fan pack modules are contained in a single cooling subsystem (one for the DAS 1000 Series), and each fan pack module consist of 3 fans and a fan monitoring PCB. One fan in the system can fail without impacting operation of the disk array. The entire cooling subsystem can be detached from the array cabinet and replaced while the system continues to operate.

The SCSI Host Connection

The main component of the connection to the ESCALA host is the standard dedicated SCSI-2 SE/DE adapter excepted for the DAS3500 (Fibre Channel). It is a 20MB/s Fast Wide differential MCA/PCI-to-SCSI-2 Adapter. The connection uses also a SCSI-2 bus cable, and an asynchronous RS232 cable for the DAS1300, DAS2900 and DAS3200.

The DAS3500 uses a Fibre Channel connection (FC-AL) to connect the SP to the Host.
The DAS3500 provides 2 internal 3-ports hubs (one for each Storage Processor) to chain the SP of one DAS3500 or between two DAS3500.

The Host Connection can use also an external hub to chain or to share SP of DAS3500. This solution is a more secure solution than the internal hub and it's recommended for HA solutions.

The local connections can use copper cables up to 30 meters. The distant connections (DAS3500 or host) have to use a mix of copper cables and fiber cables (up to 500 meters) with MIAs modules on the hubs or on the SPs. For Customers who want to get more than 500 meters between DAS3500 and the Hosts, the Fibre Link Extender module has to be use with fiber cables (9/125µm).

Limits: 3 DAS3500 per FC-AL loop.

Disk Drives Specifications

Nominal Disk Capacity (GB)	4.2	8.8	17.8
Actual Disk Capacity (10*6 B)	4372	8800	17800
Interface	SCSI-2	SCSI-2	SCSI-2
Form Factor	3.5"	3.5"	3.5"
Seek Time (Average R/W) (ms)	8.4 /9.9	8.5 /10.5	8.5 /10.5
Spindle speed (RPM)	7202.7	7202.7	7202.7
Latency (ms)	4.17	4.17	4.17
Transfer Rate			
-buffer to/from media (MB/sec)	9.59 to 12.58	10 to 15	10 to 15
-buffer to/from host (MB/sec)	up to 20		
Buffer Size (kB)	512	1024	1024

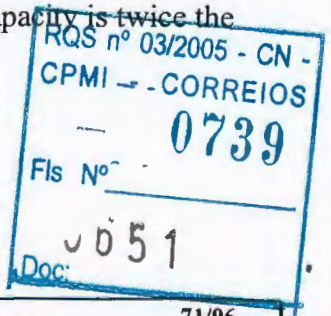
Disk drives are common to the DAS 1000, 2000 and 3000 Series.

Mirrored Caching Option

On DAS1300, DAS2900 and DAS3200/DAS3500 models, with dual SP, a cache memory is available. Mainly dedicated to write access caching, it can be also configured as a read cache or as a read and write cache.
The write cache drops the response time for every write access and thus alleviate the write penalty tied to RAID5. A small amount of read cache (2 to 4 MB) will benefit sequential access.

The DAS 1000, 2000 and 3000 Series write cache is fully protected against power failures by a Battery Backup Unit (BBU), against memory components by an ECC (Error Correcting Code) and against SP failures by mirroring. The mirrored copy of data and associated address is saved on the second SP.

The DAS1300 can have 6, 14, 30, or 62 MB of cache memory. A 2 MB memory space is reserved by the SP for internal use. DAS2900 and DAS3200/DAS3500 can have 28 or 60 MB of cache memory. A 4 MB memory space is reserved by the SP for internal use. The actual memory capacity is twice the user size due to mirroring protection.



Single board Caching Option

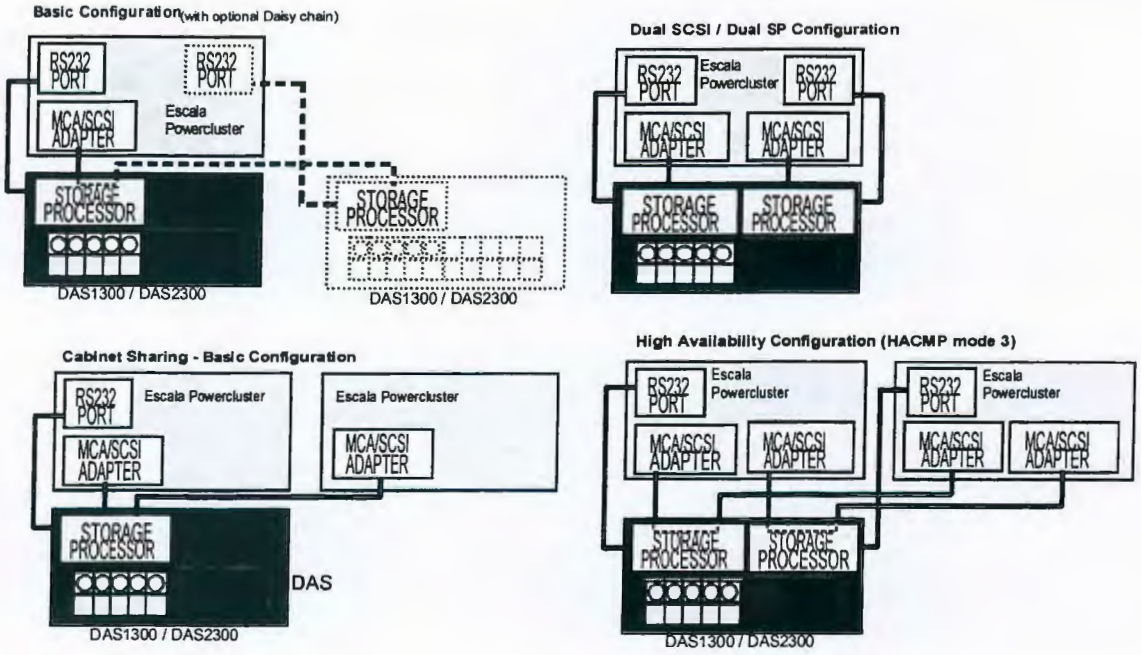
On the DAS1300, DAS2900 and DAS3200/DAS3500 models, with only **one SP**, a cache memory option is now available. This option offers a competitive price for basic configurations.
The DAS 1000, 2000 and 3000 Series single board cache is protected against power failures by a Battery Backup Unit (BBU), and against memory component failure by an ECC (Error correcting Code). No mirrored copy of data is provided.

The DAS1300 can have 6, 14, or 30 MB of cache memory. A 2 MB memory space is reserved by the SP for internal use. DAS2900 and DAS3200/DAS3500 can have 28 MB of cache memory. A 4 MB memory space is reserved by the SP for internal use.

Prerequisites & Configurability

The DAS 1000, 2000 and 3000 Series are available as a standard offering on DPX/20 (150 Series or higher) and on ESCALA platforms.
AIX 4.1, or later, is required.

The following configurations are possible for the DAS1300, DAS2900 and DAS3200/DAS3500:



Performance in these configurations is dictated by a number of factors, including host CPU utilization, SCSI bus traffic, individual disk usage, write cache option.

The basic configuration includes a single DPX/20 or ESCALA host interfaced to the DAS through a standard MCA-to-Differential/SCSI-2 host adapter. In this configuration, a single Storage Control Processor (SP) is used to access up to 10 (DAS1300), 20 (DAS2900) or 30 (DAS3200/DAS3500) drives in the array chassis. A second array can be daisy chained to the first (up to 534GB: 30x17.8GB for the 3000 Series). The cache memory is available as an option.

The dual Storage Control Processor (SP) configuration offers a higher performance and availability alternative to the basic configuration through the addition of second SP. The mirrored cache memory is available as an option. The SPs can be configured to any of the disks within the subsystem, *however, shared access to a single drive is not supported.* A second DAS 1000, 2000 and 3000 Series array can be daisy chained to the first. In the dual SP configuration, system level redundancy is provided at the drive, power supply and cooling levels. Redundancy at the Storage Control Processor level is also provided: *failover requires operator interaction with the host system.*

The dual SCSI adapter or Fibre Channel adapter/dual SP configuration extends the capabilities of the dual SP configuration by extending a separate SCSI or Fibre bus to the second SP. As with the previous configurations, the optional cache is available and a second array can be daisy chain to the first system. Failover of the storage processors, or SCSI-2 adapters, or Fibre Channel adapters can be initiated *through operator interaction with the host system.*

The cabinet sharing configurations: in this configuration, the SCSI-2/Fibre Channel-to-SP connections are on separate SCSI/Fibre buses, thereby allowing both host systems to share the DAS array as a highly integrated, high availability storage solution.

Limitations to the DAS 1000, 2000 and 3000 Series Cabinet Sharing Configuration:

- Dynamically shared access by two systems to a single drive requires host software (HANFS or HACMP).
- HANFS and HACMP configurations are supported on redundant configurations.

Configuration rules and hints for DAS1300, DAS2900 and DAS3200/DAS3500

Basic Cabinet

One SP is included in the basic cabinet, with 3 power modules for DAS2900 or DAS3200/DAS3500, only 1 for DAS1300.

Number of Disk Drives Allowed

DAS3200/DAS3500:	5 to 30
DAS2900:	5 to 20
DAS1300 without cache:	3 to 10
DAS1300 with cache:	5 to 10
All models with cache and hot-spare disk	6 to 10, 20 or 30

A location exclusion exists between the hot-spare disks and the 5-disk group dedicated to cache saving.

RAID Group Binding Rules

RAID0:	3 to 16 drives per group (3 to 10 for DAS1300)
RAID1:	always 2 drives per group
RAID1/0:	4 to 20 drives per group (4 to 10 for DAS1300)
RAID3:	always 5 drives per group
RAID5:	3 to 16 drives per group (3 to 10 for DAS1300)

In a DAS1300, or in a DAS 2000 Series with more than 5 drives per group, a very small risk of single point of failure exits at internal SCSI bus level.
When configured in RAID1 RAID3 or RAID5 an amount of capacity of one disk is used for redundant data storage.

Number of Power Modules

For the DAS1300:
The second power supply is an option, power redundancy is only assumed with it. Add the second power supply with 2SPs or with the cache option. NOEMIE will set the option as default. You may remove it to get a lower price, but availability will become poor.
For the DAS2900 and DAS3200/DAS3500:
The third power supply will be delivered with every subsystem.

Number of Storage Processors (SP)

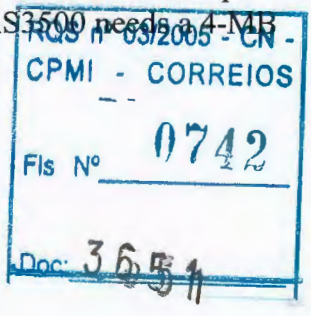
The second SP is recommended for higher availability (associated or not with the second SCSI connection) and for performance over 10 drives.
For high availability, it is mandatory to have the mirrored cache option.
For DAS2900, the single SP configuration is able to manage up to 15 disks without internal I/O saturation (short random I/Os).

Mirrored Cache

The mirrored cache option needs the dual SP configuration, 5 disk drives or more, and the Battery Backup Unit. The memory modules are provided by pairs. Memory size is 32 or 64 MB per SP. A 2-MB space will be reserved for internal use on DAS1300. DAS2900 or DAS3200/DAS3500 needs a 4-MB reserved space.

Single Board Cache

The single board cache option is available in single SP configuration, 5 disk drives or more, and the Battery Backup Unit. The memory size is limited to 32 MB for every model. A 2-MB space will be reserved for internal use on DAS1300. DAS2900 or DAS3200/DAS3500 needs a 4-MB reserved space.



Microcode

The DAS 1000, 2000 and 3000 Series Storage System Manager (DASMGR) software, is an integrated set of utilities that allow users to configure the array, monitor the status of the major storage system components, and download updates of the arrays internal microcode. For DPX/20, DASMGR is available under a specific MI that includes also user's documentation, and media. For Escala, DASMGR is delivered with AIX 4.1.
The Storage processors are controlled by on board internal software. This microcode is included in the base configuration of the subsystem. Enhanced functions are distributed through updates of this software. It is customer installable through the DASMGR utility.
In addition we can take advantage of a new graphic array management tool simplifying day-to-day operational tasks. Called ArrayGUIde, this tool is basically available and requires a graphical color display on the host or somewhere on a LAN connected to the host.

Performance

Performance takes advantage of the capability of mixing RAID architectures to fit application needs. The appropriate RAID level must be chosen according to the file size and the type of access. The write cache drops the write response time for all RAID levels, sweeps out the RAID 5 penalty and boosts the read after write access.

The raw performance of the DAS1300 reaches in RAID 5 for one 5-disk LUN:

- 350 I/Os per second (100 % of READ, random access of 512 bytes, without cache)
- 120 I/Os per second (100% of WRITE, random access of 512 bytes, with an 8MB cache).
- a 13ms response time for 20 I/O per second (read without cache)
- a 7.3 ms response time for 20 I/O per second (write with an 8MB mirrored cache)
- a 5 ms response time for 20 I/O per second (write with an 8MB single cache).

The raw performance of the DAS2900 is much higher for large configurations (more than 12 drives).

- 1200 I/Os per second (100 % of READ, random access of 4 Kbytes, cache hit = 0, access time = 32 ms, 20-disk 4-LUN RAID5, Dual SP Dual SCSI configuration).
- 4 ms less than DAS1300 in access time for 4 Kbytes I/Os in the same conditions.
- 500 I/Os per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Dual SP Dual SCSI configuration).
- 340 I/Os per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Single SP Single SCSI configuration).
- a 7 ms response time for 20 I/O per second (100 % of WRITE, random access of 4 Kbytes, 30 MB of mirrored write cache, 20-disk 4-LUN RAID5, Single SP Single SCSI configuration).

These values are worst cases, measured within a full size working space, the access time includes a higher seek time than the one usual applications get.

5.8. EMC² Enhanced Symmetrix Subsystems (Symmetrix 3000)

Symmetrix enables to consolidate storage from multiple heterogeneous UNIX, Windows NT and AS/400 hosts. Optional Symmetrix Enterprise Storage Platform (ESP) software also allows mainframe information to be resident and accessible on the same Symmetrix 3000 system.

Symmetrix 3000 Enterprise Storage systems protect the largest relational databases and most demanding applications with the highest degree of data protection. The enterprise is fully protected against planned or unplanned disruption to information availability and accessibility. Protection choices include disk Mirroring (RAID 1), Symmetrix Remote Data Facility (SRDF™) remote mirroring software, hardware redundancy, and non-disruptive microcode and component replacement:

- EMC's disk Mirroring provides the highest data availability for mission-critical applications. By creating two copies of data on separate disk drives, Mirroring ensures both the highest availability and highest system performance.
- SRDF software maintains mirrored copies of data on physically separated Symmetrix systems to ensure continuous business operations in the event of planned or unplanned system or data center outages and disasters.
- EMC TimeFinder™ allows businesses to create independently addressable business continuance volumes (BCVs) for mainframe and open systems enterprise information. The BCVs are copies of active production volumes that can be used to run simultaneous tasks in parallel with one another. This gives customers the ability to do concurrent operations, such as data warehouse loads and refreshes or point-in-time backups, without affecting production systems.
- Symmetrix systems support non-disruptive microcode update loading. The business or agency remains online and unaffected even as it gains the advantages offered by enhanced capabilities.
- Symmetrix systems feature a full-system battery that guarantees no lost writes and orderly transitions or shutdowns during power outages. Extensive proactive and predictive intelligent maintenance features, such as cache and disk scrubbing and an integrated Remote Maintenance Processor (RMP), add to Symmetrix's information protection and continuous information availability features.
- The Symmetrix 3000 family provides the highest performance systems to enhance online transaction processing and other response-time intensive applications:
- Up to 16GB of non-volatile cache (8GB on Symmetrix 3630 systems) helps ensure that all of the applications run at top speed.
- In addition to its large, intelligent cache, Symmetrix's parallel processing capabilities achieve levels of performance that result in dramatic reductions in both online response times and batch processing windows.

The major components in the Symmetrix 3000 are the directors (channel directors and disk directors), cache, and disk devices, as discussed below:

Ultra-SCSI Director:

The Ultra SCSI director is a single card that has four differential wide interfaces for connection to host systems and one high-speed path to cache. It can attach to hosts supporting Ultra-SCSI connectivity

and Fast-Wide differential SCSI connectivity. The Ultra SCSI director contains two advanced microprocessors that process commands and data from the host and manage access to cache. They support data transfer rates up to 40 MB/sec with a host over each channel interface simultaneously. On each Ultra-SCSI channel director, data transfers from the host to cache occur as four concurrent operations. Each Ultra SCSI director can support up to 960 logical volumes (with a maximum of 2,048 logical volumes per Symmetrix 3830 and Symmetrix 3930 and 1,024 logical volumes for the 3630 Symmetrix)

Fibre Channel Director:

The Fibre Channel director is a single card that has two FC ANSI compliant 1 Gigabit Fibre Channel interfaces for connection to open systems hosts and one high-speed path to cache. It supports a data transfer rate of up to 100 MB/sec. The Fibre Channel director contains two advanced microprocessors that process commands and data from the host and manage access to cache. The Fibre Channel SCSI protocol mapping and upper level protocol layers are both implemented within the director. Each Fibre Channel director can support up to 256 logical volumes per Symmetrix system.

Serial Channel Director:

The serial channel director processes frames from the mainframe host and manages access to cache. The serial channel director supports data transfer rates up to 17 MB/sec with the host. With the IBM ESCON Multiple Image Facility (EMIF) Symmetrix can contain up to 1,024 different images. EMC offers four-port serial channel directors, which can support up to 1,024 logical volumes per board. Symmetrix serial channel directors support 2 Control Unit Address (CUADD) images, 512 logical devices per ESCON port and 32 separate logical paths (LPaths) addressable to one port. The 32 logical paths may be shared in any fashion between the 2 CU images. For example, all 32 logical paths can be configured on one CU image and none on the other. Or, 32 logical paths may be split between the ports (for example, 18 on CUADD 0 and 14 on CUADD 1)

SRDF Remote Link Director:

The Remote Link Director (RLD) is a 4-port serial channel director microcode configured as the link between Symmetrix units in a Symmetrix Remote Data Facility (SRDF) configuration. The Remote Link Director (RLD) interfaces to Symmetrix channels via a serial channel interface adapter. The Remote Link Director supports data transfer rates up to 17 MB/sec and supports up to 1,024 logical volumes per board. Symmetrix requires a minimum of two and supports up to four RLDs in each Symmetrix 3630 unit used in an SRDF configuration. When one of the processors of a serial channel director (two ports on each processor) is configured as an RLD, *only one of the ports* on that processor can be configured as a remote link, while the remaining port is not used. The second processor can be configured as a serial director, with *both ports* being used for serial channels. If two ports of the four-port RLD are needed as remote links to other Symmetrix units, only one port from each processor can be used.

Disk Director:

The disk director is a single card that provides an interface between cache and the disk devices. Each

disk director supports one disk device on each of its four SCSI buses, but is capable of supporting up to eight devices per SCSI bus in the Symmetrix 3930 (six in the 3830, four in the 3630). Each disk director provides an alternate path to the disk devices of the other disk director. That is, should the primary path through a disk director to a disk device fail, the Symmetrix 3000 accesses that device through the other disk director.

Cache:

The Symmetrix 3630 model has two standard cache slots. Symmetrix 3830 and 3930 models have four standard cache slots. The Symmetrix 3630 models support a maximum of 8,192 MB of cache when 4 GB cache cards are installed in both slots. The Symmetrix 3830 and 3930 support a maximum of 16,384 MB of cache when 4 GB cache cards are installed in all four slots. Individual cache memory cards are available in 512 MB, 1 GB, 2 GB, and 4 GB sizes.

Symmetrix 3000 model specifications:

	Connectivity directors											
Model	**Ultra SCSI**		**Fibre Channel**		**Serial Channel**		**Remote Link**		**Cache directors**		**Disk devices**	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3630-18/36	2	4	2	4	2	4	2	2	2	2	8	32
3830-18/36	2	4	2	4	2	4	2	2	2	4	16	96
3830-18/36(1)	2	6	2	6	2	6	2	4	2	2	16	96
3930-18/36	2	8	2	8	2	8	2	6	2	4	32	256

(1) With option to convert to cache slots in Front End Director slots.

5.9. Serial Storage Architecture (SSA) Disk Subsystems

Notes: Discontinued: 30 June 1999. However, SSA disks will still be available as an add-on option. Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

The Serial Storage Architecture (SSA) Disk Subsystems are second-generation, leading-edge serial storage subsystems that implement industry-standard Serial Storage Architecture (SSA) to deliver outstanding performance, capacity, and availability in a low cost, scalable package.
In the transaction processing environment, the SSA Disk Subsystems provide the ideal solution when used as mirrored storage in a "high availability" server systems for applications that require sustained high performance despite a single failure. If the cost of data protection is more important than high performance, then RAID 5 should be considered. In engineering/scientific, data-mining, data-warehousing, and decision support applications, the ability to sustain high data rates makes the SSA Disk Subsystems an attractive solution.

5.9.1. SSA Disk Subsystem Models

The SSA Disk Subsystem offer is comprised of two functionally equivalent models. The Rack Model

is designed to be mounted in a standard 19-inch rack and is four EIA units high. The Deskside Model is a standalone unit.
The SSA Disk Subsystem provides power and packaging for SSA disk drive modules.

The two SSA Disk Subsystem models (rack and deskside) can be populated with up to 16 auto-docking, customer replaceable, SSA disk drive modules. These 16 disks are grouped together in fours. The rack and deskside models provide circuitry that will automatically connect these groups of disk drives together. The automatic connections are made based on the presence of signals on the external connector. If there are signals present at one connector of a pair of connectors then these connectors will not be connected automatically. If there is not a signal at both of the connectors in a pair then these connectors will be connected automatically.

The disk drive modules are connected to each other strings of four modules (two strings at the front of the SSA Subsystem and two strings at the back). These strings can be connected to each other, to strings in other SSA Disk Subsystem, or to SSA adapters. The adapters can be in separate using systems or in the same using system.

The disk drive modules are available in two different capacities: 4.5GB, and 9.1GB.
The 9.1GB SSA Disk Drive features require AIX 4.1.5.
The basic SSA Disk Subsystem is delivered with four 4.5GB disk drives. However, select features allow these to be replaced by the 9.1GB modules at time of original order. Features are provided to add any combination of supported SSA disk drive modules, up to a maximum of 16, providing up to 145.6GB of disk storage capacity (using 9.1GB disk drives).
The shared SSA Disk Subsystem in High Availability Solution is available. In this case the basic delivery is eight 4.5GB "mirrored" disk drives (with an option to select 9.1GB).

The two SSA Disk Subsystems include three auto-docking power/cooling units. These provide redundant power to all sixteen disk drive module positions. These units can also be replaced by the customer.

The SSA Disk Subsystem is configured with three fan-and-power-supply assemblies. The fan-and-power-supply assemblies can run on either ac or dc power.
They provide all the power generation and distribution for the SSA Disk Subsystem.

The SSA Disk Subsystem can be disconnected from its related SSA adapters while the using system is running. Also, most of the field-replaceable units (FRUs) of the SSA Disk Subsystem can be removed and replaced while the Subsystem and the using System are running.

These models offer:

Outstanding Capacity/Footprint

- 4.5GB, and 9.1GB drives
- Four to 16 drives per Subsystem.

Outstanding Subsystem and Adapter Performance

- Up to 8,000 ops/sec/subsystem
- Up to 140MB/sec/subsystem
- Up to 3,000 ops/sec/adapter
- Up to 35MB/sec/adapter.

Outstanding Availability and Reliability

- SSA dual paths to every disk
- Redundant power and cooling
- Concurrent maintenance on power, cooling, and drives.

For SSA attachments refer to the Adapters description.

5.9.2. SSA Disk Drive Modules and Capacity

The SSA Disk Subsystem is configured with 4 Disk Drive Modules (18 GB up to 36.4GB using 9.1GB disk drive). Up to 16 Disk Drive Modules (72 GB up to 145.6GB using 9.1GB disk drive) can be connected to the Subsystem.

All the Disk Drive Modules start their power sequence when the input voltage is inside the specified limits. Their motors are started under control of the SSA adapters in the using system. To prevent the need for excessive electrical current, the Disk Drive Module motors are not all started together (at least 10 seconds delayed).

5.9.3. SSA Loops and Links

The Disk Drive Modules of the SSA Subsystem are connected through two or more SSA links to an SSA adapter that is located in the using System. The Disk Drive Modules, SSA links, and SSA Adapter are configured in loops. Each loop provides a data path that starts at one connector of the SSA Adapter and passes through a link (SSA cable) to the Disk Drive.

5.9.4. Disk Drive Module String

In the SSA Subsystem, the Disk Drive Modules are arranged in strings of four modules. Each string has its own two SSA connectors and can be connected through external SSA cables to a pair of connectors on the SSA adapter to make a SSA loop of four modules.
A string can also be connected to other strings to make a bigger loop.
The strings can be in the same SSA Subsystem or in different SSA Subsystems.

6. Tape Libraries and Subsystems

6.1. DLT 4000 and DLT 7000-Cartridge Tape Library

This DLT 4000/7000-Cartridge Tape Library is also designed in Bull as "DLT LibraryXpress". It is a stand-alone subsystem providing 10-cartridge capacity and housing up to two DLT4000 (20/40 GB/s) or DLT7000 (35/70 GB/s) drives.

The DLT technology is available with the 10-cartridge library (Overland) fitted with 2 DLT drives, offering a 400GB capability and a 6MB/second transfer rate

The DLT Library Xpress gives you the most options for capacity, performance and growth of any tape library available.

Then, as your needs grow even greater, the exclusive SmartScale Storage design will let you snap on additional modules for a simple expansion of up to 3.2 Terabytes with transfer rates of up to 172 GB/hour, all while protecting your original investment!

The combination of high-performance DLT drive technology and Overland Data's proven Mainframe Class library robotics gives you peace of mind. Your data is safe when you combine the highly reliable Library Xpress and backup & storage solutions across Bull platforms.

Specifications

Drives and Media	LXB4210
Drive type	DLT4000
Number of drives	Two
Media type	CompacTape IV
Tape type	5 in. metal particle, .5 mil thick
Tape length	1800 feet
Cartridge size	4.1 in. * 4.1 in. * 4.1 in.
Magazine size	10 cartridges

System performance

Read/write tape speed	110 ips, streaming
Search tape speed	streaming 150 ips
Sustained native transfer rate (max/drive.)	5 MB/sec. - 180 MB/min.
Peak SCSI transfer rate per drive	20 MB/sec. synchronous mode
Cartridge load /unload time	10 seconds
Average access time from (BOT)	45 seconds
Average rewind time	45 seconds

Data organization

Data compatibility	digital linear tape
Recording format	128 track serial serpentine
Recording density	82,000 bpi
Read/write head w/MIG	2 channel ferrite
Native capacity	200 GB
Data compression	Standard Digital Lempel-Ziv (DLZ) algorithm
Compressed capacity (2:1)	400 GB

System reliability & data integrity

Head life	10,000 hours
Mechanism life	500,000 cycles
Media life	500,000 passes
Error correction code	Reed Solomon ECC, 64-bit CRC on each 4 KB of data, 16-bit parity check on each record, internal parity check on the buffer
Hard error rate	less than 1 to 1017 bits read
Undetected error rate	less than 1 to 1030 bits read

Connectivity & system compatibility

Drive interface (diff.)	Fast SCSI-2
Library interface (diff.)	Fast SCSI-2

Physical dimensions

Dimensions rackmount (H * W * D)	17 in. * 17 in. * 22 in. (17.78 cm * 43.2 cm * 55.88 cm)
Dimensions desktop (H * W * D)	8 in. * 19 in. * 23 in. (20.32 cm * 48.26 cm * 58.42 cm)
Weight rackmount	65 lbs. / 29.53 kg
Weight desktop	70 lbs. / 31.8 kg

A 4-line, 20-character LCD front-panel display provides direct access to comprehensive library status. Configure the library or drives through the panel or from software. Check the loader robotics and magazine status, and access system statistics and command history.

Magazine handling is easy, just push one button to load or unload, or lock it in the LibraryXpress for security.

Standard Connection (recommended)

- One SCSI-DE connection to the robotics control and two drives.

High Availability Connection

- One SCSI-DE connection to the robotics control and to one drive
- One dedicated SCSI-DE board and cable to the second drive.

The DLT Entry Library is sourced from Overland Data, where it is designated as LPX4210.

The DLT Entry Library is supported through services offered by NetBackup Software.

6.2. Magnetic Tape Drive

A Magnetic tape drawer is available for open-reel tape configurations. It is made by Bull's partner StorageTeK. It runs 9-track, ½ inch standard tapes.

6.2.1. STK9914 1/2" 9 TrackTape Drive Drawer

(Discontinued)
Available on the EPC430 and EPC450 through reconnection only, when upgrading from the EPC400.

The Optional 1/2-Inch 9-Track Tape Drive Drawer contains the STK9914 Tape Drive.
The STK9914 is an autoloading, autothreading, reel to reel tape device.

Its main features are:

- ANSI Standard 9-track tape interchange,
- selectable tape density: 6250bpi (GCR mode), 1600bpi and 3200bpi (PE mode) and 800bpi (NRZ mode),
- transfer rate: 781kB/s,
- tape speed: 42/125ips,
- reel size: 6 to 10.5" (IBM Hub)
- tape length: up to 3600'
- MTBF (specified): 25000H.

Attachment

- Connection to an SCSI2-DE controller.

The 1/2-inch 9-Track Tape Drive Drawer does not have support for battery backup operation.

7. Storage Area Network (SAN)

The term SAN designates a new type of storage architecture in which the storage systems are attached to a high speed network dedicated exclusively to storage. Connections between storage systems and servers or clients use interconnect technologies such as hubs and switches. SANs enable storage to be externalized from servers improving system performance. The application servers (usually UNIX or NT based) connected to this high-speed network exchange data using a SCSI-type I/O protocol.

7.1. SilkWorm 2800 Fibre Channel Switch

7.1.1. Highlights

The SilkWorm® 2800 switch is a 16-port Fibre Channel Gigabit switch that provides connectivity for up to 16 Fibre Channel compliant device ports. The SilkWorm 2800 switch is used to connect servers with storage devices to create a SAN (Storage Area Network). Devices in a Fibre Channel SAN can access information anywhere in the SAN.

The SilkWorm 2800 switch features:

- Simple hardware installation thanks to universal ports: each port supports F, FL or E-port mode of operation, which is automatically selected by the switch software itself.
- Easy setup and configuration: simple network initialization by entering the IP address on the front panel (no need to connect a terminal).
- Automatic discovery of all the devices connected to the switch.
- Plug-and-play connections without powering down the switch.
- Convenience of switch connections and controls at the front panel.
- Switch interconnection to build various topologies, including fully meshed and high available fibre channel network.
- Dynamic addition of a new switch to a running network.
- Zoning services to create virtual independent area within or across several switches.
- Translative mode to reconnect the fabric devices that support only the PLDA protocol (private loop).
- Quick Loop, to create virtual private loops across the switch.
- Management tools accessible from the front panel, Telnet or via the WEB.
- Software products offering advanced features to manage the SAN and secure access to information.

Top performance to satisfy high expectations

- Data path in hardware results in lowest end-to-end latency time in the industry, increasing throughput.
- Cut-through frame forwarding moves frame traffic efficiently without having to receive the complete frame first.
- In-order delivery of data frames guarantees that frames are delivered to a destination in the same order as received by the switch from the originator.

- Flexible switch buffering stores a data frame for only as long as is absolutely necessary, moving data faster through the switch.

7.1.2. Limitations

- Minimum firmware and software level are required for disk subsystems and PCI adapter to interoperate with the switch.
- Translative mode, quick loop and switch interconnection are not yet validated in the AIX environment.
- FL-port and connection of hubs or loops on the switch are not supported.
- The Silkworm 2400 (8 port model available in the StoreWay catalog) has not been validated with AIX servers.

Hardware components

The SilkWorm 2800 switch includes the following hardware components:

- Motherboard containing the CPU, memories and ASICs.
- Hot swappable auto-ranging power supply. An optional redundant power supply can be installed in the switch.
- Hot swappable fan assembly with redundant fans.
- Up to 16 1-gigabit-per-second (GB/sec) full duplex ports supporting ShortWave multimode GBIC (dual SC connectors), allowing connections up to 500 m without additional link extender.
- Front panel with buttons and display to manage the switch and launch diagnostics.
- 10/100 Base T Ethernet connection (RJ45 connector).

Software components

The SilkWorm 2800 switch includes the following software components:

- The fabric operating system allowing the operation and management of the fabric.
- A Simple Name Server, which discovers connected devices, and registers/deregisters the device information when a connection changes.
- The Registered State Change Notification: dynamic detection of changes in topology and port status.
- Multicast Service (Alias Server): sends a single data copy simultaneously to group members.
- A switch management accessible through 5 access methods:
  - front panel controls located on the switch.
  - Telnet commands via Ethernet connection.
  - SNMP agent embedded in the switch.
  - SES (SCSI-3 Enclosure Services) access via Ethernet connection.
  - WEB based management tools.
- Zoning Service: confines access among devices by creating logical subsets of devices for additional management of and security in the SAN.

- Diagnostics: Embedded online and offline diagnostics.

Hardware requirements

The Escala PCI servers supporting the PCI fibre channel adapter (DCCG141-0000) can be connected to a switch, using:

- MIA (Media Interface Adapter)
- Optical Fibre Channel cable.

Software requirements

AIX 4.3.2 or later.

Supported Storage Subsystems

Symmetrix and DAE/DAS 5000 support, with the releases of microcode or flares mentioned below, the fabric protocol required to be connected to a switch.

The **Symmetrix family** can be connected to the switch, using

- Fibre Channel Director
- Optical Fibre Channel cable.

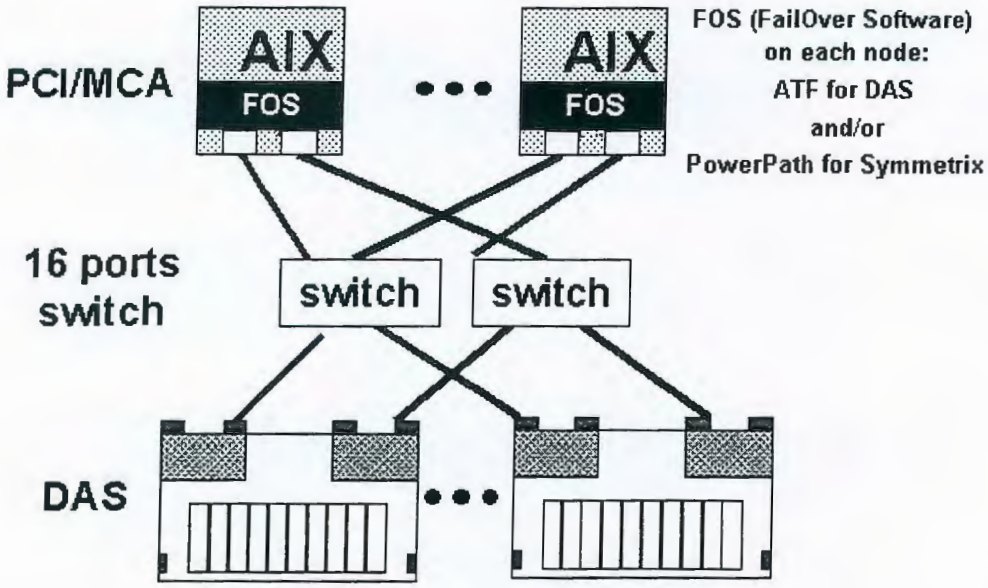
Minimum Symmetrix microcode release: 5265

The **DAS5700 family** can be connected to the switch, using

- Optical Fibre Channel cable
- MIA (Media Interface Adapter).

Minimum flare level on the DAS5700: 4.12.02

Sample configuration: multiple servers, dual path, dual switch



7.1.3. Technical specifications

Fibre Channel protocol:	Fibre Channel ANSI Standards: FC-AL (v 4.5), FC-AL-2 (v 5.7), FC- FLA (v 2.7), FC-GS-2 (v 4.0), FC-PH (v 4.3), FC-PH-2 (v 7.4), FC-PH-3 (v 9.4), FC-PLDA (v 2.1), FC-SW (v 3.3), FCP (rev 012), SES (rev 8a)
Number of Fibre Channel ports:	16
Fibre Channel port speed:	1.0625 GB/sec, full duplex
Operation modes:	Fibre Channel Class-2 and -3 connectionless service
Switch bandwidth:	16 GB/sec end-to-end
Frame buffers:	16 frame buffers for each port at 2,112 bytes per frame
Fabric latency:	<2 µsec with no contention
Data traffic types:	Unicast, multicast, and broadcast
Data transmission ranges:	Up to 500m with short-wave GBIC
Port types:	Universal ports: G_Port (E- and F-Port modes) or FL_Port automatic configuration
Weight:	8.6 kg (19 lbs.) with 4 option modules.

Chassis types

Rackmount dimensions

2U, 19-in. (EIA compliant)

H: 8.7 cm (3.44 in.), W: 44.75 cm (17.62 in.), D: 43.1 cm (16.99 in.)

Tabletop dimensions

H: 8.7 cm (3.44 in.), W: 42.9 cm (16.88 in.), D: 43.1 cm (16.99in.)

Power Requirements

Nominal:
100-120 VAC, 50/60 Hz
200-250 VAC, 50/60 Hz
Operational:
90-134 VAC, 50/60 Hz
180-257 VAC, 50/60 Hz

Operating Environment

Temperature (operating):	10°C -- 40°C
Temperature (non operating):	-35°C - 65°C
Humidity:	5% 85% non-condensing @ 40°C (104°F)
Altitude:	Up to 3,000 m (9,800 ft)
Shock (operating):	5 G, 11 ms_half sine

Safety

European Union Market
Compliance with the Low Voltage Directive EEC/73/23 amended by EEC/93/68 and thus to the following European standards:

- EN 60950
- EN 60825 *

* Only applicable for laser product.

North American Market
Certified in conformance to UL 1950 (USA) and CSA 950 (Canada), and display the UL and CSA labels.

Other Countries
Certified as conforming to IEC950.

Electromagnetic Compatibility

European Union Market
Compliance with the EMC directive EEC/89/336 amended by EEC/93/68 and thus the following European Standards:

- EN55022 Class A
- EN50082-1
- EN61000-3-2 *
- EN61000-3-3 *

* Mandatory at least for all shipped products on January first 2001.

North American Market

Compliance with the following requirements:

- For USA: FCC part 15 Class A.
- For Canada: CSA C108-8 & IECS-003 Class A.

Other Countries

Compliance with the following requirements:

- Japan: VCCI Class 1 (or A).
- Rest of the World: CISPR22 class A.

Localization

Local country power cord supplied.

7.2. Fibre Channel Optical Link Extender

7.2.1. Highlights

The FLX-2000 extends the distance of high-speed optical fibers well beyond the 500 m limit of multimode optical fibers. Finisar's Optical Link Extenders facilitate new applications such as remote storage and disaster recovery.

A pair of FLX-2000s extend a link by converting the short-haul copper or multi-mode optical signal to a long-haul, single-mode signal, and vice versa. Its internal Digital Signal Conditioner re-times the signal over the long-served over long distances with a bit error rate of 10^{-12} or better.

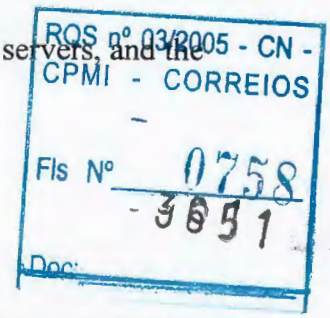
Simple to install, FLX-2000 link extenders include comprehensive system status monitoring and link diagnostics. The link monitoring and diagnostics provide quick fault detection and isolation. Integration with network management is provided via an RS232 serial port attached to a local terminal or modem to allow remote access.

7.2.2. SAN topologies & interoperability

Long distance links have been qualified only with one Optical link extender at both ends of the fiber. Interoperability with other devices on the long-haul optical fiber has not been qualified.

The Optical link extender has been qualified with links up to 10 km. Longer distances can be obtained in SFR (up to 120 km).

The short-haul connection has been qualified with DAS RAID subsystems, AIX PCI servers, and the Gadzoox Bitstrip fibre channel hub.



7.2.3. Packaging

The Optical Link Extender is a tabletop equipment, which can be stacked. Flat mounting on a wall is possible. Rack mounting kit is not available.

7.2.4. Technical specifications

Fibre channel specification

Protocol: Fibre Channel
Data rate: 1.062 Gbps

Electrical specification

Power requirement: +5 V (3 A), redundant inputs
Power supply: 110/220 V input, +5 V (4 A) output

Front-panel LED

Power
System
Short-haul
Long-haul

Short-haul connectivity

Short-haul copper cable: Shielded balance per FC-PH specification
Maximum short-haul copper distance: 25 m

Long-haul connectivity

Long-haul fiber connector: ST
Long-haul fiber cable: Single-mode zero dispersion at 1310 nm, 9/125 µm
Maximum long-haul distance: 10 km (optional up to 120 km)
Minimum Tx power: -3 dBm
Minimum Rx sensitivity: -26 dBm

Physical Dimensions

Dimensions: 8.2" x 7.5" x 1"(20,8 cm x 19,5 cm x 2,5 cm)
Weight: 2.5 lbs (1.3 kg)
Operating Temperature: 0 to 50°C

Other

Laser safety: Class 1 per FDA/CDRH, IEC 825-1
Agency Approvals: UL1950, CSA 22.2 950, EN 60950,IEC 950, CE Mark, VCCI

Electromagnetic Specifications

Emission: FCC Part 15 Class A, EN55022A, EN 55022, DOC CAS C108.8
Immunity: EN 50082-1

7.3. Gadzoox Biststrip™TW Fibre Channel Hub

7.3.1. Highlights

The Gadzoox Bitstrip™ TW Fibre Channel Arbitrated Loop (FC-AL) hub is specifically designed to be a cost effective entry point into high availability, gigabit storage networking. The Bitstrip TW incorporates several active features, such as Gadzoox' Reflex intelligent port bypass and per port data regeneration, which ensure reliable, trouble free, plug and play operation as well as a high degree of data integrity.

The Bitstrip TW is a 9-port FC-AL active hub that uses a DB-9 connector for each port allowing native connection to copper cabling. The Bitstrip TW also supports optics on all 9 ports through the use of external DB-9 to optics Media Interface Adapters (MIAs). MIAs are hot-pluggable and field upgradable, providing hub users with maximum flexibility in mixing copper and optical connections in their Fibre Channel systems. Power is automatically supplied on a per port basis to each connected MIA.

The Reflex feature, an intelligent port detection and bypass capability, dynamically reconfigures the arbitrated loop network to preserve communication between all operating devices. Using Reflex, the Bitstrip TW manages movement of nodes on and off the network, constantly monitoring nodes for failure, cable disconnection or network reconfiguration. Non-operating nodes are automatically bypassed, newly communicating nodes are automatically entered onto the loop. All loop reconfiguration is handled by the Bitstrip TW without disrupting communication on the remainder of the network. In the absence of the Bitstrip TW, the physical loop would need to be recabled on the addition or removal of a node, bringing the network down and disrupting communications.

The Bitstrip TW can be cascaded to other FC-AL hubs for the expansion of the loop. Port expansion is supported to the FC-AL limit of 126 nodes. Any port may be used for cascading.

The Bitstrip TW implements the most complete suite of intelligent data detection tests to ensure the highest availability of the Fibre Channel Arbitrated Loop. This test suite includes:

- Valid 8B/10B Data Detection
- Oscillation Detection
- Open Cable Detection

These three tests allow the Bitstrip TW to differentiate between valid Fibre Channel data and erroneous data, preventing corruption on the loop. Multiple detection circuits ensure that nodes will be bypassed only on real line failures, allowing transient events such as bit failures to be handled by the Fibre Channel frame level protocol. In the event that a node is bypassed, front panel LEDs provide convenient indications.

7.3.2. SAN topologies & interoperability

Despite the advanced features of the hub to retime and regenerate the signal allowing hub cascading, hubs interconnections must be avoided because of the risk of performance bottleneck. The hub shares the 100 MB/s bandwidth between the connected devices. Thus with 8 servers connected to a single hub, the average bandwidth per server is only 12,5 MB/s (100/8), i.e. much less than SCSI. Interconnecting hubs does not increase the available bandwidth, but at the opposite share the 100 MB/s between more devices. The single case where hubs interconnection is tolerated (but should not exceed 3) is when there is no more than 9 devices (host bus adapters or storage subsystems) and the interconnection simplify the cabling. Typical examples are the disaster recovery configurations. Please refer to the SAN configuration guide for more information.

Another consequence of the bandwidth sharing concerns servers with multiple adapters: attempting to connect multiple adapters to a single hub is a design error. It will not increase the bandwidth available for the server, and furthermore, a failure of the hub (like a power outage) will impact all the connected adapters.

The interconnection of hubs and switches has not yet been qualified.

7.3.3. Packaging

The hub is a tabletop equipment.

It can also be mounted into a rack. It is designed as a precise half rack chassis so that two hubs installed with a single, 1U-height rack space. There is a double rack mount kit designed for mounting two hubs, side by side into a rack.

7.3.4. Technical Specifications

Bit Rate

1.0625 Gigabit/Second, 8B/10B encoded

Data Rate

100 MByte/Second each direction

Standards Support

Fibre Channel Arbitrated Loop

Physical Specifications

(H) 1.7 in./43mm, (W) 8.7in/221mm, (D) 5.7 in./145mm

Weight

Net - 3 lbs., Shipping - 3.3 lbs.

LED Indicators

1 Amber/port - LED on indicates port by-pass
1 Green - LED on indicates power on

Environmental Specifications

Operating temperature: +10 deg. C to +40 deg. C
Storage temperature: -30 deg. C to +60 deg. C
Operating humidity: 80% maximum relative humidity

Electrical Specifications

AC Voltage: 100-240 VAC
Power: 2A, 50-60 Hz

Electromagnetic Specifications

FCC Part 15 Class A, EN55022A

Agency Approvals

UL1950, CSA 950, EN60950 (IEC950), CE Mark, VCCI

7.4. MIA

7.4.1. Highligths

The MIA is a high performance integrated duplex data link for bi-directional communication over multimode optical fiber for Fibre Channel applications. It is compliant with the Media Interface Adapter (MIA) specification. The MIA is specifically designed to connect to electrical high speed data communications links that require extended distance performance. The previous limit of 30 m in copper connections can easily be extended to 500 m with multimode.

7.4.2. SAN topologies & interoperability

The MIA has been qualified with Gadzoox hubs and DAS subsystems.

Caution

This MIA, introduced in 9/99, replaces the product number MI DCOQ001-0000. It is not compatible with PCI copper DB9 fibre channel PCI adapters (LP 6000: DCCG166-0000, LP 7000ᵉ: DCCG141-0000, LP 8000: DCCG147-0000). To support optical connections on AIX servers, a PCI adapter with the native optical interface must be used. If necessary, existing adapters must be replaced.

7.4.3. Packaging

The MIA is plugged directly on copper / DB9 connectors on hub's ports or on DAS host interface ports.

7.4.4. Technical specifications

Bit Rate

1.0625 Gigabit/Second, 8B/10B encoded

Data Rate

100 MByte/Second each direction

Standards Support

Fibre Channel

Physical Specifications

(H) 0.63 in./ 16 mm, (W) 1.4 in. / 36 mm, (D) 2.7 in. / 68.6 mm

Environmental Specifications

Operating temperature: +0 deg. C to +70 deg. C
Storage temperature: -40 deg. C to +85 deg. C

Optical interface

SC Duplex Optical Interface
50 µm multimode optical fibers
62.5 µm multimode optical fibers

Electrical Interface

DB-9
75 ohm Input / Output
Single +5V Power Supply

Safety

Class 1 Laser Safety Compliance IEC825-1
FDA radiation performance standards 21 CFR, chapter 1 subchapter J
UL 1950 Approved
FCC Part 15 class B

Chapter 4: Memory Expansion Cards

1. EPC400 Memory

The Escala EPC400 Model system memory is organized in memory banks made up of four memory DIMMs.

The four memory connectors on the System Planar can house:

- Either one memory bank
- Or four memory risers hosting up to six memory banks.

Each memory riser hosts six memory DIMM connectors.

A memory bank hosted on memory risers is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs)

The maximum memory bank is 512 MB.
The maximum memory configuration is 3 GB.

The Escala EPC400 Model supports the following memory DIMMs:

- DIMM Standard 72 bit 168 pin with EDAC
- VCC 3.3V
- Time of Access 60 ns
- Functionality Extended Data Output (EDO)
- Height 1.25 inch max
- Package Type TSOPII
- Application ECC
- Memory Data Bus peak throughput: 2.8 GB/s

A memory bank can be made up of DIMMs having capacity of 16/32/64/128 MB.

Table of the memory bank capacity

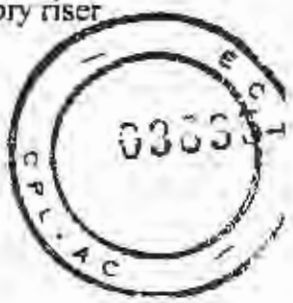
Technology	DIMM Size (MB)	Memory Bank Capacity
16 Mbits	16 MB	64 MB
16 Mbits	32 MB	128 MB
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB

2. EPC430 Memory

The Escala EPC430 system memory is organized in memory banks made up of four memory DIMMs. Memory banks are hosted on four memory riser cards connected to the planar board.

Each memory riser card has eight memory DIMM connectors.

A memory bank hosted on four memory riser cards is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs).



The maximum size of a memory bank is 1 GB.
The maximum memory configuration is 8 GB.

The Escala EPC430 supports the following memory DIMMs:

- SDRAM DIMM, 72 bit, 168 pin
- VCC 3.3V
- Access Time 10 ns (100MHz, CAS latency 2 mode)
- Height 1.65 inch
- Application ECC
- LVTTL electrical interface
- Memory Data Bus peak throughput: 5.6 GB/s
- PC100 Intel specifications compliant.

A memory bank can be made up of DIMMs having capacity of 64/128/256 MB.

Table of the memory bank capacity

Technology	DIMM Size	Memory Bank Capacity
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB
128 Mbits	256 MB	1 GB

3. EPC440 Memory

The Escala EPC440 Model system memory is organized in 2 memory cards. Each memory card can house 8 pairs of synchronous DRAM (SDRAM) DIMMs of the same capacity.

The following DIMMs are available:

- 128 MB (64 Mbits technology)
- 256 MB (128 Mbits technology).

The minimum memory capacity is 256 MB.
The maximum memory capacity is 8 GB (2 memory cards + 32x256 MB DIMMs).

The Escala EPC440 Model supports the following memory DIMMs:

- DIMM Standard 72 bit 200 pin JDEC
- 10ns clock size
- 64 data bits + 8 ECC bits
- Single bit correct, double bit detect, single packet detect ECC

4. EPC450 Memory

The Escala EPC450 system memory is organized in memory banks made up of four memory DIMMs. Memory banks are hosted on four memory riser cards connected to the planar board.

Each memory riser card has eight memory DIMM connectors.

A memory bank hosted on four memory riser cards is made up of 1 DIMM for each memory riser (total of 4 memory DIMMs).

The maximum size of a memory bank is 1 GB.
The maximum memory configuration is 8 GB.

The Escala EPC450 supports the following memory DIMMs:

- SDRAM DIMM, 72 bit, 168 pin
- VCC 3.3V
- Access Time 10 ns (100MHz, CAS latency 2 mode)
- Height 1.65 inch
- Application ECC
- LVTTL electrical interface
- Memory Data Bus peak throughput: 5.6 GB/s
- PC100 Intel specifications compliant.

A memory bank can be made up of DIMMs having capacity of 64/128/256 MB.

Table of the memory bank capacity

Technology	DIMM Size	Memory Bank Capacity
64 Mbits	64 MB	256 MB
64 Mbits	128 MB	512 MB
128 Mbits	256 MB	1 GB

5. EPC800 Memory

5.1. For 604e models - "up to 4 GB"

Four memory slots are available on this series; it is possible, at the initial order or on site to increase the memory capacity up to 4096MB by adding memory motherboard (up to 4 boards) and SIMMs.

The SIMMs are mounted on a memory motherboard "up to 1GB".

5.1.1. Memory Motherboard "up to 1 GB"

The motherboard "up to 1GB" allows to install up to four sets of 4 SIMMs (4 x 16/32/64MB) on four banks; all SIMMs in a bank must be of the same type.

5.1.2. Memory Modules

5.1.2.1. 64 MB MM64 Module

The 64MB MM64 Module provides a set of four 16MB SIMMs.

- 60-ns 16 mega-bit/chip
- 5.0-volt

5.1.2.2. 128 MB MM128 Module

The 128MB MM128 Module provides a set of four 32MB SIMMs.

- 60-ns 16 mega-bit/chip
- 5.0-volt

5.1.2.3. 256 MB MM256 Module

The 256MB MM256 Module provides a set of four 64MB SIMMs.

- 60-ns 16 mega-bit/chip
- 5.0-volt

6. EPC1200 and EPC1200A Memory

The system memory of the Escala EPC1200 and Escala EPC1200A is organized in quads. Four memory boards are addressed at the same time. Each board in a quad must be of the same size. The system can contain up to five quads (20 memory boards – time of access 10ns). For outstanding reliability, these boards use ECC SDRAM memory.

The following types of quad-memory boards are available:

- 512 MB (4x128 MB)
- 1 GB (4x256 MB)
- 2 GB (4x512MB)
- 4 GB (4x1024MB)
- 8 GB (4x2048MB).

The base EPC1200 comes with 512MB (4x128 MB) of memory, while the base EPC1200A comes with 1GB (4x256 MB) of memory. For both models, the maximum configuration is 32 GB of memory (the system could house physically up to 40 GB of memory, but it is limited to 32 GB).

System memory is accessed through two distinct ports. For optimal performance, memory should be installed balanced between the two memory ports. For example, better performance is achieved if the system uses two 1GB boards balanced between the two ports than if it uses a single 2GB board.

7. EPC2400 Memory

The system memory of the Escala EPC2400 is organized in quads. Four memory boards are addressed at the same time. Each board in a quad must be of the same size. The system can contain up to four quads (16 memory boards). For outstanding reliability, these boards use ECC SDRAM memory.

The following types of quad-memory boards are available:

- 2 GB (4x512 MB)
- 4 GB (4x1024 MB)
- 8 GB (4x2048 MB)
- 16 GB (4x4096 MB).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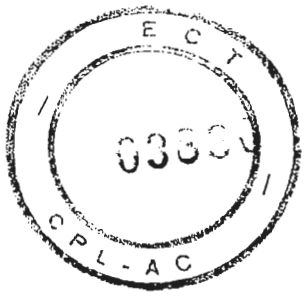
The base EPC2400 comes with 2 GB (4x512 MB) of memory. The maximum configuration is 64 GB of memory.

The memory is accessed as four related but distinct ports. Balanced accesses use all four ports in a coordinated parallel manner and can obtain up to four times the data in the same amount of time. Unbalanced configurations will function properly, but the unbalanced portion of the memory will not make use of the full memory bus bandwidth.

Example: A system with 8 GB of memory should perform better if two 4 GB features are installed than one 8 GB feature is installed, while installing four 2 GB features may provide additional performance for some applications.



Chapter 5: Interconnections, Communications Adapters and Modems

1. Communication Technologies and Networks

Communications technologies are classified in three groups available on Escala EPC:

- LAN: Ethernet Thick/Thin/Twisted pair, Ethernet 100Mbps, (fast Ethernet), Gigabit Ethernet, FDDI Fibre single ring, FDDI Fibre Dual Ring, FDDI UTP, Token Ring, ATM
- WAN: 1- or 4- port multi-protocol serial I/, 1 or 4 port HiSpeed WAN, 4 port multiprotocol, ISDN
- Asynchronous Network: 8/16/64/128 port async EIA-232, 8/16/64/128 port async EIA-422)

Based on these technologies, different communications are necessary to build a cluster:

- back-end communication networks or interconnects
- a front-end communication network (TCP-IP based)
- a serial network or heart beat link
- an administration network (dedicated to administration or linked with enterprise network)
- other front-end network (per ex : X25 based) (See WAN controllers and Multiport controllers)

1.1. Front-end Communication Network (TCP-IP based)

The front-end communication is often the enterprise network to which the nodes of the clustered server are connected. This network is based on TCP-IP communication protocol and LAN technologies. For HA purposes, the network availability features need at least 2 network accesses per node, which means 2 adapters per nodes connected to 2 different networks.
The front-end communication network is also named External LAN and is configured node per node, when required. Controllers are generated. Cabling is optional when available.
Ethernet, Fast Ethernet, Gigabit Ethernet, Token-ring, FDDI (Single ring or dual ring), and ATM are supported (Gigabit Ethernet is available on PCI bus based servers only)
For more information, see the section describing each controller.

1.2. Serial Network or Heart Beat Link

The serial network is used by the HACMP subsystem to exchange cluster state (heart beat) protocol information (exchange keep-alive and event information). The nodes are linked together by serial lines. Each node is connected by a serial line to one (for 2-node configurations) or two nodes in order to build a ring figure.

1.3. Administration Network

The Administration Network is used for general-purpose and faster administration; a separate Ethernet-based network linking all the EPC components can be used. This network is constructed by a dedicated hub linking all the nodes, the console concentrator, if any, and either the PowerConsole or the cluster console. Establishing a separate network for administration operations brings security but requires a dedicated Ethernet adapter on every node.
For resource optimization purpose, this network may be the front-end network or the basic interconnect used for only HA configurations or server consolidation.
This administration network is generated with the PowerConsole whatever the number of nodes. The Ethernet controller integrated in each node is used to build the network. If this Ethernet controller is already used for the front-end network, it is possible to connect the hub to the front-end network for resource optimization or to add an Ethernet controller in each node to build a private and dedicated network.

1.4. Back-end Communication Networks or Interconnects

Interconnect communication network is also named back-end network or private network.
An interconnect is a complete network dedicated to internode communications by applications. The interconnect links a group of nodes inside the cluster. This network is dedicated and private to the cluster.
It is possible to have multiple interconnects for different purpose linking different groups of nodes

An interconnect can be used as a high-performance network for exchanging information related to CMP mode operation (concurrent access). An interconnect can also be used to handle data exchanges in Client/Server or three-tier architectures. The interconnect protocol supported is TCP-IP. A number of implementations, based on different technologies (Ethernet, Fast Ethernet, Gigabit Ethernet, FDDI), different levels of redundancy (simple or double connections), and optional network devices (hubs, switches), are possible. The following interconnect kits are available:

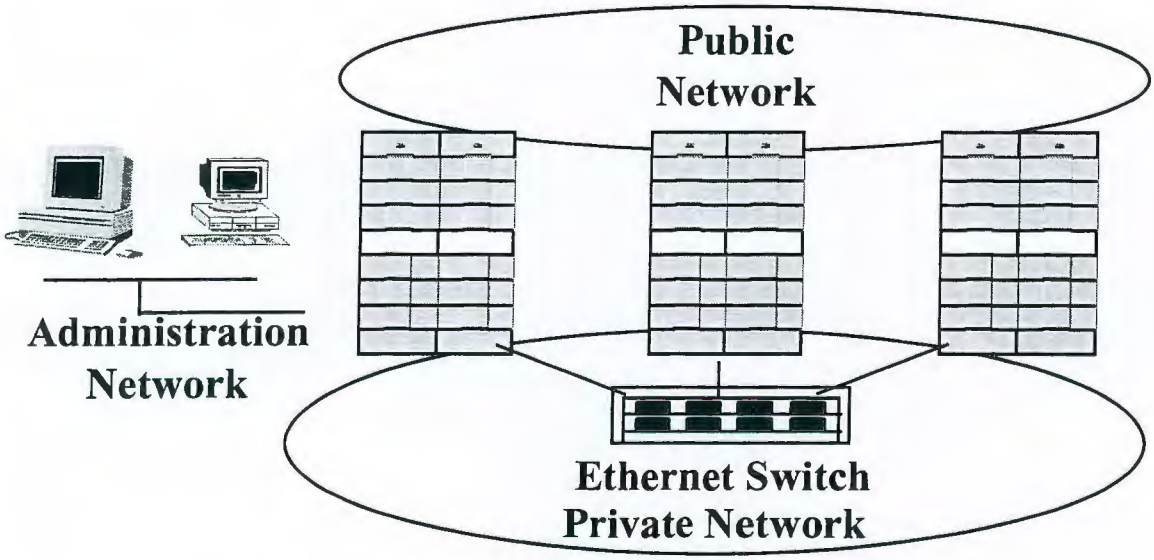
- Ethernet 100Mbps single connection (with 1 hubs for more than 2 nodes interconnects)
- Gigabit Ethernet single connection (with 1 switch for more than 2 nodes interconnects)
- FDDI dual ring 100Mbits/N (with 2 hubs for more than 2 nodes interconnects)

(Note: When needed, double connection interconnects can be implemented by using two interconnect kits for single connection.)

It is possible to have no interconnect, for example in a consolidation server configuration.

1.4.1. Ethernet 100 Mbps Interconnects

For two interconnected nodes: 2 Ethernet 100 Mbps controllers one for each node and 1 RJ45/RJ45 cross cable to link both adapters and build a private Ethernet network are necessary.
Beyond 2 interconnected nodes, it is necessary to have a Ethernet 100Mbps single switch kit based on 3COM Supertack II switch 3000 and 3300 models (the 3300 model is the successor of the 3000 model). An Ethernet interconnect base kit is needed for each interconnected node. This kit contains one Ethernet 100Mbps controller and one RJ45/RJ45 cable to be connected to the switch.



This is a basic interconnect implementation without redundancy for Client/Server communication.

1.4.2. Interconnect Fast Ethernet Switch

The Fast Ethernet switch comes from 3COM: SuperStack II Switch 3000 and 3300 models (the 3300 model is the successor of the 3000 model).

The SuperStack II Switch 3x00 12 port supports Ethernet and Fast Ethernet Switching in one stackable switch. It supports both full & half duplex on all ports which is able to provide 200 Mbps of bandwidth to each connected device, with auto-negotiation providing smoc th migration from Ethernet to Fast Ethernet. There are 12 Copper Fast Ethernet Ports: autosensing 10BASE-T/100BASE-TX interfaces (RJ-45 connector). The SuperStack II Switch 3x00 switch also offers an optional high-speed slot for an additional Fast Ethernet port (RJ-45 copper or SC fiber) support. It provides full duplex Fast Ethernet and 2 km distance on fiber. Local management can be performed via an RS-232 (DB-9 port) line. The SuperStack II Switch 3x00 switch supports up to 8,160 MAC addresses for the largest, high-performance networks.

1.4.3. Gigabit Ethernet Interconnects

For two interconnected nodes: 2 Gigabit Ethernet adapters one for each node and 1 SC-SC optical fiber cable to link both adapters and build a private Gigabit Ethernet network are necessary.

Beyond 2 interconnected nodes, it is necessary to have a Gigabit Ethernet switch based on the 3COM SuperStack II 9300 model. A Gigabit Ethernet interconnect base kit is needed for each interconnected node. This kit contains one Gigabit Ethernet adapter and one SC-SC optical fiber cable to be connected to the switch.

1.4.4. Interconnect Gigabit Ethernet Switch

The Gigabit Ethernet switch comes from 3COM: SuperStack II Switch 9300 model.

This switch provides 12 Gigabit Ethernet ports. It delivers full line rate, non-blocking switching among all ports. It supports full-duplex mode on all ports and up to 16,000 MAC addresses.

1.4.5. FDDI Interconnects

FDDI-based Interconnect Architectures

- Dual Ring FDDI without Hub for 2 nodes

Dual Ring allow to build a redundant network interconnect to a cluster of 2 nodes. It is targeted to Client/Server applications.

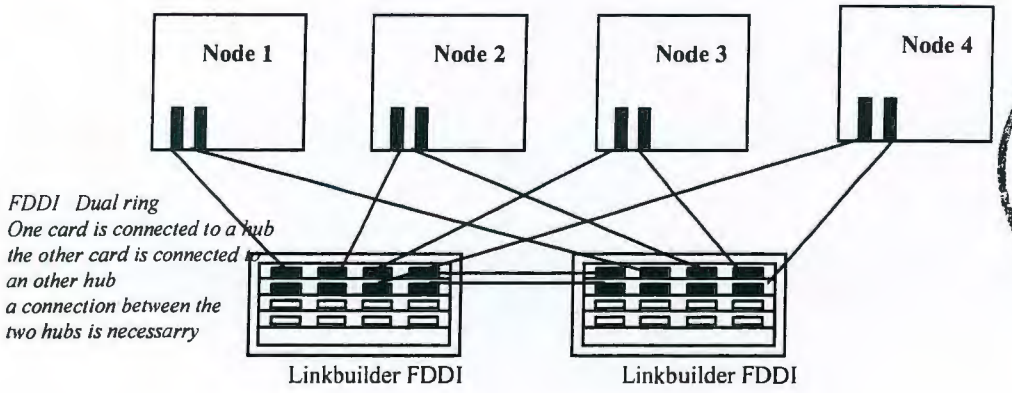
- FDDI with two Hubs in Dual homing configuration

Beyond 2 nodes to insure ring integrity, it is necessary to add hubs that can re-routed messages when a failure occurs. Hub high availability feature will be given by a Dual homing configuration based on two hubs.
The hub FDDI is the Linkbuilder FDDI of 3COM with Module type « 4 port fibre ». The dual homing configuration gives the ability to interconnect up to 14 nodes.

The FDDI Hub Kit contains:

- 2 Linkbuilder FDDI (each based on 4 slot chassis)
- 2 FDDI Fibre MIC-MIC cable (6m) to interconnect the two hubs and build the two rings between the hubs.
- 2 Management modules, one per Linkbuilder, in one slot of each Linkbuilder
- 4 « Fibre 4-ports » modules, 2 per Linkbuilder. One module takes one slot in the Linkbuilder.

The FDDI Hub kit allows to interconnect up to 6 nodes of an Escala EPC configuration.
An FDDI Hub Extension kit allows to interconnect a 7th and a 8th node. This extension kit contains 2 « Fibre 4-ports » modules, 1 per Linkbuilder.
A FDDI Interconnect base kit is necessary for each node to be interconnected. The kit contains a FDDI Dual Ring Adapter and two FDDI Fibre MIC-MIC Cable (6m). One cable will be connected to one of the Linkbuilder, the other to the other Linkbuilder as displayed in the following figure.



Dual Homing configuration

2. Modems

An ISA modem adapter and an external modem are available.

2.1. ISA Modem Adapter

The ISA modem adapter provides support for a modem line to an Escala EPC400, EPC430, EPC450 or a PowerConsole (Escala S100). It is used for RSF (Remote Services Facilities) usage to allow communications with a Customer Service Center for maintenance purpose: it allows asynchronous communications in a reliable way via a connection to the PSTN (Public Switched Telephone Network).

This adapter features:

- automatic adaptation to the line conditions and capacities of the remote modem
- support for data transmission rate up to 33.6 kbps
- full or half-duplex mode on the switched telephone network
- automatic or manual dialing
- automatic or manual answer

Hardware:

- 1 RJ11 connector
- ISA bus
- Form factor: short length card

Cables:

The base board provides a RJ11 connector and a RJ11 cable is delivered with it according to the country.
For the United States, there is a specific and additional connector to connect directly the Phone on the :d.

Attachment:

The controller fits into a single ISA slot.

Operating System Requirement:

- AIX 4.2.1, or later

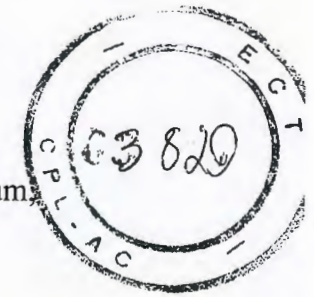
2.2. External Modem

An external modem is available for EPC440, EPC1200, EPC1200A and EPC2400 servers.

The modem is intended to be dedicated to RSF (Remote Services Facilities) operation. RSF is a Bull software that performs system error monitoring and handles communications for remote maintenance operations. The modem, together with RSF, provides a link, via a phone line, between the system at the customer site and a Bull Customer Service.

The external modem has the following features:

- automatic adaptation to the line condition and capacities of the remote modem for the following standards: V34, AT&T V32terbo, V32bis, V32, Bell 212A and 103/113, V22, V22bis, V29, V42, V42bis.
- support for data transmission rate up to 33.6 kbps
- full or half-duplex mode on the switched telephone network
- automatic or manual dialing, automatic or manual answer



The modem is available for the following countries: France, UK, Germany, Italy, Belgium, Netherland, US.

Hardware:

- Modem box with a RS232 DB25 connector, a power connector and two RJ11 connectors for the phone line and the phone set.
- Modular power supply with jack (cable length 1.8m), specific voltage input and plug depending on the country choice.

Cables and adapters:

- RS232 cable, DB25M/DB9F, 1.7 meter
- RJ11/RJ11 cable, specific wall socket adapter depending on the country choice.

Note: a specific kit (rack cables set) is needed for connection to RL470/RL470A or EPC1200/EPC1200A systems.

Operating System Requirement:

- AIX 4.3 or later.

3. Multiport Controllers

3.1. Multiport Controllers on EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

3.1.1. 8-Port Async Controller EIA-232 (EPC400, EPC430 and EPC450)

The 8-port Async Controller provides support for attaching a maximum of eight EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC400, EPC430 or EPC450 system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with EIA-232D requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- Form factor : short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect)

Cables:

The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2., or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.2. 8-Port Async Controller RS-422A (EPC400, EPC430 and EPC450)

The 8-port Async Controller provides support for attaching a maximum of eight RS-422A asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC400, EPC430 or EPC450 system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with RS_422A requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- Form factor: short length card

Cables:

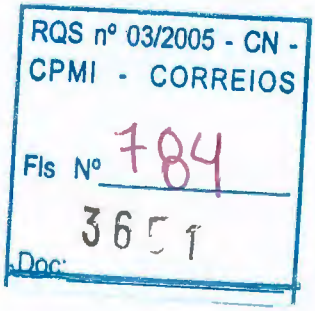
The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2., or later



The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.3. 8-Port Async Controller EIA-232 and RS-422 (EPC440, EPC1200, EPC1200A and EPC2400)

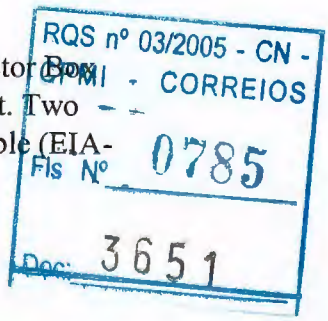
The 8-port Async Controller provides support for attaching a maximum of eight EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC system unit.

Hardware:

- Eight asynchronous ports
- PCI bus
- Compatibility with EIA-232D and RS-422A requirements
- 20 MHz IDT3041 RISC processor
- 128K memory
- 2 16C554 quad UARTs
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200 and 230000 bps, and 5, 6, 7, 8 bits per character
- Form factor : short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect)

Cables:

The base board provides a 78-pin female D-shell connector. An 8-port DB25 DTE Connector Box comes standard with the controller and provides the eight connectors for device attachment. Two modem cables are available (EIA-232 and RS-422) 3 meters long. One terminal/printer cable (EIA-232) 20 meters long.



Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.3, or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

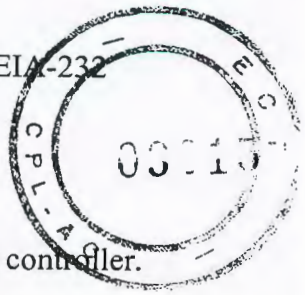
3.1.4. 64 Port Async Controller EIA-232/RS-422A (EPC400, EPC430 and EPC450)

The 64 port Async Controller provides support for attaching a maximum of 64 EIA-232 or RS-422A asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC400, EPC430 or EPC450 system unit.
The Controller is delivered with a 3 meters EBI (External Bus Interface) cable and has an EBI out connector, that allows up to four 16 ports connector boxes to be daisy chained. The maximum distance between the adapter and a connector box is 6 meters. EIA-232 and RS-422A connector boxes can be mixed on the same daisy link. The first 2 connector boxes are power supplied by the 64 port adapter; the third requires an external power supply for the two last ones.
This configuration provides support for up to 64 EIA-232 or RS-422A devices per PCI slot

Hardware:

- Up to 64 asynchronous ports
- PCI bus
- 20 MHz IDT3051 RISC processor
- 1 Mbyte of dual port DRAM

- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps[1]
- Form factor: short length card
- Full set of modem control lines (including Ring Indicator and Carrier Detect) on all EIA-232 lines



Cables:

The base board provides an EBI connector and a 3-meter EBI cable comes standard with the controller.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2., or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.5. 16 Port Connector Box EIA-232 for 64 ports Async Controller (EPC400, EPC430 and EPC450)

The 16 port Connector Box is a subsystem with four 16C554-compatible UARTS which support sixteen RJ45 EIA-232 serial ports. It is connected to the 64 Port Async Controller with an EBI (External Bus Interface) cable. When used as third connector box linked to the same 64 Port Async Controller, it requires an additional power supply to power the third and the fourth ones.

[1] For the moment, the Software limits the troughput to 38.4 Kbps

The connector box features the following:

- 16 async ports, each with a data interchange rate of up to 115,2 kbps
- EIA-232D compatibility
- full set of modem control signals (including Ring Indicator and Carrier Detect)
- surge suppression circuitry

A 0,4-meter EBI cable comes together with the connector box. This cable can be used to link another connector box which can be either another EIA-232 or an RS-422A connector box.

Conformance to standard

This connector box meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.6. 16 Port Connector Box RS-422A for 64 ports Async Controller (EPC400, EPC430 and EPC450)

The 16 port Connector Box is a subsystem with four 16C554-compatible UARTS which support sixteen DB25 RS-422A serial ports. It is connected to the 64 Port Async Controller with an EBI (External Bus Interface) cable. When used as third connector box linked to the same 64 Port Async Controller, it requires an additional power supply to power the third and the fourth ones.

The connector box features the following:

- 16 async ports, each with a data interchange rate of up to 115,2 kbps
- RS-422A compatibility
- surge suppression circuitry

A 0,4-meter EBI cable comes together with the connector box. This cable can be used to link another connector box which can be either another EIA-232 or an RS-422A connector box.

Conformance to standard

This connector box meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.7. Auxiliary power supply for 16 port connector box for 64 port Async controller (EPC400)

An auxiliary international power supply is required on the 3rd connector box, if more than 2 connector boxes (EIA-232 or RS-422A) are connected to a 64-port Async controller.
The power supply is delivered with an additional plug adapter necessary for the 16-port EIA-232 concentrator. It uses a 5 pin DIN plug connector on a 6-foot cable.

3.1.8. 128-Port Async Controller EIA-232 (EPC400, EPC430, EPC440, EPC450 and EPC2400)

The 128-port Async Controller provides support for attaching a maximum of 128 EIA-232 asynchronous serial devices (such as modems, terminals, and printers) to an Escala EPC system unit.

The Controller features two V11 synchronous channels that can link up to four Cluster Boxes (RANs) each via a "daisy chain". Each of those lines must be terminated by a terminator plug (delivered with the adapter).
This configuration provides support for up to 128 EIA-232 devices per PCI slot.

The ability to use synchronous attachments to any Remote Async Node provides even greater flexibility in system configuration, allowing customers to use synchronous modems for long-distance connectivity.
It is possible to use either V11/RS422 or V24/RS232 synchronous modems.
However, it is not possible to interpose more than one pair of such synchronous modems within this "daisy chain" of RANs.

Hardware:

- PCI bus
- 20 MHz IDT3041 RISC processor

- 1 Megabytes of tri-port DRAM
- Maximum EIA-232 distance supported is 62 meters (200 feet).
- Full modem support on all the lines, including Ring Indicator and Data Carrier Detect.
- dual high speed V11 channels : up to 3,7 Mbps per channel
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800 and 115200 bps
- surge suppression circuitry
- Form factor : short length card

Cables:

DB15-DB15 cables are required for the connection of the cluster boxes. Three lengths are available: 0,20-meter, 4,6-meter (direct connection or modem connection), 15-meter.

Attachment:

The controller fits into a single PCI adapter slot.

Operating System Requirement:

- AIX 4.2 or later

The total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standard

This board meets the following electromagnetic emissions and safety standards:

Emissions:

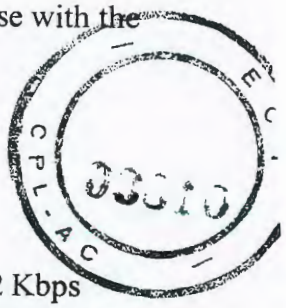
- FCC Part 15, class B
- DOC CSA C108.8f
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.9. 16 Port Cluster Box (RAN) for 128 port-adapter (EPC400, EPC430, EPC440, EPC450 and EPC2400)

The Cluster Box, also called Remote Async Node, is an intelligent interface device for use with the 128 Ports Async Controller.
It is connected to the 128 Ports Async Controller through a synchronous link.



The Cluster Box features the following:

- 16 async ports (RJ45 connectors), each with a data interchange rate of up to 115,2 Kbps
- support for cable lengths of up to 61m (200 ft) (provided the cable does not exceed a load capacitance of 2500pf).
- EIA-232D compatibility
- full set of modem control signals
- external power supply
- Machine-readable Vital Product Data (VPD)
- Character processing capability

The cluster-box requires a power supply that is delivered with it together with the power cord. It also requires a terminator plug when used as the last element of a daisy-chain; this plug is delivered with it.

This cluster box meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

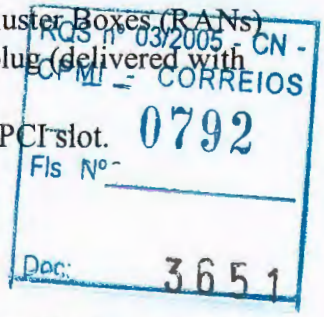
Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.10. 128-Port Async Controller EIA-232 / RS422 (EPC1200, EPC1200A)

The 128-port Async Controller provides support for attaching a maximum of 128 EIA-232 or RS422 asynchronous serial devices (such as modems, terminals, and printers) to an Escala system unit.

The Controller features two V11 synchronous channels that can link up to four Cluster Boxes (RANs) each via a "daisy chain". Each of those lines must be terminated by a terminator plug (delivered with the adapter).
This configuration provides support for up to 128 EIA-232 or RS422 devices per PCI slot.



The ability to use synchronous attachments to any Remote Async Node provides even greater flexibility in system configuration, allowing customers to use synchronous modems for long-distance connectivity.
It is possible to use either V11/RS422 or V24/RS232 synchronous modems.
However, it is not possible to interpose more than one pair of such synchronous modems within this "daisy chain" of RANs.

Hardware:

- PCI bus
- 20 MHz IDT3041 RISC processor
- 1 Megabyte of tri-port DRAM
- Maximum RAN distance supported is 300 meters (1000 feet).
- dual high speed V11 channels : up to 3,7 Mbps per channel
- surge suppression circuitry
- Form factor: short length card

Cables:

DB15-DB15 cables are required for the connection of the cluster boxes. Three lengths are available: 0,20-meter, 4,6-meter (direct connection or modem connection), 15-meter.

Attachment:

The controller fits into a single PCI adapter slot.

Operating System Requirement:

- AIX 4.3 or later

Total number of 8 ports, 64 ports and 128 ports asynchronous controllers cannot be more than the maximum supported by the model and in any case is limited to 8

Conformance to standards

This board meets the following electromagnetic emissions and safety standards:

Emissions:

- FCC Part 15, class B
- DOC CSA C108.8f
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950

- IEC 950 Safety (TUV) EN (60950)

3.1.11. 16 Port Cluster Box (RAN) for 128 port-adapter

The Cluster Box, also called Remote Async Node, is an intelligent interface device for use with the 128 Ports Async Controller.
It is connected to the 128 Ports Async Controller through a synchronous link (max. distance: 300m/1000feet).

There are two types of box style Remote Async Nodes: EIA-232 and RS-422

The Cluster Box features the following:

- 16 async ports (RJ45 10 positions connectors)
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400 and 57600 bps, and 5, 6, 7, 8 bits per character
- support for cable lengths of up to 61m (200 ft) (provided the cable does not exceed a load capacitance of 2500pf).
- EIA-232D or RS-422A compatibility
- full set of modem control signals
- external power supply 100-250Vac at 50 or 60 Hz
- Machine-readable Vital Product Data (VPD)
- Character processing capability

The cluster-box requires a power supply that is delivered with it together with the power cord. It also requires a terminator plug when used as the last element of a daisy-chain; this plug is delivered with it.

This cluster box meets the following electromagnetic emissions and safety standards:

Emissions:

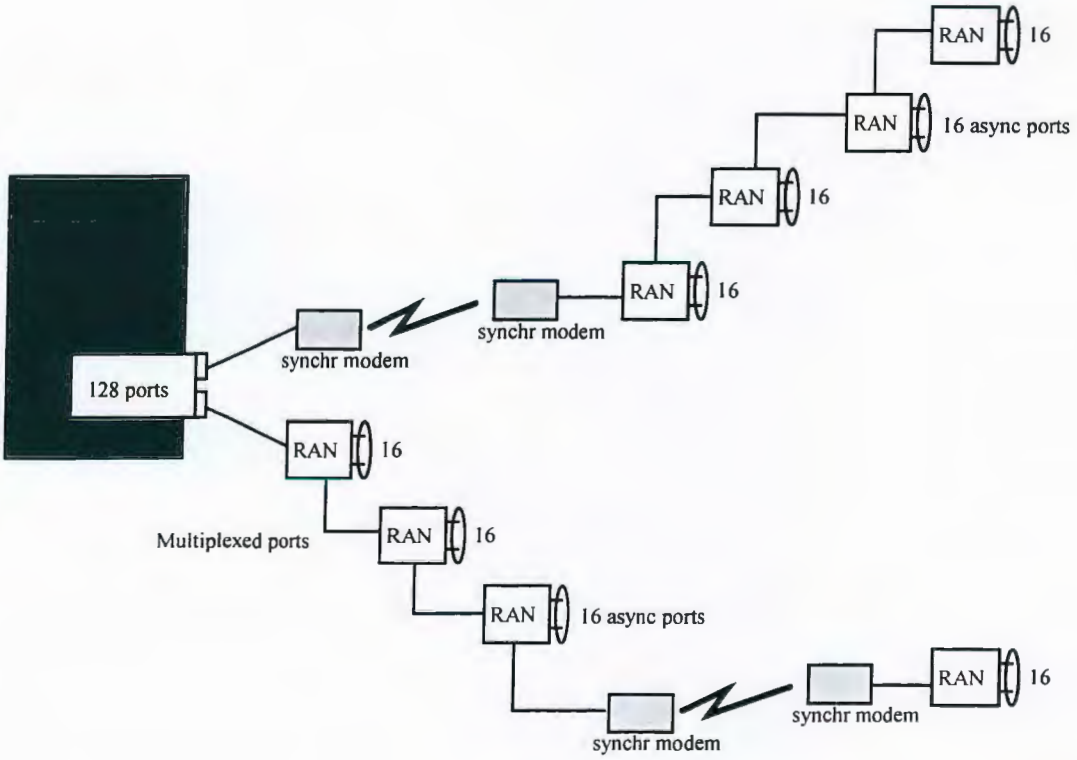
- FCC Part 15, class B
- DOC CSA C108.8 and ICES003
- EN 55022

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 950
- IEC 950 Safety (TUV) EN (60950)

3.1.12. Multiport Controllers Usage Summary Table

	Printers, Terminals	Async Modems	Sync Modems
8 Port EIA-232 Controller	X	X	
8 Port RS-422A Controller	X		
64 Port EIA-232/RS-422A Controller			X (to Cluster Box)
16 Port Connector Box EIA-232 for 64 Port EIA-232/RS-422A Controller	X	X	
16 Port Connector Box RS-422A for 64 Port EIA-232/RS-422A Controller	X		
128 Port EIA-232 Controller			X (to Cluster Box)
16 Port Cluster Box (RAN) for 128 Port EIA-232 Controller	X	X	X (to other Cluster Box or to 128 port adapter)



3.2. Multiport Controllers on EPC800

3.2.1. 8-Port Async Enhanced Controller-EIA-232

The 8-port Async Enhanced Controller-EIA-232 provides support for attaching a maximum of eight EIA-232D asynchronous serial devices (such as modems, terminals, and printers) to the system unit.

Hardware

- Eight asynchronous ports, each with a data interchange rate of up to 38.4K bps,
- Full set of modem control lines,
- 12.5MHz 80C186 processor,
- 256KB memory,
- 32 KB memory window,
- 8530 serial communication controller,
- Compatibility with EIA-232D requirements,
- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, and 38400 bps.

Cables

The base board provides a 78-pin female D-shell connector. An 8-port DB25 Connector Box comes standard with the controller and provides the eight connectors for device attachment. It supports cable lengths of up to 61 m (200 ft.), provided the cable does not exceed a load capacitance of 2500 pico-farads.

Attachment

The controller fits into a single Micro Channel adapter slot.

3.2.2. 8-Port Async Enhanced Controller-EIA-422A

The 8-port Async Enhanced Controller-EIA-422A provides support for attaching a maximum of eight EIA-422A asynchronous serial devices such as modems, terminals, and printers to the system unit.

Hardware

- Eight asynchronous ports, each with a data interchange rate of up to 38.4K bps
- 12.5MHz 80C186 processor
- 256KB memory
- 32 KB memory window
- 8530 serial communication controller
- Compatibility with the EIA-422A requirements

- Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, and 38400 bps.

Cables

The base board provides a 78-pin female D-shell connector. An 8-port DB25 Connector Box comes standard with the controller and provides the eight connectors for device attachment. It supports cable lengths up to 1220m (4000 ft).

Attachment

The controller fits into a single Micro Channel adapter slot.

3.2.3. 16-Port Async Controller-EIA-232

The 16-Port Async Controller-EIA-232 provides support for attaching a maximum of 16-EIA-232D asynchronous serial devices such as terminals and printers to the system unit.

Hardware

16 asynchronous ports, each with data interchange rate of up to 38.4K bps
16-byte buffering on transmit and receive operations
Compatibility with EIA-232D requirements
Each port can be configured for the following baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, and 38400 bps.
The controller supports the following signal lines: RxD, TxD, DTR, DCD, and RTS (RTS always high). It does not support modems.
- Wrap plug for 78-pin connector (supplied for testing).

Micro Channel considerations:
- ### I/O slave
- ### 16-bit data and address widths
- ### Support for data and address parity
- ### Type 3 adapter card size.

Cables

The base board provides a 78-pin female D-shell connector. A 16-port DB25 Connector Box comes standard with the controller and provides the sixteen connectors for device attachment. It supports cable lengths of up to 61 m (200 ft.), provided the cable does not exceed a load capacitance of 2500 pico-farads.

Attachment

The controller fits into a single Micro Channel adapter slot.

3.2.4. 16-Port Async Controller-EIA-422A

The 16-Port Async Controller-EIA-422A provides support for attaching a maximum of 16 EIA-422A asynchronous serial devices such as terminals and printers to the system unit.

Hardware

16 asynchronous ports, each with a data interchange rate of up to 38.4K bps
Built-in surge protection circuitry on the controller
16-byte buffering on transmit and receive operations
Compatibility with the EIA-422A requirements
Wrap plug for 78-pin connector (supplied for testing).
Micro Channel considerations:
- ### I/O slave
- ### 16-bit data and address widths
- ### Support for data and address parity
- ### Type 3 adapter card size.

Cables

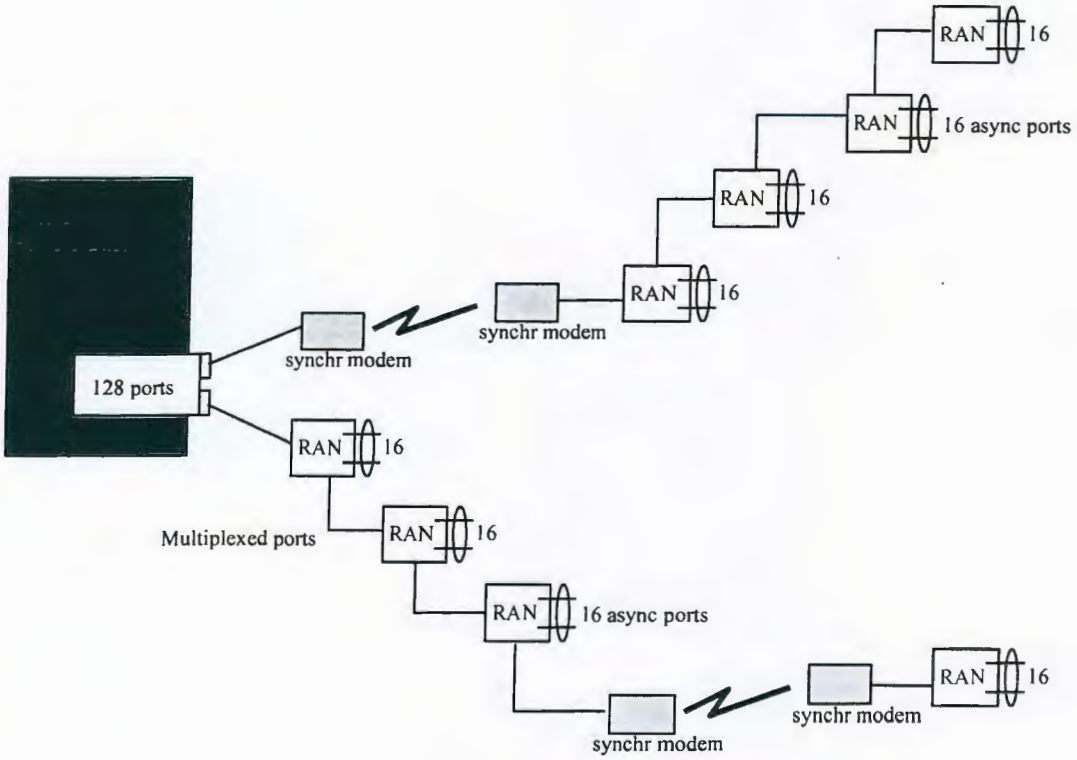
The base board provides a 78-pin female D-shell connector. A 16-port DB25 Connector Box comes standard with the controller and provides the sixteen connectors for device attachment. It supports cable lengths up to 1220m (4000 ft).

Attachment

The controller fits into a single Micro Channel adapter slot.

3.2.5. Multiport Controllers Usage Summary Table

	Printers, Terminals	Async Modems	Sync Modems
8 Port EIA232	X	X	
8 Port EIA422A	X		
16 Port EIA232	X		
16 Port EIA422A	X		
128 Port EIA232			X (to Cluster Box)
16 Port Cluster Box (linked to 128 the Port board)	X	X	X (to other Cluster Box or to 128 port adapter)



4. WAN Controllers

4.1. WAN Controllers for EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

4.1.1. 4Ports Multi-protocol Serial I/O Adapter (EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400)

The 4Ports Multi-protocol Serial I/O Adapter is a high end SDLC and X.25 adapter which provides a very powerful SDLC and X.25 offer at a moderate pricing.

The 4Ports Multi-protocol Serial I/O Adapter consists of a card that supports 4 ports with either V.24 or V.35 or V.11/X.21 physical interface. Each port can run either SDLC or X.25 and its physical interface type is software selectable

The 4Ports Multi-protocol Serial I/O Adapter is fully integrated in the Bull communication offer:

TCP/IP, XTI, XX25 and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits per port according to stacks capabilities.

SNA/20 applications can run and have access to SDLC network through this adapter (EPC400, EPC430, EPC440 and EPC450 only).

The adapter can support up to 2500 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware:

- ### PCI long card, 1 slot used
- ### NET2 conformance
- ### 2 Mbps per port (4 x 2Mbps Max)
- ### Maximum line speed :
  - ### V24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 2 Mbps
- 4 x HDLC communication controllers (4 x ZILOG IUSC) available on the card:
  Each one is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21. This adapter allows to have either 4 times the same interface or different types of interfaces on the same board. The **4Ports Multi-protocol Serial I/O Adapter** provides an efficient way to have independent ports and allows a high availability of the board in case of troubles. Furthermore, flexibility is insured in case of evolution of one of the interfaces.

Cables:

The board provides a 100 points female connector. A 2m cable attaches the 100-point connector to a distribution box. The distribution box has four 25-point connectors that could be connected to appropriate cables providing different types of interfaces. The cables are listed hereafter:

V.24 cable: up to 28.8 Kbps (10m)
V.35 cable: up to 64 Kbps (10m)
V.11/X.21 cables: up to 2 Mbps (10m)

Attachment:

The controller fit into a single long PCI adapter slot

PSX25 Software:

PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to PSX25 Software description for more details.

Operating System Requirement

AIX 4.2.1, or later: TCP/IP, OSI, XTI, XX25, SNA/20 and HVX stacks

Limitation:

- the total number of 4ports and 1 port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the model, and in any case limited to 8.
- the 4ports Multi-protocol Serial I/O Adapter cannot be plugged in the first and the last PCI slot of an Escala EPC400, EPC430 and EPC450 model.

4.1.2. 1Port Multi-protocol Serial I/O Adapter (EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400)

The **1Port Multi-protocol Serial I/O Adapter** is an entry level SDLC and X.25 adapter which provides a powerful X.25 and SDLC offer at a very competitive pricing.

The **1Port Multi-protocol Serial I/O Adapter** consists of a card that supports either one V.24 or V.35 or V.11/X.21 physical interface. This physical interface type is software selectable.

The **1Port Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, XTI, XX25** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits according to stacks capabilities.

- **SNA/20** applications can run and have access to SDLC network through this adapter (EPC400, EPC430, EPC440 and EPC450 only).

###

The adapter can support up to 200 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware:

PCI short card, 1 slot used
NET2 conformance
Maximum line speed:

V24:	28.8 Kbps
V.35:	64 Kbps
V.11/X.21:	128 Kbps

1 HDLC communication controllers (ZILOG IUSC) available on the card:
It is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21.

Cables:

The board provides a 25 points female connector that could be connected to appropriate cables providing different types of interfaces. The cables are same as for 4Ports Multi-protocol Serial I/O Adapter and are listed hereafter:

V.24 cable: up to 28.8 Kbps (10m)
V.35 cable: up to 64 Kbps (10m)
V.11/X.21 cables: up to 128Kbps (10m)

Attachment:

The controller fits into a single short PCI adapter slot

PSX25 Software:

PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to PSX25 Software description for more details.

Operating System Requirement

AIX 4.2.1, or later: TCP/IP, OSI, XTI, XX25, SNA/20 and HVX stacks.

Limitation:

the total number of 4ports and 1port Multi-protocol Serial I/O Adapters cannot be more than the maximum supported by the model, and in any case limited to 8.

4.1.3. PSX25 Software (EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400)

PSX25 software is dedicated to the support of the 4ports and 1port Multi-protocol Serial I/O Adapters.

The X.25.2 and X.25.3 software, compliant with X.25-92 and ISO 8822, is running on the host.

The **PSX25** software running under AIX is made of the following components:

interfaces for the:
- AIX TCP/IP stack and enabling to run any TCP/IP application over X.25
- OSI X.25 stack and the OSI (MAX3) X.25 API
- XTI and XX25 APIs
- SNA/20 stack and enabling to run SNA/20 applications in QLLC/X.25 mode.
- HVX stack and enabling to run HVX applications over X.25 networks.

Configuration tools integrated with SMIT providing an easy configuration of the adapters.
A large set of utilities to administrate and monitor the adapters.

PSX25 software supports simultaneous accesses of the various communication stacks to the same or different physical links. It is provided under a base and additional extension MI's:
- access to a single X.25 line
- access from 2 to 4 X.24 lines
- access from 5 to 8 X.25 lines
- access from 9 to 32 X.25 lines

PSX25 product includes a local SNMP agent with a Management Information that contains statistics, operational and configuration tables. This includes:

- A subset of the Management Information Base defined by the Internet Standards RFC 1381 and RFC 1382. This is made to interoperate with market existing manager.
- A specific Management Information Base which goals the completeness of information and gives a full advantage of **PSX25** stack management.
- A browser that provides system operators with an easy-to-use interface to monitor and configure PSX25 lines through the SNMP agent. It is based on the AIX standard SMIT interface

Limitations:

The IBM X.25 API provided by IBM's X.25 Software cannot be used through the PSX25 product. The Bull X.25 APIs (MAX3 or XTI) has to be used.
does not support SNA Server

4.1.4. 2-Port Multiprotocol PCI Adapter (EPC1200, EPC1200A and EPC2400)

The **2-Port Multiprotocol PCI Adapter** allows connections between stand alone system on a Wide Area Network (WAN). To access WAN lines, the 2-port Multiprotocol PCI Adapter connects via external communications equipment including Channel Service Units, Data Service Units and Synchronous Modems.

The **2-Port Multiprotocol PCI Adapter** consists of a card that supports 2 ports with either V.24 or V.35 or V.11/X.21 physical interface. Each port can run either SDLC or X.25.

The **2-Port Multiprotocol PCI Adapter** offer:

TCP/IP, Communication Server applications run and have access to X.25 networks through this adapter.

Communication Server application run and have access to SDLC networks through this adapter.

Hardware:

- PCI short card, 1 slot used
- 2 Mbps full duplex per port (2 x 2Mbps Max)
- PCI bus compatible (32-bit slot)
- HDLC controller at 10 MHz (HITACHI 64570)
- 512 KB of DRAM
- Automatic configuration of interrupt request level setting and memory address
- 32-bit memory access
- Two 36-pin female VHSI ports connect to 36-pin high-density male connectors
- Support for V.24/EIA-232, V.35, and X21 with V.11(X.27) signaling
- External clocking

Cables:

Each port accepts a high-density 36-pin male cable connector. The types of connector used on the interface-specific end of cable are:

Interface	Connector
V.35	Type M
V.24	DB25
X.21	DB15

The 2-Port Multiprotocol PCI Adapter recognizes the cable and automatically prepares the port for that interface.

Attachment:

The controller fit into a single short PCI adapter slot

AIX Link X25 Software:

AIX Link X25 software is dedicated to the support X.25 on the **2-Port Multiprotocol PCI Adapter**.

Operating System Requirement

AIX 4.3, or later: TCP/IP, Communication Server stacks

4.1.5. AIXlink X.25 software (EPC1200, EPC1200A and EPC2400)

Under AIX, using the X.25 communication controller requires the AIX link X.25 software.

The software supports TCP/IP as well as IBM specific API and applications such as X.25 API and SNA Server. It includes an SNMP proxy agent and MIB support for X.25 and LAP-B statistics of the X.25 Communication Controller. It also includes an X.3, X.28 and X.29 PAD function for attachment of asynchronous terminal and devices.

This software applies only to the X.25 Communication Controller for EPC800 and to the 2-Port Multiprotocol PCI Adapter for EPC1200, EPC1200A and EPC2400.

4.2. WAN Controllers for EPC800

4.2.1. 4Ports Multi-protocol Serial I/O Adapter

The **4Ports Multi-protocol Serial I/O Adapter** is a high end SDLC and X.25 adapter which provides a very powerful SDLC and X.25 offer at a moderate pricing.

The **4Ports Multi-protocol Serial I/O Adapter** consists of a card that supports 4 ports with either V.24 or V.35 or V.11/X.21 physical interface. Each port can run either SDLC or X.25 and its physical interface type is software selectable

The **4Ports Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, SNA/20, HVX, XTI** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits per port according to stacks capabilities.

- **SNA/20** applications run and have access to SDLC networks through this adapter.

The adapter can support up to 2000 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware

- Type 3 adapter, 1 slot used
- NET2 conformance
- 2 Mbps per port (4 x 2Mbps Max)
- Maximum line speed :
  - V.24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 2 Mbps

4 x HDLC/SDLC communication controllers (4 x ZILOG IUSC) available on the card: Each one is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21. This adapter allows to have either 4 times the same interface or different types of interfaces on the same board. The **4Ports Multi-protocol Serial I/O Adapter** provides an efficient way to have independent ports and allows a high availability of the board in case of troubles. Furthermore, flexibility is insured in case of evolution of one of the interfaces.

Cables

The board provides a 100 points female connector. A 2m cable attaches the 100-point connector to a distribution box. The distribution box has four 25-point connectors that could be connected to appropriate cables providing different types of interfaces. The cables are listed hereafter:

- V.24 cable: up to 28.8 Kbps (10m)
- V.35 cable: up to 64 Kbps (10m)

- V.11/X.21 cables: up to 2 Mbps (10m)

Attachment

The controller fit into a single type 3 MCA adapter slot.

PSX25 Software

The PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to the PSX25 Software description for more details.

Operating System Requirement

- AIX 4.1.5 :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : none
- AIX 4.2.1, or later :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : SNA/20

Limitation

- the total number of 4ports and 1 port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the model with an extension cabinet, and in any case limited to 8.

4.2.2. 1Port Multi-protocol Serial I/O Adapter

The **1Port Multi-protocol Serial I/O Adapter** is an entry level SDLC and X.25 adapter which provides a powerful X.25 and SDLC offer at a very competitive pricing.

The **1Port Multi-protocol Serial I/O Adapter** consists of a card that supports either one V.24 or V.35 or V.11/X.21 physical interface. This physical interface type is software selectable.

The **1Port Multi-protocol Serial I/O Adapter** is fully integrated in the Bull communication offer:

- **TCP/IP, SNA/20, HVX, XTI** and **OSI** applications run and have access to X.25 networks through this adapter. This board can support up to 1024 virtual circuits according to stacks capabilities.
- **SNA/20** applications run and have access to SDLC networks through this adapter.

The adapter can support up to 200 frames/sec (with frame size = 128) according to stacks capabilities.

Hardware

- Type 3 adapter, 1 slot used
- NET2 conformance
- Maximum line speed :
  - V.24: 28.8 Kbps
  - V.35: 64 Kbps
  - V.11/X.21: 128 Kbps
- 1 HDLC/SDLC communication controllers (ZILOG IUSC) available on the card:
  It is software personalized with one of the following interfaces: V.24, V.35 and V.11/X.21.

Cables

The board provides a 25 points female connector that could be connected to appropriate cables providing different types of interfaces. The cables are same as for 4Ports Multi-protocol Serial I/O Adapter and are listed hereafter:

- V.24 cable: up to 28.8 Kbps (10m)
- V.35 cable: up to 64 Kbps (10m)
- V.11/X.21 cables: up to 128Kbps (10m)

Attachment

The controller fit into a single type 3 MCA adapter slot.

PSX25 Software

The PSX25 software is dedicated to the support X.25 on the 1port and the 4ports **Multi-protocol Serial I/O Adapter**. Refer to the PSX25 Software description for more details.

Operating System Requirement

- AIX 4.1.5 :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : none
- AIX 4.2.1, or later :
  - X.25 : TCP/IP, OSI, XTI, SNA/20 and HVX stacks
  - SDLC : SNA/20

Limitation

- the total number of 4ports and 1port Multi-protocol Serial I/O Adapters can not be more than the maximum supported by the model and its extension cabinet, and in any case limited to 7.

4.2.3. PSX25 Software

The **PSX25** software is dedicated to the support of the 4ports and 1port Multi-protocol Serial I/O Adapters.

The X.25.2 and X.25.3 software, compliant with X.25-92 and ISO 8822, is running on the host.

The **PSX25** software running under AIX is made of the following components:

- interfaces for the :
  - AIX TCP/IP stack and enabling to run any TCP/IP application over X.25
  - OSI X.25 stack and the OSI (MAX3) X.25 API
  - SNA/20 stack and enabling to run SNA/20 applications in QLLC/X.25 mode.
  - HVX stack and enabling to run HVX applications over X.25 networks.
- Configuration tools integrated with SMIT providing an easy configuration of the adapters.
- A large set of utilities to administrate and monitor the adapters.

The **PSX25** software supports simultaneous accesses of the various communication stacks to the same or different physical links. It is provided under a base and additional extension MI's:

- access to a single X.25 line
- access from 2 to 4 X.24 lines
- access from 5 to 8 X.25 lines
- access from 9 to 32 X.25 lines

The **PSX25** product includes a local SNMP agent with a Management Information that contains statistics, operational and configuration tables. This includes:

- A subset of the Management Information Base defined by the Internet Standards RFC 1381 and RFC 1382. This is made to interoperate with market existing manager.
- A specific Management Information Base which goals the completeness of information and gives a full advantage of **PSX25** stack management.
- A browser that provides system operators with an easy-to-use interface to monitor and configure PSX25 lines through the SNMP agent. It is based on the AIX standard SMIT interface.

Limitations

- The IBM X.25 API provided by IBM's X.25 Software cannot be used through the PSX25 product. The Bull X.25 APIs (MAX3 or XTI) has to be used.
- does not support SNA Server

4.2.4. 4-Port HiSpeed WAN Communication Adapter

This adapter is a high end X.25 adapter that provides a very powerful X.25 offer at a moderate pricing.

This adapter enables the system to gain access to X25 networks. The product consists of a base card that should be completed with 4 daughter cards regarding the interface chosen. 3 interfaces are supported: V35, V11, V24.

This adapter is fully integrated in Bull's communication offer. **TCP/IP, SNA/20, HVX** and **OSI** applications have access to X25 networks through this adapter. This board can support up to 1024 virtual circuits and up to 1500 X25 packets/s (with packet size = 128) according to the stacks capability.

Hardware

Type 5 adapter, 1 slot used
Micro Channel bus 32 bits
RISC 32 bits processor: LSI LOGIC LR33000; 25MHZ
4 MB memory
NET2 conformance
2 Mbps across 4 ports (2Mbps Max)
Maximum line speed: V35: 64 Kbps, V11: 2 Mbps, V24/V28: 19.2 Kbps
4 x HDLC communication controllers (4 x ZILOG IUSC 20 MHz) available on the base card: Each one is personalized with an interface card providing one of the following interfaces: V35, V24, V11. This adapter allows either 4 times the same interface or different types of interfaces on the same board. The **4Port HiSpeed WAN Communication Adapter** provides an efficient way to have independent ports and allows a high availability of the board in case of trouble. Furthermore, flexibility is insured in the event of evolution of one of the interfaces.

+ 4port HiSpeed X25 comm adapter			
+ V35 HiSpeed X25 interface card	max 4	|	
+ V24 HiSpeed X25 interface card	max 4	|	
+ V11 HiSpeed X25 interface card	max 4	|	total: max 4

Cables

The base board provides a 78-point female connector. A 3m cable attaches the 78-point connector to a distribution box. The distribution box has four 25-point connectors that could be connected to appropriate cables providing different types of interfaces. The cables are listed hereafter:

V35 cable: up to 64 Kbps (10m)
V11/X21 cables: up to 2 Mbps (10m)
V24 cable: up to 19.2 Kbps (10m).

Attachment

The controller fit into a single type 5 Micro channel adapter slot.

HiSpeed X.25 Software

The HiSpeed X.25 software is dedicated to the support of the 1-port and the 4-port communication adapters. Refer to the HiSpeed X.25 Software description for more details.

An SNMP agent is also available to manage HiSpeed boards. Refer to SNMP Agent for HiSpeed Adapters software description for more details.

Limitation:

the total number of 4 port HiSpeed WAN adapter and 1 port HiSpeed WAN adapter cannot be more than the maximum supported by the model, and in any case limited to 6.

The 4-Port HiSpeed WAN Communication Adapter is certified BABT.

4.2.5. 1-Port HiSpeed WAN Communication Adapter

This adapter is an entry level X.25 adapter that provides a powerful X.25 offer at very competitive pricing.

This adapter enables the system unit to gain access to X25 networks. The product consists of a base card that should be completed with 1 daughter card regarding the interface chosen. 3 interfaces are supported: V35, V11, V24.

This adapter is fully integrated in Bull's communication offer. **TCP/IP, SNA/20, HVX** and **OSI** applications can access X25 networks through this adapter. This board can support up to 256 virtual circuits and up to 200 X25 packets/s (with packet size = 128) according to the stacks capability.

This adapter design will replace the old **1Port HiSpeed WAN Communication Adapter** and supports the new features:

same daughter boards as the 4Port HiSpeed Communication Adapter
same cables as the 4Port HiSpeed Communication Adapter

Hardware

Intelligent adapter: two DMA channels, three timers, interrupt controller, input/output predecoder and so on.
Type 3 adapter, 1 slot used
Micro Channel bus 8 bits
80C186 INTEL processor, 15.36 MHz
1 MB memory
VDE & FCC class A conformance

Line speed up to 128 Kbps: V35: 64 Kbps, V11: 128 Kbps, V24/V28: 19.2 Kbps

1 HDLC communication controllers available on the base card:
It is personalized with an interface card providing one of the following interfaces: V35, V24, V11.

+	1port HiSpeed X25 comm adapter		
+	V35 HiSpeed X25 interface card	max 1 |	
+	V24 HiSpeed X25 interface card	max 1 |	
+	V11 HiSpeed X25 interface card	max 1 |	total: max 1

Cables

The base board provides a 25-point female connector that could be connected to appropriate cables providing different types of interfaces. The cables are same as for 4Port HiSpeed Communication Adapter and are listed hereafter:

- V35 cable: up to 64 Kbps (10m)
  V11/X21 cables: up to 2 Mbps (10m)
  V24 cable: up to 19.2 Kbps (10m)

Attachment

The controller fit into a single Micro channel adapter slot.

HiSpeed X.25 Software

The HiSpeed X.25 software is dedicated to the support of the 1-port and 4-port communication adapters. Refer to the HiSpeed X.25 Software description for more details.

An SNMP agent is also available to manage HiSpeed boards. Refer to SNMP Agent for HiSpeed Adapters software description for more details.

- Limitation:

  the total number of 4 port HiSpeed WAN adapter and 1 port HiSpeed WAN adapter cannot be more than the maximum supported by the model, and in any case limited to 6.

The 1Port HiSpeed WAN Communication Adapter is BABT certified.

4.2.6. HiSpeed X.25 Software

The HiSpeed X.25 software is dedicated to the support of the 1-port and the 4-port communication adapters. The actual X.25.2 and X.25.3 software, compliant with X.25-88 and ISO 8822, is loaded on the adapter itself. The HiSpeed X.25 software running under AIX consists of the following components:

Interfaces for:
- AIX TCP/IP stack, enabling any TCP/IP application to be run over X.25
- OSI X.25 stack and the OSI (MAX3) X.25 API
- SNA/20 stack, enabling SNA/20 applications to run in QLLC/X.25 mode.
- HVX stack, enabling HVX applications to run over X.25 networks.

Configuration tools integrated with SMIT providing easy configuration of the adapters.
A set of utilities to administer and monitor the adapter.

This software does not support the IBM specific X.25 API provided by IBM's X.25 Software.

The HiSpeed X.25 software supports simultaneous accesses of the various communication stacks to the same or different physical links. It is provided under two separate MI's, one for the 4-port adapter supporting 1024 VC's and up to 1500 packets/s and one for the 1-port adapter supporting 256 VC's and up to 200 packets/s.

Limitations:

The IBM X25 API provided by IBM's X.25 Software cannot be used through the Hi Speed X25 boards. The Bull X25 API (MAX3) has to be used.
No support of SNA Server.

4.2.7. SNMP Agent for HiSpeed Adapters

An agent is a component of a network management system, which is responsible for a managed node. It responds to requests made by a manager components and issues notifications to them when particular events occur. Communication with the manager or network-control host (for example the ISM manager) is accomplished by means of the Simple Network Management Protocol (SNMP v1).

The SNMP Agent for HiSpeed Adapters performs the monitoring of the resources related to all HiSpeed WAN Comm. Adapters present on the managed node, in order to provide up to date information regarding their performances and behaviors, and control on their configurations.

4.2.7.1. Standard Functionalities

The Management Information Base supported by the SNMP Agent for HiSpeed Adapters contains statistics, operational and configuration tables. The statistic tables contain statistics information about the HiSpeed Adapters. The operational tables contain configuration information currently set in the HiSpeed Adapters. The configuration tables contain objects that can be changed to manage the HiSpeed Adapters configuration.

This includes:

- A subset of the Management Information Base defined by the Internet Standards RFC 1381 and RFC 1382. This is made to interoperate with market existing manager.
- A HiSpeed Adapters specific Management Information Base which goals the completeness of information and gives a full advantage of the HiSpeed Adapters management.

4.2.7.2. Enhanced Functionality: the browser

The aim of this tool is to provide system operators with an easy-to-use interface to monitor and configure the local and remote nodes' HiSpeed Adapters through the SNMP agent installed on the target node.

Us[illegible] the MIB browser, users are allowed to access any line of SNMP table supported by the agent to [illegible]ess the values of its objects. For statistics and operational tables, the access is read-only, so that no update can be performed by the users. For configuration tables, users are allowed to:

- Read the current object values.
- Update the objects with the values supplied by the users, when allowed.

This tool is based on the AIX standard SMIT interface and is provided as a utility with the SNMP Agent for HiSpeed Adapters.

4.2.8. 4-Port Multiprotocol Communications Controller (MPQP)

The 4-Port Multiprotocol Communications Controller attaches a system unit to synchronous communications networks using EIA-232D/V.24, EIA-422A, V.35, or X.21 physical interfaces. The controller only supports indoor operation on the EIA-422A interface.

Th[illegible]ntroller consists of a base card and a daughter card. The two cards are physically connected and require a single Micro Channel adapter slot.

The base card prepares all inbound and outbound data, performs address searches, and in general relieves the system processor of many communications tasks. This controller supports bit synchronous, character synchronous, and asynchronous protocols when appropriately programmed with loadable application software. Not all of the features of the 4-Port Multiprotocol Communications Controller are supported by the software.

The daughter card supports four interfaces: EIA 232D/V.24 on Ports 0 to 3, EIA 422A on Ports 0 and 2, CCITT X.21 on Port 0, and CCITT V.35 on Ports 0 and 1. It also provides drivers, receivers, and surge protection. Surge protection is provided only on the EIA-422A interface on Port2. The EIA-422A interface on Port 0 is designed to operate using synchronous protocols with attachment cables less than 25m (82.5 ft) long.

Hardware

Supports four ports concurrently,
512KB memory,
16-bit DMA data transfer width,
Two selectable interrupt levels,
Supports the following interfaces in international countries: EIA-232D/V.24, V.35, and X.21,
CRC generation and checking,
Micro Channel considerations:
Memory and I/O slave,
16-bit data width.

Cables

Devices are attached to the controller using a 4-Port Multiprotocol Interface Cable, which connects to daughter card.

4.2.9. X.25 Communication Controller (CoPro2)

This is an X.25 adapter provided by IBM on RS/6000. This product is an ***alternative to the 1Port HiSpeed WAN Communication Adapter, but with a much less attractive price/performance ratio.*** It should be used only when there is a need to support software products not supported by the HiSpeed X.25 or PSX25 software.

The X.25 Communication Controller provides support for attaching a system unit to an X.25 network. The controller provides a single port that can accommodate three selectable interfaces: V.11, V.24 and V.35. The port has a 37-pin female D-shell connector.

This board can support up to 512 virtual circuits and up to 40 X.25 packets/s.

Hardware:

512KB memory
Full-duplex synchronous protocol
Supports the following interfaces in international countries:
Leased X.21 interface at up to 64Kbps
EIA-232D/V.24 interface at 19.2Kbps
V.35 interface at 56Kbps
Wrap plug for 37-pin connector (supplied for testing).
Micro Channel considerations:
I/O slave
16-bit data width
24-bit address width
Type 3 adapter card size

Cables:

Six separate cable lengths are optionally available with the controller (two for each interface). For more information on the cables mentioned, see the Cable Configurator.

Attachment:

The controller fits into a single Micro Channel adapter slot.

X.25 Software

For AIX 4.1, the X.25 software is no more delivered free of charge with the AIX operating system. A dedicated AIX link X.25 software is needed.

Operating System Requirement

AIX 4.1., or later

4.2.10. AIX link X.25 software

Under AIX, using the X.25 communication controller requires the AIX link X.25 software.

The software supports TCP/IP as well as IBM specific API and applications such as X.25 API and SNA Server. It includes an SNMP proxy agent and MIB support for X.25 and LAP-B statistics of the X.25 Communication Controller. It also includes an X.3, X.28 and X.29 PAD function for attachment of asynchronous terminal and devices.

This software applies only to the X.25 Communication Controller for EPC800 and to the 2-Port Multiprotocol PCI Adapter for EPC1200, EPC1200A and EPC2400.

5. LAN Controllers

5.1. LAN Controllers for EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400

5.1.1. Ethernet 10/100 Mbps (Fast Ethernet) PCI Controller

The Ethernet 10/100 Mbps PCI Controller is a Fast Ethernet network adapter that allows Escala EPC400, EPC430, EPC440, EPC450, EPC1200 and EPC1200A systems to connect to 10 Mbps or 100 Mbps Ethernet network. It works with PCI (Peripheral Component Interconnect) buses and connects to any 10Base-T or 100Base-TX compliant Ethernet hub to deliver 10 times the bandwidth delivered by Ethernet.
The adapter automatically selects between 10 and 100 Mbps operation.
For 100 Mbps operation, the adapter supports operation on two pairs category 5 unshielded twisted-pair (UTP).
For 10 Mbps operation, the adapter supports Category 3,4, or 5 UTP cable.

TCP/IP, SNA/20, HVX, XTI, and **OSI** applications are run through this adapter.

Connectivity rules:

The maximum length of a twisted pair segment- distance from a repeater to a host system-is 100 meters.
The diameter of collision domain -distance between two end-stations- is 205 meters.

Features

- 10 Base-T (twisted-pair) support
- 100 Base-TX support
- Support Full-Duplex operation at 100 Mbps
- Support for Category 3 or 4 UTP cable for 10 Mbps, category 5 UTP cable for 10 Mbps and 100 Mbps
- Activity (transmit/receive) and Link Integrity LED indicators mounted on bracket.
- Does not support Full-Duplex operation at 10 Mbps.
- IEEE 802.3
- CSMA/CD
- TCP/IP, SNMP Complient
- Automatically selects between 10 Mbps and 100 Mbps operation.

Hardware:

- Interface with the 32-bits PCI local bus
- 32-bit data path with bus-master design

Cables:

Refer to the Cabling Guide for more details.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2 or later

5.1.2. Gigabit Ethernet-SX PCI Adapter

The Gigabit Ethernet-SX PCI based adapter is available on EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400 systems. This technology allows to provide the scalability and performance required to meet the increasing demands on today's communications.

Technical Overview:

The adapter provides one full-duplex 1000Base-SX connection. It is a short form factor PCI card with a SC-fiber connector to connect with short-wave (850 nm) 62.5 or 50 micron multi-mode fiber (MMF) to a Gigabit Ethernet network. The adapter requires a 32 or 64 bit PCI bus slot running at 33 or 66 MHz and supports both 3.3 V and 5 V signaling. The adapter conforms to PCI (Peripheral Component Interconnect) Local Bus Revision 2.0 and 2.1, IEEE 802.3z Gigabit Ethernet, and IEEE 802.3x flow control standards.

Connectivity Rules:

The following table gives the range of cable lengths from the adapter to another Gigabit Ethernet equipment:

Fiber type:	*Modal bandwidth MHz-km:*	*Minimum length meters:*	*Maximum length meters:*
MMF 62.5 um	160	2	220
MMF 62.5 um	200	2	275
MMF 50 um	400	2	500
MMF 50 um	500	2	500

Features:

- Provides a 1 Gbps (1000BaseSX) full-duplex Ethernet LAN connection.
- Activity (transmit/receive) and Link Integrity LED indicators mounted
- on bracket.
- 1 MB on-card FIFO for transmit and receive

Hardware:

- 64 bit single PCI slot, 64-bit data path with bus-master design

Operating System requirement:

- AIX Versions 4.3.2 or later.
- AIX 4.3.2 or later is required for Jumbo Frame support.

Machine requirements:

- EPC400, EPC430, EPC440 and EPC450: Up to 2 adapters are allowed in the system.
- EPC1200, EPC1200A and EPC2400: Up to 8 adapters are allowed in the system, provided that the following maximum limits are respected: 1 adapter per PCI bus, 3 in the primary I/O drawer, 4 in secondary I/O drawers.

5.1.3. Token Ring 16/4 PCI Controller

The Token Ring PCI adapter is designed to allow Escala EPC400, EPC430, EPC440, EPC450, EPC1200 and EPC1200A systems to connect to a 4 Mbps or 16 Mbps Token Ring local area networks. This adapter automatically selects the Correct Token-Ring speed (4 or 16 Mbps).

The adapter has:

- one connector RJ45 to attach to UTP cabling.
- one connector DB9 to attach to STP (IBM type 1) cabling.

TCP/IP, SNA/20, HVX, XTI, and **OSI** applications are run through this adapter.

Features

- 4 Mbps or 16 Mbps
- compatible with IEEE 802.5 specifications
- Support Full-Duplex

Hardware:

- Interface with the 32-bits PCI local bus
- 32-bit data path with bus-master design
- PCI Short - Form factor adapter

Cables:

Refer to the Cabling Guide for more details.

Attachment:

The controller fits into a single PCI slot.

Operating System Requirement

- AIX 4.2.1, or later

5.1.4. ATM 155 Mbps Controller

The Asynchronous Transfer Mode (ATM) Controller is a high-performance PCI controller that allows Escala EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400 systems to connect to an ATM network.

The controller is designed to provide a bandwidth of 155 Mbps on the ATM network and allows operation in a Classical IP or LAN Emulation (LANE) network environment.

TCP/IP with AIX 4.2.1 (or higher version) applications run through this adapter.

Features:

- RFC 1577 Classical IP support
- LAN Emulation V1.0 support
- Compliant with ATM ForumUNI Specification V3.0 and V3.1 for switched virtual circuits
- Virtual connection setup and tear down
- PVC and SVC concurrent support
- Maximum of 110 VC's
- ATM Adaptation Layer (AAL-5) support
- Bandwidth allocation and management
- SNMP sub-agent

Hardware:

- Compliant with ATM Forum standards
- Self configuration
- 32-bit PCI bus master
- Type short adapter card size

Cables:

Requires a 65 micron multi-mode fiber cable with SC connector

Attachment:

The controller fits into a single PCI slot

Operating System Requirement:

- AIX 4.2.1 or later

5.1.5. Fibre Distributed Data Interface (FDDI) Controllers

The Fibre Distributed Data Interface FDDI is designed to allow Escala EPC400, EPC430, EPC440, EPC450, EPC1200, EPC1200A and EPC2400 systems to connect to:

- Multi-mode fiber Single-Attach Station (SAS) or Dual-Attach Station (DAS)
- UTP (Unshielded Twisted Pair) Single Attach Station (SAS)

A FDDI LAN can be up to 100 km (62 miles) and can include up to 500 system units. There can be up to:

- 2 km (1.24 miles) between system units or concentrators when using multi-mode fiber,
- 100 meters between system units or concentrators when using UTP.

Remote IPL is not supported via FDDI devices.

TCP/IP, SNA/20, HVX, XTI, and **OSI** applications are run through these adapters.

Hardware:

- Data rate of up to 100Mbps
- PCI features:
  - Bus master
  - Memory and I/O slave
  - 32-bit address and data width
  - Support of "Dual Homing"
  - Machine-readable Vital Product Data (VPD)
  - PCI short-form factor adapter (SAS or DAS)
- Physical Medium Dependent (PMD)
  - Fiber ANSI X3T9.5 compliant
    Up to 2 Km between nodes
    SC connector
  - UTP ANSI X3T12 TP-PMD compliant
    Up to 100m between nodes
    1 RJ45 connector
- Station Management SMT 7.3
- SNMP Management

Cables:

- Fiber MIC 62.5µm Multi-mode
- UTP UTP cross over category 5 cable

Attachment:

The FDDI controller (SAS or DAS) fits into a single PCI adapter slot.

Operating System Environment

- AIX 4.2.1 or later

5.2. LAN Controllers for EPC800

5.2.1. Token-Ring Network Controller

The Token-Ring Network Controller is a Micro Channel bus master DMA controller used to attach the system unit to either a 4M bps or a 16M bps Token-Ring local area network.

This controller supports high-performance applications. The Token-Ring High-Performance Network Controller is cable- and network-compatible with existing token-ring controllers, so no new cables or network components are required. All controllers on a token-ring network must operate at the same speed.

TCP/IP, OSI (& SNA/20 with AIX 4.1) applications run through this adapter.

Hardware

- IEEE 802.5 compatibility
- Eight Address/interrupt states supported
- Controller cable supplied to connect to the Cabling System socket
- Micro Channel considerations:
  - Bus master
  - I/O slave
  - 16-bit data width
  - 24-bit address width
  - Support for data and address parity
  - Support for streaming data (only as a DMA bus master)
  - Type 3 adapter card size.
- One 9-pin female D-shell connector.

Attachment

The controller fits into a single Micro Channel adapter slot.

5.2.2. Auto Token-Ring LANstreamer MC32 Adapter

The Token Ring MCA adapter is designed to allow a Escala system to connect to a 4 Mbps or 16 Mbps Token Ring local area networks. This adapter automatically selects the Correct Token-Ring speed (4 or 16 Mbps)
The adapter has one connector RJ45. The RJ-45 connector is used to attach to UTP cabling.

A 30cm conversion cable is included with the adapter to attach to STP (IBM type 1) cabling.

TCP/IP, OSI, SNA/20 applications run through this adapter.

Features

4 Mbps or 16 Mbps
compatible with IEEE 802.5 specifications

Hardware

Interface with the 32-bits MCA local bus
32-bit data path with bus-master design

Cables

The cable is not delivered with the adapter. It can be ordered from Bull Express:

- Ref 5153 (5 meters) from the host to a Token-ring hub (RJ45/RJ45 cable),
- Ref 5155 (15 meters) from the host to a Token-ring hub (RJ45/RJ45 cable),
- Ref 5828 (4 meters) from the host to the filter MAU.

Attachment

The controller fits into a single MCA slot.

Operating System Requirement

AIX 4.1.4, or later

.2.3. Ethernet 10/100 Mbps (Fast Ethernet) MCA Controller

The Ethernet 10/100 Mbps MCA Controller is a Fast Ethernet network adapter that allows an Escala system to connect to 10 Mbps or 100 Mbps Ethernet network. It provides network performance improvement over existing 10 Mbps Ethernet LANs and can connect to any 100BaseTx compliant Ethernet network to deliver 10 times the bandwidth delivered by Ethernet.

The adapter automatically selects between 10 Mbps and 100 Mbps operation.

OSI, SNA/20 and **TCP/IP** applications run through this adapter.

Features

- Single-port connection to 10BaseT or 100BaseTx Ethernet LANs through switch or hub
- Automatic operation at 10 Mbps or 100 Mbps depending on port speed at the hub or switch

- Fully 802.3u Fast Ethernet standard compatible
- Full-duplex capability
- Full-frame buffering on both transmit and receive
- 32-bit Micro Channel DMA bus master
- Support for full 64-bit streaming with 80MB capability on MCA bus
- Type 3 Micro Channel form factor
- Support for network boot operations
- MCA parity generation and detection

Hardware Requirements

- The controller fits into a single MCA slot.

The Ethernet 10/100 Mbps MCA Controller provides a single-port connection to 10BaseT or 100BaseTx Ethernet LANs.

- Connect to 10BaseT Ethernet LAN via 10BaseT hub or switch using Category 3, 4, or 5 unshielded twisted pair (UTP) wiring
- Connect to 100BaseTx Ethernet LAN via 100BaseTx capable hub or switch using Category 5 unshielded twisted pair (UTP) wiring

The maximum length of a twisted pair segment - distance from a repeater to a host system - is 100 meters.
The diameter of collision domain -distance between two end-stations- is 205 meters.

Software Requirements

- AIX Version 4.1.5 or Version 4.2.1, or later

5.2.4. Ethernet LAN Controller (LSA component)

The Ethernet LAN Controller (LSA) is a high-performance Micro Channel bus master DMA controller that allows the system unit to attach to an Ethernet network.

The controller is designed to provide a connection to a 10Mbps Carrier Sense Multiple Access/Collision Detection (CSMA/CD) Ethernet network.

The controller provides connectors compliant with 10 Base 5 and 10 Base T (RJ45).

To attach the system unit to the network for connection to RJ45 Twisted Pair, the customer must supply the appropriate cable.

To attach the system unit to the network for connection to the standard 50-ohm (thick) the customer must supply the appropriate cable and order an external transceiver.

TCP/IP, OSI, SNA/20 applications run through this adapter.

Hardware

- IEEE 802.3 or Ethernet Version 2 compatibility
- Selectable interrupt levels
- 32-bit cyclic redundancy check
- Micro Channel considerations
  - Bus master
  - I/O slave
  - 32-bit data and address widths
  - Support for data address parity
  - Type 5 adapter card size.

Attachment

The controller fits into a single MCA slot.

5.2.5. ATM 155 Mbps Controller

The Asynchronous Transfer Mode (ATM) Controller is a high-performance Micro Channel controller that allows the system unit to attach to an ATM network.

The controller is designed to provide a bandwidth of 155 Mbps on the ATM network and allows operation in a Classical IP network environment.

TCP/IP with AIX 4.1.4 (or higher version) applications run through this adapter.

Features

- RFC 1577 Classical IP support
- Compliant with ATM ForumUNI Specification V3.0 for switched virtual circuits
- Virtual connection setup and tear down
- PVC and SVC concurrent support
- Maximum of 1024 VC's
- ATM Adaptation Layer (AAL-5) support
- Bandwidth allocation and management
- SNMP sub-agent

Hardware

- Compliant with ATM Forum standards
- ATM segmentation and reassembly
- Self configuration
- Micro Channel considerations
- Bus master
- Type 5 adapter card size

Cables

Requires a 65 micron multi-mode fiber cable with SC connector

Attachment

The controller fits into a single MCA slot

Operating System Requirement

- AIX 4.1.5 or later

5.2.6. Fibre Distributed Data Interface (FDDI) Controllers

The Fibre Distributed Data Interface (FDDI) Controller is designed to support all TCP/IP, NFS and operations in either Multi-Mode fiber or shielded twisted-pair (STP) wiring.

The base adapter allows communications on a Single-Attach Station (SAS) network, while the optional upgrade allows communications on a Dual-Attach Station (DAS) network.

A FDDI LAN can be up to 100 km (62 miles) and can include up to 500 system units. There can be up to 2 km (1.24 miles) between system units or concentrators.

Remote IPL is not supported via FDDI devices. An API is provided for the device driver.

Hardware

Data rate of up to 100Mbps
4B/5B encoding of data for transmission
320C25 Microprocessor
Micro Channel features:
Bus master
Memory and I/O slave
32-bit data width
32- bit address width
Support for data and address parity
Machine-readable Vital Product Data (VPD)
Type-3-adapter-card size (SAS or DAS upgrade).

Cables

All FDDI controllers require Multi-Mode FDDI optical fiber jumper cables.

Attachment

The standard controller fits into a single Micro Channel adapter slot. The optional upgrade requires an additional slot.

Chapter 6: Cluster Management, Terminals and Printers

1. Cluster management

Cluster management capability is an essential feature that contributes to reduce the cost of system administration.
Escala Cluster is based on standard Escala platform and AIX system so each node has:

- a serial port S1 for low level connection to a console for basic system installation, configuration, debugging or messages, service diagnostics mode and maintenance
- a serial port S2 for connection to a modem for Remote Maintenance capabilities.
- a dedicated system administration interface (SMIT)

Cluster management answers to the need to provide a single point of administration build on a single hardware console such that both system console and system management interface will be supported.

Main hardware components used for Cluster Management are the following:

- System Console
- Cluster Console
- PowerConsole
- Administration Hub
- Console Concentrator

The cluster management capability is three-fold:

- A single system console
- A single point of control: a collection of administration tools for managing the entire cluster from a single X/Window graphical console
- Integration in a customer's centralized enterprise management such as ISM (see cluster management software)

. System Console

A System Console of a Unix server is an alphanumerical terminal that allows to boot, stop and troubleshoot the system. The system console for the EPC systems is a BQ306 terminal. This solution provides basic system management.

1.2. Graphical Consoles and Infrastructure

1.2.1. Cluster PowerConsole

Cluster PowerConsole designates a configuration of an Estrella graphical workstation or an Escala S100 graphical workstation, a console concentrator, a hub along with the necessary cabling, and cluster management software (including ClusterAssistant, ClusterWatch, Netscape browser, PTX, ArrayGuide...).

The Cluster PowerConsole may be supplemented by any 'ISM Server'. ISM brings a customizable comprehensive and sophisticated suite of tools for the professional information systems administrator that can be leveraged with the dedicated cluster management tools (See below). The user takes benefits of ISM capabilities for visualization of cluster topology, life monitoring of the entire cluster and centralized alarm management.

EPC content

The PowerConsole is factory integrated and preloaded with the administration graphic interface.

PowerConsole 1° hardware (Estrella based) content:

1) Estrella 300-200 MHz base with
   - 1 PowerPC 604/ev processor @200Mhz
   - 4 sockets for SIMM memories
   - 1 SCSI-2 F/W adapter
   - 1 Business audio board
   - 1 Eth. port 10/100Mbps (RJ45 and AUI)
   - 2 serial ports (RS232C)
   - 1 parallel IEEEE port
   - Keyboard, Mouse and Monitor ports
   - 5 PCI/ISA slots (2PCI, 2ISA, 1 shared)
2) 1 floppy 1.44MB in diskette bay
3) 5 SCSI devices bays (Two 3.5", three 5.25")
4) 1 CD-ROM (600MB 8x) (in 5.25" bay)
5) 1 4.3GB SCSI-2 F/W High Perf disk drive (in 3.5" bay)
6) 512 KB L2 Cache Memory base option
7) 64 MB DIMM Memory ECC-EDO
8) High Resolution Graphic Adapter (PCI) with 2MB Memory
9) Keyboard, 3-button Mouse
10) 17" Color display with cables (Europe)
11) 8 Port Asynchronous adapter EIA-232 (ISA) W/Connector box
12) Asynchronous RS232 and Eth cables

Optional and highly recommended QIC or DAT or VDAT media (in 5.25" bay).
(Note: This Estrella-based hardware offer has been discontinued.)

PowerConsole 2° hardware (Escala S100 based) content:

1) Escala S100-233 MHz base with

- 1 PowerPC 604e processor @233Mhz - 1MB L2cache
- 128MB RAM
- 9.1GB SCSI-2 F/W disk
- 1 CD-ROM
- 1 SCSI-2 F/W bus for disks
- 1 Eth. port 10Mbps (RJ45)
- 1 Floppy disk 1.44MB
- Keyboard and Mouse ports
- 2 serial ports - 1 centronics port
- 5 I/O slots (3xPCI, 2xPCI/ISA)
- 2 open bays for 1 media/disk or 2 disks

2) Graphics components with

- 1 GXT130P Graphics Adapter
- 17" Color Display
- 3-Button Mouse and Keyboard

Optional

Highly recommended QIC or DAT or VDAT media.
Additional 9.1GB or 4.5GB disks
Additional communication adapters (Ethernet 10/100 Mbps, Token-Ring, FDDI)
Electronic ISA modem board

PowerConsole enhancements

Most of the PowerConsole hardware enhancements are for higher configurability

- High-resolution graphics adapter with extension memory:

For simultaneous High level graphical applications (in conjunction with Netscape navigator for example), it is recommended to configure the PowerConsole 1° with a High-resolution graphics adapter available on Estrella 300. The PowerConsole 1° is an Estrella 300 that in a standard configuration offers the Bull SVGA CIRROS entry-level graphics adapter. For better resolution and avoid conflict in color palette when running in parallel different graphical tools, the High-Resolution Graphics Adapter with appropriate VRAM extension memory is now offered. The High-Resolution Graphics Adapter is a version of the Millennium board from MATROX, which is a more powerful graphics PCI board for Estrella Series 300. In complement, 6MB VRAM Extension Memory allows to provide better resolutions and color depth.

- Optional internal disks for higher storage capacity:

The PowerConsole functionalities offer the integration of NIM (Network Installation Management) application for the backup of system disks of the EPC nodes. System disk backups can be stored on a particular cluster node or on the PowerConsole. In that late case, additional storage capacity is required on the PowerConsole. This optional extra disk capacity can be a 4.3 GB disk, or a 9 GB disk, or both as permitted in PowerConsole configurations.

- Optional communication adapter for connection to customer's network:

Better explanation is provided for establishing the TCP-IP network for administration purpose. The remaining ambiguity on administration-dedicated network has been solved, and an important concern with respect to the customer's network infrastructure is now fully treated with the optional support of an extra adapter for connecting the PowerConsole to that network according to its type (Ethernet, FDDI, Token-ring).

⇒ The administration-dedicated network is an Ethernet-based private network made of an administration hub connecting the EPC nodes, the console concentrator and the PowerConsole. Besides, the nodes (S1 plug) are wired to the serial ports on the console concentrator. This administration-dedicated network utilizes an Ethernet board on any node and the PowerConsole. The nodes are connected to the customer's public network through other network boards. For allowing remote access to the PowerConsole from an X-terminal or any station with X-Terminal emulation on the customer's network, the PowerConsole can be equipped with an additional network adapter connecting it to the customer's network. Be careful that remote access from an X-terminal is only possible if its windows manager resides on the PowerConsole.

⇒ When the customer's network is an Ethernet network, the administration-dedicated network becomes an option. When that option is not chosen, the console concentrator and the PowerConsole are directly connected to the customer's network, as the EPC nodes are.

1.2.2. Cluster Console

The Explora 17" Color X-Terminal is used on Escala EPC as Cluster Console.
The Cluster Console solution is suggested with a Console concentrator for any EPC configurations, as an alternative cost-effective choice to the PowerConsole. In that case, a self-bootable X-terminal (NCD Explora Console) replaces the Estrella workstation, but ClusterAssistant, the PowerConsole software is no longer available.

For 2-node configuration, the Cluster Console has a particular implementation. A serial line links the X-terminal to the S1 plug of a node. This node is in turn linked to the S1 plug of the other node. The two nodes and the X-terminal are also connected through the administration hub. Such an X-terminal can thus both act as single system console and single point of control. The provided console switching facility is software and based on standard CU commands. Such a solution is called Cluster Console.

The Cluster Console solution has been discontinued as of 30 June 1999.

1.2.3. Console Concentrator

A Console Concentrator (3COM CS/2600) is a device connected to S1 console plug of every cluster node which allows any ASCII terminal connected to it through a serial line to act as cluster system console. Wiring the cluster nodes with serial lines to the console concentrator makes troubleshooting possible even when node network interface is down. The console concentrator can be rack mounted and there can be such a device for 8 nodes. Larger configurations will require additional console concentrators linked together through Ethernet network. Connecting the Console Concentrator to the enterprise network allows to use any workstation (like ISM station) or X-terminal on the network as remote administration console in addition to the PowerConsole or the Cluster Console. The Console Concentrator is one or more 3COM's CS/2600 terminal servers. A Console Concentrator can serve a configuration up to 8 nodes. The 3COM's CS/2600 terminal server offers a ten-port capacity with full modem support and simultaneous support for multiple protocols for connecting up to 10 system consoles:

- 10 Ports for Multiprotocol Connections: the concentrator support TCP/IP (Transmission Control Protocol/ Internet Protocol), TN3270, and OSI (Open Systems Interconnect) standard.
- Support for up to eight concurrent sessions per port (subject to total system limitations) gives easy access to multiple hosts
- RS-422 signal support allows terminal connections at distances exceeding 1000 feet (305 meters)
- Full modem support on all ports
- Support for the Serial Line Internet Protocol (SLIP) and the Point-to-Point Protocol (PPP) enables dial-up access to TCP/IP resources
- 3Com's Transcend ® Remote Boot and Configuration Services (RBCS) Version 2.1 software provides an SNMP-based environment for central booting and configuration, enabling you to boot and configure multiple devices from one location.

1.2.4. Ethernet-based Administration Hub

An Ethernet-based Administration Hub (3COM Hub Superstack II) is provided to make the interconnection of the nodes and the console concentrator, and provide a faster network for administration graphical tools. This Ethernet hub (3Com Hub Superstack II 12 ports) is provided to build a private Administration Network between the nodes, the cluster console or the PowerConsole, and the Console Concentrator.

1.2.5. System Console

An alphanumeric terminal is provided as basic cluster ASCII System Console, which can be used for maintenance operations, and especially as spare console when the graphical console is out of order.

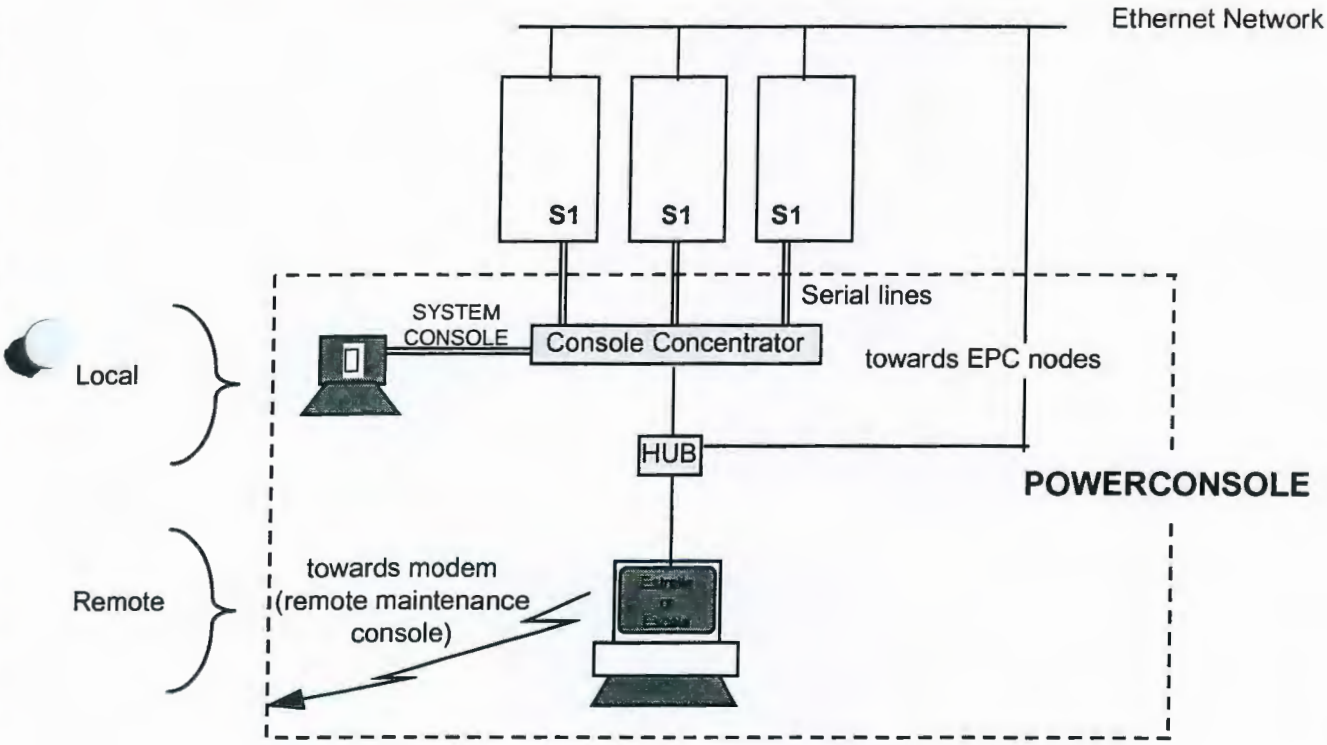
1.3. Packages and Configurations

The solution could consist of different packages and configurations:

- A System Console, an ASCII-Terminal (BQ306). To have only the system console is only possible with 2 nodes Escala EPC configurations. This is an entry-offer for cluster administration. As soon as a Cluster Console or a Cluster PowerConsole is configured, a System console is generated for local system maintenance and backup console.
- A Graphical Console, i.e. a PowerConsole (Estrella workstation - model 340) or a Cluster Console (X-Terminal Explora console).
- Beyond 2 nodes Escala EPC configurations, a Cluster Console or a Cluster PowerConsole is mandatory. A cluster Ethernet administration Hub and Console Concentrator are systematically generated with the first Cluster Console and Cluster PowerConsole.
- For 2 nodes Escala EPC configurations, Cluster console or Cluster PowerConsole is optional. If Cluster console is chosen, then Cluster administration Hub is systematically generated but no Console Concentrator for cost effectiveness. If Cluster PowerConsole is chosen, then cluster Ethernet administration Hub and Console Concentrator are systematically generated with the first Cluster PowerConsole.
- A second Cluster console is allowed only if a first one has been chosen, but not if a Cluster PowerConsole has been chosen first. It is not possible to mix Cluster Console and Cluster PowerConsole in the same Escala EPC configuration.
- A second Cluster PowerConsole is allowed only if a first one has been chosen, but not if a Cluster Console has been chosen. It is not possible to mix Cluster Console and Cluster PowerConsole in the same Escala EPC configuration.
- A Console Concentrator, a 3COM CS/2600 terminal server connected to the console plugs of the EPC nodes. A CS/2600 terminal server can serves up to 8 nodes. There may be several CS/2600 terminal servers for larger configurations.
- Serial cables for linking the cluster nodes (up to 8), the PowerConsole or the Cluster Console, and possibly the System Console, to the Console Concentrator. For every node there is a cable which links the node to the Console Concentrator. It is connected to the node's S1 plug.
- For remote maintenance, a modem can be plugged onto the PowerConsole, if any. Otherwise, a modem is connected to a node's S2 plug. One modem is used for the in-calls and the out-calls. RSF is installed in cluster configuration mode. RSF client on every node and RSF server on the

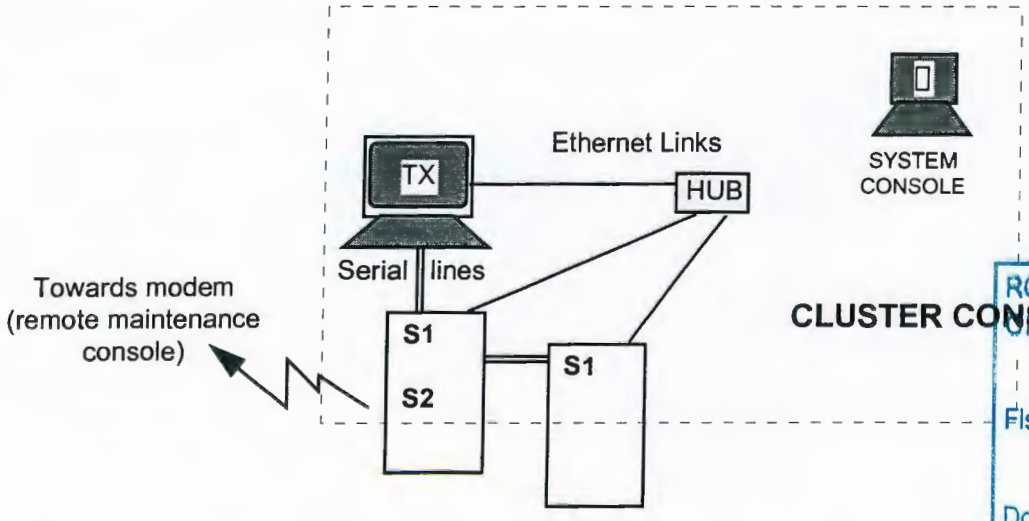
PowerConsole or on the node the modem is connected to. Alternatively, you can install a / modem and RSF on each node.

- The cluster nodes are connected to an Ethernet-based network for faster administration. The Console Concentrator and the PowerConsole or the Cluster Console are linked to that Ethernet network. An Ethernet Hub, said administration hub, is provided for making the connection.



Cluster PowerConsole

- For two-node configuration, the Console Concentrator is an option. In that case, the Cluster Console can be directly connected to the S1 plug of a node.



Cluster Console (2-node EPC)

1.4. Cluster Management Consoles and Cluster Management Software

The use of one console to manage the activity of all the cluster nodes not only saves floor space bu provides an intelligent method for managing the cluster.

1.4.1. System Administration

The Cluster Console or PowerConsole is the single point of control where all the cluster system administration tools can be invoked. In particular this interface allows an operator to perform basic console tasks such as:

- accessing console(s)
- booting / rebooting nodes
- installing/configuring software

1.4.2. Cluster PowerConsole Management Software: ClusterAssistant

The ClusterAssistant, a GUI (CDE) type tool, enables the administrator to manage via icons and function sequences the several nodes of an Escala EPC system as if it was a single-node system. For cluster-wide management, the PowerConsole can, through the ClusterAssistant (an X/Windows GUI), launch sophisticated administration tools for control and monitoring resources over the cluster. These tools address on a global and an individual basis the different management phases such as deployment, operation, administration, security and availability.
Whereas the PowerConsole provides a single control point, the ClusterAssistant can be said to provide a single system view, in that it can launch cluster-wide administration tools. The "Full" Cluster management facilities are built upon the HACMP framework: installation of HACMP package on every cluster node is mandatory. The PowerConsole is able to manage HA nodes on a "Full" Cluster management mode and "non-HA" nodes with "reduced" Cluster management. On "non-HA" mode, the PowerConsole features supported encompass:

- System Console and Rlogin
- Operating System Backup and Release management through NIM
- Support of optional graphical management host such as ArrayGUIde and Performance ToolBox.

This also applies for a server consolidation even though there is no need of high availability features.

ClusterAssistant is only available on the PowerConsole.

ClusterAssistant Enhancement

The ClusterAssistant is an application group within the Common Desktop Environment running on the PowerConsole. The ClusterAssistant GUI is mainly augmented with an application group and icons for new operations.
The enhancements of ClusterAssistant are related to the integration of NIM (Network Installation Management), access to interconnect equipment management tools and a lightweight access control.

Network Installation Management (NIM)

NIM for AIX is a client/server software implementing remote software distribution and maintenance facilities. NIM is part of AIX. Integrated in EPC, it enables to install the Base Operating System (BOS) and optional software on one or more nodes, and to create the backup files of system disk (*rootvg*) of the nodes on the PowerConsole. NIM integration allows to avoid the need of tape device for each node.
A NIM configuration comprises of servers providing resources (System image, PTFs, LPPs) for installations, a set of installable client nodes, and definitions of available networks in the NIM environment. An administration server for configuring, controlling, and updating the NIM environment is known as the NIM Master. The PowerConsole hosts the NIM Master and evenly a NIM resource server. The NIM resource server can also be hosted on an EPC node, but in this version, the NIM server is not redundant and no failover scripts are supplied.

The integration of NIM consists of:

- Assisted configuration of NIM in a EPC environment: it is based on the cluster topology data kept in a repository on the PowerConsole
- NIM save / restore of system images: such an operation applies to the *rootvg* disks of the cluster nodes. The administrator can backup the system of a group of nodes. The resulting system image can be stored on an internal disk then on a tape of the PowerConsole or on a resource server, which can be a particular node. Conversely the administrator can restore the system of one node from the image stored on a tape of the resource server
- Centralized distribution of LPPs : on a group of cluster nodes the administrator can

  ⇒ install or upgrade AIX,
  ⇒ install or remove a LPP (Licensed Program Product)
  ⇒ install or remove a PTF (Program Temporary Fix)

NIM integration allows to handle EPC with NIM clients on nodes running AIX 4.3 as well as EPC with NIM clients on nodes running AIX 4.1 or 4.2 but with a different level of functionality and ease-of-use. Restrictions will appear in user documentation (PowerConsole and ClusterAssistant Setup Guide) or for the latest information in the SRB. The NIM Master runs on the PowerConsole workstation with AIX4.3. The point of control for NIM operations is the PowerConsole. Ease of use is improved by a graphical user interface developed into the cluster assistant. Standard administration tools of NIM, SMIT and VSM are accessible through ClusterAssistant. The GUI for NIM is a new application group folder containing the icons associated to the different NIM operations.
HACMP makes use of boot address and service address regarding an adapter. If there is no administration-dedicated network, IP aliasing mechanism is implemented such that NIM application can still work.

Interconnect equipment management

LinkBuilder FDDI hub, Oncore FDDI switch and Fast Ethernet 3COM's Switch 3x00 10/100 can be configured and monitored using a set of specific line commands executed via ASCII menu-driven tools. When there is a left serial port on the console concentrator, such an equipment can be connected on a free serial port of the console concentrator via an RS-232 cable enabling to open a telnet session to it from the PowerConsole. Icons providing for telnet session are added into ClusterAssistant.

Access Control Policy

A simple mechanism of access control is implemented in order to support two administrator profiles:

- a root administrator: an administrator with the *Root* rights
- a supervisor: an administrator who has not got the *Root* rights but who can access to the monitoring tools of the ClusterAssistant panel.

1.4.3. ClusterWatch

ClusterWatch is a monitoring tool for the clustered systems which provides both the current status (dynamic information reflecting the current cluster state and events) and configuration information (cluster topology and resources). The ClusterWatch is launched from the ClusterAssistant.
The ClusterWatch comprises a GUI (Web) interface providing the system status at a glance: system, memory, storage load and utilization, with colored alarms on thresholds and on hardware and software ...ects, and statistics on cluster reliability.
It provides users with the benefits of:

- Secure monitoring of the local or remote cluster
- Reduction in system management costs

ClusterWatch offers two user interfaces: a SMIT interface available on each node and a Web interface on the PowerConsole. ClusterWatch is made of a Web server part, which allows to be accessible from any Web browser to the network.

1.4.4. HACMP Services

The HACMP (High Availability Cluster MultiProcessing) software for AIX provides dynamic cluster reconfiguration on cluster modifications and updates. Key benefits include:

- Ability to link cluster modifications without stopping cluster operations,
- Dynamic and automatic migration and reconfiguration capability,
- Ease of use due to the Helps which contribute to increased levels of continuous operational support,
- Reduction in planned outages,
- Single entry point for user administration of clustered systems,
- Single view management, similar to managing a single system,
- Easier, faster cluster administration, because changes are made only once.
- Reduction in administrative errors.

1.4.5. Distributed Unix Utilities

The Distributed Unix Utilities, such as Array Guide, PTX, DSMIT, timed and RSF can be exerted from the PowerConsole, where the manager part resides and interacts with the agent counterparts on the cluster nodes.

1.4.6. Loadleveler

Loadleveler is a software distributed on the cluster nodes. The other tools such as CSPOC of HACMP, Cluster Diagnostic Tool, Clstat, Easy Configuration are installed on every node. The associated GUI can be accessible to any X-terminal connected a cluster node.

1.4.7. Cluster Console Management

The Cluster Console option provides an X-terminal that can be attached to any node of the EPC to perform cluster-wide management by exerting the various administration tools available on every node:

- Installation/configuration, change management, inventory and software distribution denotes the deployment phase. HACMP software includes such facilities. NIM application of AIX enables software distribution on cluster nodes from a single point.
- System monitoring, control, backup/restore, time synchronization and job scheduling represent activities of the operation phase. ClusterWatch, CSPOC, Clstat, Timed, LoadLeveler are tools that can be used for those activities, in addition to base SMIT tools of AIX. As far as LoadLeveler is concerned, the PowerConsole acts a submit-only node.
- Administration deals with user management, license management and accounting and can be performed through NIS and AIX tools
- Availability category groups activities which cover performance management, fault management, shared disk management, resource balancing, and remote maintenance, and which contribute to assure availability of the cluster. PTX, ClusterWatch, Cluster Diagnostic Tool, ArrayGuide, LoadLeveler, RSF meets these area.

1.4.8. Cluster Management

Cluster Management main features are:

- System Management:
  - Remote system boot and remote shutdown,
  - Software installation and updating facilities,
  - Global user management,
  - Mailing,
  - Remote commands execution.

- Centralized Management Interface:
  - Display or modify configuration parameters,
  - Help in failures detection and diagnostic,
  - Performance monitoring,
  - Easy installation and configuration,
  - Cluster PowerConsole configuration,
  - Cluster PowerConsole GUI customization,
  - Management of multiple Escala EPC systems (including central point of control for management of DAS storage subsystems through the Navisphere GUI).

2. Bull Display Terminals and Concentrators

2.1. BQ306 ASCII/ANSI Terminal

The BQ306 is a monochrome entry-level display terminal; it is used on Escala EPC as System Console.

It is a system-attached, 14-inch monochrome display station used for asynchronous communications. The display terminal supports the EIA-232D (CCITT V.24/28) interface or the EIA-422A (CCITT V.11) interface.

The BQ306 display terminal provides BQ303 and WYSE 55 emulation modes.

The display terminals support transmission speeds from 50 bps to 114Kbps on EIA-232D and EIA-422A interfaces.
The data stream is compliant with ANSI X3.4/3.64 standard.
The Character Sets available are ISO 646 with national versions (7 bits coding) and 8 bits coding ISO Latin-1 (Western Europe), Latin-2 (Eastern Europe) 8859/1 and 8859/2, Latin-5 (Western Europe + Turk) 8859/9, and Latin Cyrillic 8859/5, PC437, 86x, 85x.

The BQ306 can attach directly to a host processor, when using EIA-232C or EIA-422, at 50bps to 114Kbps.
It can communicate remotely to a host processor using EIA-232C interface at 50bps to 64Kbps.

BQ306 Features

The BQ306 terminal supports both ANSI-based and PC type character sets and keyboards. Furthermore, this terminal supports:

- DEC VT320, VT220, VT100, VT52, and WYSE 55 terminal personalities
- Up to 25 international keyboards languages
- 101/102 keys PC style keyboard and 105 keys DEC style keyboard
- ISO latin/1, /2, /5, Cyrillic supplementary character sets
- White and amber screen phosphor
- 24-line by 80/132 column data display and 25th status line
- 15x12 and 10x14 character matrix
- Screen saver feature
- Auxiliary printer port.

The terminal is available in two models:
An international model and a low emission version that supports up to 25 keyboard languages and user-selectable French, German, Italian, Spanish or English setup screens and status line messages

System attachment

The BQ306 is attached to the system unit standard serial port using appropriate asynchronous cables EIA-232/V.24, or to an 8, 16 or 64 port asynchronous adapter port using appropriate cables EIA-232/V.24 (see cabling configurator)

The BQ306 is also attachable to the 128 port asynchronous controller of the system via a 16-port cluster box using appropriate asynchronous cables EIA232.

2.2. Explora 17" Color X-Terminal

(This product has been discontinued.)

The Explora 17" Color X-Terminal is used on Escala EPC as Cluster Console.

The Explora 17" Color X-Terminal is a high-performance X terminal providing 64-bit performance and super-high resolution for demanding users requiring advanced graphics, imaging, digital video, animation, and sound capabilities.

User benefits

- Fastest Performance: Runs graphical applications more rapidly
- Highest resolution: Increases by 46% the amount of screen image viewable (compared to 1280x1024)
- Latest 64-bit Architecture: Provides full support for emerging multimedia applications
- Largest Standard Memory: Supports complex graphics software with ease
- Choice of monitors

Unrivaled Performance and Resolution

The Explora 17" Color X-Terminal sets remarkable new standards in resolution, architecture and performance whatever your benchmark. With unequaled 1600x1280 resolution and 200,000 Xstones rating, these models clearly outpace the competition, and at 3.83 Xmarks their leads increases even more dramatically.

Cutting-Edge Architecture

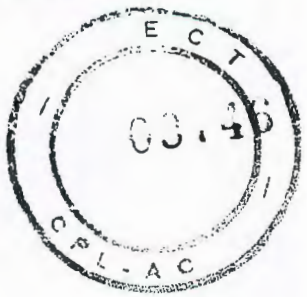
Powerful 64-bit processing - an X terminal first - is what makes such record-breaking performance possible. The R4600 processor's scalability also makes it easy to adapt to future technologies. And for even more dramatic performance improvements, the BQX architecture optimally balance every components including the software, custom ASICs, and other unique enhancements.

Unbeatable Application Access

When it comes to taking full advantage of highly complex graphical applications such as CAD, CASE, GIS, and technical publishing, these terminals have no peer. For example, they draw graphics with the fastest speed, while allowing you to view the maximum picture area of all the images you're displaying. Their sophisticated audio, imaging, and video capabilities also make them ideal for demanding multimedia applications, such as computer-aided training that incorporate MPEG-1 digital video. Add to that an integral parallel port that allows easy attachment of input/output devices (such as printers, scanners, and floppy disk drivers), and full Energy Star compliance, and you have the industry's premier X terminal offer.

4.3 Keyboards

The keyboard features double-rate typematic default speed for the cursor keys. All keyboards are 102 keys, except the US model, which is 101 keys.



Keyboards available are:

- French
- US
- UK
- Italian
- German
- Spanish
- Danish
- Finnish/Swedish
- Norwegian
- Portuguese
- Belgian

ESCALA Attachment

The keyboard connects to the ESCALA keyboard port using a 2.75-m (9-ft) detachable cable with a 6-pin MINI-DIN connector.

4.3 Mouse

An optomechanical 3-Button Mouse (320 dpi) allows users to point to and select items on a display. The cover on the mouse snaps off for routine cleaning of the roller ball.

ESCALA Attachment

mouse connects to the system unit mouse port using a 2.75-m (9ft) detachable cable with a 6-pin MINI-DIN connector. The mouse controller is built into the system unit.

Chapter 7: Reference Information

The following sections present information that will help you plan for the Escala EPC400, EPC430, EPC440, EPC450, EPC800, EPC1200, EPC1200A and EPC2400 system units, and devices.

1. Physical Considerations

The following is a summary of the information you can use to compare systems and external removable media, and plan office space for the Escala EPC Series.

System Unit or Device	Height	Width	Depth	Minimum Weight	Maximum Weight
Model EPC400 - Rack CPU drawer	1775 mm (69.8 in)	580 mm (22.8 in)	1080 mm (42.5 in)	-	490 kg (1089 lbs)
Model EPC440 CPU drawer	350 mm (13.8 in)	443 mm (17.5 in)	870 mm (34.3 in)	71.4 kg (157 lbs)	88.6 kg (195 lbs)
Model EPC800 - Rack CPU drawer	1775 mm (69.8 in)	580 mm (22.8 in)	1080 mm (42.5 in)	-	490 kg (1089 lbs)
Model EPC1200/1200A - CEC Rack I/O rack I/O drawer (7 EIA units, for EPC1200) I/O drawer (10 EIA units, for EPC1200A)	1577 mm (62 in) 1577 mm (62 in) 306 mm (12.1 in) 440 mm (17.3 in)	567 mm (22.3 in) 650 mm (25.5 in) 442 mm (17.4 in) 443 mm (17.5 in)	1041 mm (40.98 in) 1019 mm (40.1in) 748 mm (29.5 in) 843 mm (33.2 in)	-	400 kg (880 lbs) 159 kg (349 lbs) 61 kg (135 lbs) 93 kg (205 lbs)
Model EPC2400 - CEC Rack I/O rack I/O drawer (10 EIA units)	1577 mm (62 in) 1577 mm (62 in) 440 mm (17.3 in)	567 mm (22.3 in) 650 mm (25.5 in) 443 mm (17.5 in)	1041 mm (40.98 in) 1019 mm (40.1in) 843 mm (33.2 in)	- - 89 kg (195 lb)	400 kg (880 lbs) 130 kg (286 lbs) 93 kg (205 lbs)

System Unit or Device	Height	Width	Depth	Minimum Weight	Maximum Weight
DAS1300 - Rack unit	267 mm (10.5 in)	483 mm (19 in)	762 mm (30 in)		70 kg (155 lbs)
DAS2900 - Rack unit	356 mm (14 in)	483 mm (19 in)	762 mm (30 in)		79 kg (176 lbs)
DAS3200 - Rack unit	468 mm (18.4 in)	483 mm (19 in)	762 mm (30 in)		111 kg (254 lbs)
DAS3500 - Rack unit	468 mm (18.4 in)	483 mm (19 in)	762 mm (30 in)		99 kg (220 lbs)
DAS5700: DPE Enclosure rackmount	286 mm (11.25 in)	445 mm (17.5 in)	692 mm (27.2 in)		52 kg (115 lbs)
DAS5700: DAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		35.4 kg (78 lbs)
DAS5100: iDAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		36 kg (80 lbs)
DAS5100: DAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		35.4 kg (78 lbs)
DAE5000: DAE Enclosure rackmount	154 mm (6.07 in)	445 mm (17.5 in)	609 mm (24 in)		35.4 kg (78 lbs)
SSA: Rack unit	171 mm (6.7 in)	444 mm (17.5 in)	665 mm (26.2 in)		50 kg
DLT4000/DLT7000 - Rack unit	146 mm (5.7 in)	235 mm (9.2 in)	332 mm (13 in)	6.6 kg (114.9 lbs)	7.1 kg (15 lbs)

2. Electrical Requirements & Considerations

System Unit or Device	Power Source Loading (Typical in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (Typical in BTU/hr)	Power Requirement (Typical in Watts)	Power Factor	Max. Altitude
Model EPC400 - CPU drawer	0.748	200 to 245	50 or 60	2550	-	-	2500 m (8202 ft)
Model EPC430 - CPU drawer	0.748	200 to 245	50 or 60	2550	-	-	2550 m (8366 ft)
Model EPC440 - CPU drawer	0.46	200 to 240	50 or 60	1485	434	0.9 - 0.98	915 m (3000 ft) (1)
Model EPC450 - CPU drawer	0.748	200 to 245	50 or 60	2550	-	-	2550 m (8366 ft)
Model EPC800 - CPU drawer	1.1	90 to 137 or 180 to 253 (autoranging)	50 or 60	2000 kcal/h	1000	0.95	2500 m (8202 ft)
Model EPC1200/1200A CEC rack I/O rack I/O drawer (EPC1200/1200A)	1.887 up to 4.8 per PDU 0.52	200 to 240	50 or 60	6055 3250	1774 900	-	2135 m (7000 ft)
Model EPC2400 CEC rack I/O rack I/O drawer	1.887 4.8 per PDU 0.4	200 to 240	50 or 60 - -	6055 - 1228	1774 - 360	0.96 - -	2135 m (7000 ft) - -

(1): For altitudes above 195 meters, the maximum temperature limit is derated by 1 degree C for every 137 meters of elevation above 195 meters

System Unit or Device	Power Source Loading (in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (in BTU/hr)	Power Requirement (in Watts)	Power Factor (min@full power)	Max. Altitude
DAS1300 - Rack unit	0.6 (max)	100 to 240 (autoranging)	47 to 63 (autoranging)	2000 (max)	575	0.95	2438m (8,000 ft)
DAS2900 - Rack unit	0.9 (max)	100 to 240 (autoranging)	47 to 63 (autoranging)	3000 (max)	880	0.95	2438m (8,000 ft)
DAS3200 - Rack unit	1.05 (max)	200 to 240 (autoranging)	47 to 63 (autoranging)	3500 (max)	1000	0.98	2438m (8,000 ft)
DAS3500 - Rack unit	1.2 (max)	200 to 240 (autoranging)	47 to 63 (autoranging)	4000 (max)	1150	0.95	2438m (8,000 ft)
DAS5700: DPE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.95	2438m (8,000 ft)
DAS5700: DAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.98	2438m (8,000 ft)
DAS5300: iDAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.95	2438m (8,000 ft)
DAS5300: DAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.98	2438m (8,000 ft)
DAE5000: DAE Enclosure rackmount	0.4 (max)	90 to 264 (autoranging)	47 to 63 (autoranging)	1340 (avg)	392	0.98	2438m (8,000 ft)

System Unit or Device	Power Source Loading (Typical in kVA)	Voltage range (vac)	Frequency (Hertz)	Thermal Output (Typical in BTU/hr)	Power Requirement (Typical in Watts)	Power Factor	Max. Altitude
SSA - Rack unit	0.657	90 to 260 (autoranging)	47 to 63 (autoranging)	2074	657	0.99	12192 m (40,000 ft)
DLT4000/DLT7000 - Rack unit	-	100 to 240 (autoranging)	47 to 63	-	50	-	9150 m (30000 ft)

3. Temperature, Relative Humidity, and Maximum Wet Bulb Requirements

System Unit or Device	Temperature		Relative Humidity (non-condensing)		Max Wet Bulb	
	Operating	Non-Operating	Operating	Non-Operating	Operating	Non-Operating
Model EPC400 - CPU drawer	10°C to 32°C Gradient: 10°C/h	5°C to 50°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC430 - CPU drawer	10°C to 32°C Gradient: 10°C/h	5°C to 50°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC440 - CPU drawer	10°C to 40°C	10°C to 52°C	8% to 80%	8% to 80%	27°C (80°F)	27°C (80°F)
Model EPC450 - CPU drawer	10°C to 32°C Gradient: 10°C/h	5°C to 50°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC800 - CPU drawer	10°C to 40°C Gradient: 10°C/h	5°C to 55°C (41°F to 131°F) Gradient: 25°C/h	20 to 80% Gradient: 10%/h	5 to 95% Gradient: 30%/h	24°C (75.2°F) Moisture: 0.019kg water/kg dry air	28°C (82.4°F) Moisture: 0.024kg water/kg dry air
Model EPC1200/1200A - CEC rack I/O rack - I/O drawer	10°C to 40°C	10°C to 52°C (50°F to 125°F)	8% to 80%	8 to 80%	23°C (73°F)	27°C (80°F)
Model EPC2400 - CEC rack I/O rack - I/O drawer	10°C to 40°C	10°C to 52°C (50°F to 125°F)	8% to 80%	8 to 80%	23°C (73°F)	27°C (80°F)

System Unit or Device	Temperature		Relative Humidity (non-condensing)		Max Wet Bulb	
	Operating	Non-Operating	Operating	Non-Operating	Operating	Non-Operating
DAS1300/2900/3200/3500, DAS5300 DAS5700, and DAE5000 - Rack units	10°C to 38°C	-40°C to 65°C	20 to 80%	10 to 90%	23°C (73°F)	27°C (80°F)
SSA - Rack unit	10°C to 40°C	10°C to 52°C	8 to 80%	8 to 80%	23°C (73°F)	27°C (80°F)
DLT4000/DLT700 - Rack unit	10°C to 40°C	10°C to 40°C	20 to 80%	10 to 90%	-	-

Note: If any tape drive is installed, the minimum relative humidity of a system unit is 20%. If a CD-ROM Drive is installed, the minimum relative humidity of a system unit is 10%.

4. Noise Emissions Values

System Unit or Device	LWAd		LpAm		<LpA>m			
	Operating (bels)	Idle (bels)	Operating (dBA)	Idle (dBA)	Operating (dBA)	Idle (dBA)	Impulsive Noises	Prominent Discrete Tones
Model EPC400 - CPU drawer	6.3	6.1	-	-	-	-	No	No
Model EPC430 - CPU drawer	6.6	6.4	-	-	-	-	No	No
Model EPC440 - CPU drawer	6.2	5.9	-	-	43	40	No	No
Model EPC450 - CPU drawer	6.6	6.4	-	-	-	-	No	No
Model EPC800 - CPU drawer	6.0	5.5	-	-	-	-	No	No
Model EPC1200/1200A - CEC rack	7.0	7.0	-	-	-	-	No	No
EPC1200 I/O drawer	5.9	5.8	-	-	39	38	No	No
EPC1200A I/O drawer	5.9	5.3	-	-	-	-	No	No
Model EPC2400 - I/O Drawer	5.9	5.3	-	-	-	-	No	No

System Unit or Device	LWAd		LpAm		<LpA>m			
	Operating (bels)	Idle (bels)	Operating (dBA)	Idle (dBA)	Operating (dBA)	Idle (dBA)	Impulsive Noises	Prominent Discrete Tones
DAS1300 - Rack unit			N/A	N/A			No	No
DAS2900 - Rack unit	6.8	6.6	N/A	N/A	55	50	No	No
DAS3200, DAS3500, DAS5700, and DAE5000 - Rack unit			N/A	N/A			No	No
SSA - Rack unit	6.15	6.1	N/A	N/A	-	-	No	No
DLT4000/DLT7000 - Rack unit	4.9	4.9	N/A	N/A	-	-	No	No
DAS5300					54	50	No	No

Notes about Noise Emission Values:

1. L_{WAd} is the declared sound power emission level for a production series of machines
2. L_{pAm} is the mean value of the sound pressure emission levels at the operator position (if any) for a production series of machines
3. $<L_{pA}>$ is the mean value of the space-averaged sound pressure emission levels at the one-meter positions for a production series of machines
4. NA = Not Applicable (no operator position)
5. All measurements are made in accordance with ISO DIS 779, and reported in conformance with ISO DIS 7574/4

Chapter 8: Conformance to Standards

This Chapter provides information about Escala EPC conformance to standards.

The set of standards of Bull's Escala range is also fully applicable to Escala EPC.

1. Conformance to Standards—EPC400 and EPC430

Identification	Conformance	Certification	Comments
Electrical and Environmental Requirements			
Power			
EN 60950	Y	Y	Product ranking
IEC 555-2	Y	Y	
Safety Standards			
UL 1950	Y	Y	Underwriters Laboratories
CSA C22.2 No. 950-M89	Y	Y	
EN 60950 (1992 + A1 1993)	Y	Y	European Norm
IEC 950 Edition 1	Y	Y	International Electrotechnical Commission
Directive 73/23/EEC	Y	Y	CE Marking
EMC/EMI			Disturbances produced by devices
FCC CFR47 Class A	Y	Y	US
CSA C108.8 Class A	Y	Y	
VCCI Class I	Y		Japan
EN 55022 (1988) Class A	Y	Y	Norway, Europe
CISPR 22 Class A	Y	Y	
Directive 89/336/EEC	Y	Y	CE Marking
Susceptibility to External Electromagnetic Disturbance			
EN 61000 -4 -2	Y	Y	Electrostatic discharges
EN 61000 -4 -3	Y	Y	Radiated, radio frequency, electromagnetic field
EN 61000 -4 -4	Y	Y	Electrical fast transient/burst
EN 61000 -4 -5	Y	Y	Surge immunity test
EN 61000 -4 -6	Y	Y	Conducted disturbances induced by radio frequency fields
EN 61000 -4 -11	Y	Y	Voltage dips, short interruptions and voltage variations
EN 61000 -3 -2	Y	Y	Limits for harmonic current emissions
EN 61000 -3 -3	Y	Y	Limitation of voltage fluctuation and flicker
Directive 89/336/EEC	Y	Y	CE Marking
Environment Temperature			
Operating limits: Max gradient 10C/hour	10 - 38°C		
Non-operating limits: Max gradient 25C/hour	5 - 50°C		
Relative Humidity			
Operating limits: Max gradient 10%/hour, Moisture content 0.019 Kg_water/Kg_dry_air		20 to 80%	Wet: bulb + 24°C
Non-operating limits: Max gradient 30%/hour, Moisture content 0.024 Kg_water/Kg_dry_air		5 to 95%	Wet: bulb + 28°C
Acoustic Noise			
ISO 7779			Reference
C012C Class 2	Y		
Mechanical Constraints			
IEC 68-2			Reference
C013C class 1	Y		Bull standard
Packing and Packaging			
ISO 780, 2234, 2248, 3676, 4180-2, 4189-2	Y		
C138C	Y		Bull standard: Packaging configuration and labels
European Directives			
72/23/CEE	Y	Y	
89/336/CEE	Y	Y	

2. Conformance to Standards—EPC800

Status of ESCALA conformance to standards

July 5, 1996

Identification	Conformance	Certification	Comments
Electrical and Environmental Requirements			
Power			
IEC 950 class I	Y	Y	Product ranking
IEC 555-2	Y	Y	
Safety Standards			
UL 1950	Y	Y	Underwriters Laboratories
CSA C22.2 No. 950-M89	Y	Y	
EN 60950 (1992 + A1 1993)	Y	Y	European Norm
IEC 950 Edition 1	Y	Y	International Electrotechnical Commission
Directive 73/23/EEC	Y	Y	CE Marking
EMC/EMI			Disturbances produced by devices
FCC CFR47 Class A	Y	Y	US
VDE 871 6/78 Class A	Y		Germany
CSA C108.8 Class A	Y	Y	
VCCI Class I	Y		Japan
EN 55022 (1988) Class A	Y	Y	Norway, Europe
CISPR 22 Class A	Y	Y	
Directive 89/336/EEC	Y	Y	CE Marking
Susceptibility to External Electromagnetic Disturbance			
IEC 801-2 severity level 3	Y	Y	Electrostatic discharges
IEC 801-3 severity level 2	Y	Y	Electric field
IEC 801-4 severity level 3	Y	Y	Conducted disturbances (fast transiant)
IEC 801-5 severity level 3	Y	Y	Voltage/current surges
IEC 801-6 severity level 2	Y	Y	Conducted Sine Wave disturbance
EN 50082-1 (1992)	Y	Y	European Norm
Directive 89/336/EEC	Y	Y	CE Marking
Environment Temperature			
Operating limits: Max gradient 10C/hour	10 - 32°C		
Non-operating limits: Max gradient 25C/hour	5 - 50°C		
Relative Humidity			
Operating limits: Max gradient 10%/hour, Moisture content 0.019 Kg_water/Kg_dry_air			20 to 80% Wet: bulb + 24°C
Non-operating limits: Max gradient 30%/hour, Moisture content 0.024 Kg_water/Kg_dry_air			5 to 95% Wet: bulb + 28°C
Acoustic Noise			
ISO 7779			Reference
C012C Class 2	Y	Y	
Mechanical Constraints			
IEC 68-2			Reference
C013C class I	Y	Y	Bull standard
Packing and Packaging			
ISO 780, 2234, 2248, 3676, 4180-2, 4189-2	Y		
C138C	Y		Bull standard: Packaging configuration and labels
European Directives			
72/23/CEE	Y	Y	
89/336/CEE	Y	Y	

Ergonomics Features

- Display: Tilt and swivel functions, Silica coated, Anti-glare screens, Brightness and contrast controls
- Keyboards: Detached, adjustable tilt, matte-finish keys and housing

Hardware Architecture

- Processor: R4600 RISC @ 80 MHz
- Coprocessor: Three customs ASICS
- DRAM: 8 MB standard, expandable to 136 MB
- Memory upgrades: Industry-standard SIMMs fast-page mode
- Video memory: 2 MB
- Flash memory: Industry-standard PCMCIA
- NVRAM: 512 bytes of configuration memory

Color Displays

- Resolution: 1600x1280
- Color support: 8-bit (256 colors) index color model
- Color palette: 24-bit (16.7 million) look-up table
- Refresh rate: Up to 75 Hz non-interlaced
- Screen size: 17" anti-glare
- Active display area: 356x285mm

Keyboards

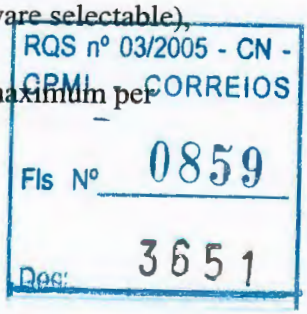
- Low-profile with two position tilt, detached with 1.5 meter coiled cable
- A large variety of national versions is available

Mouse

- Three-button, standard serial interface, 9-pin "D" connector, 1200 baud (9600 baud also supported)

Audio

- Resolution: 16-bit linear software conversion to 8-bit µlaw
- Sampling rates: 8,000 to 50,000 samples per second
- Input: One channel (mono), 3.5 mm stereo jack, line level or microphone level (software selectable), input impedance 47KW
- Output: Two channel (stereo), 3.5 mm stereo jack, line level or speaker out (1 Watt maximum per channel),
  line 775mV (typical)



Communication

- 10Base5 AUI interface (can use external 10Base2 or 10BaseT Transceiver)
- Full DB-25 serial port (dual channel) up to 115.2 Kbaud

Power

- AC voltage 110/230 VAC auto-switching, 47 to 63 Hz
- AC frequency 50 to 60 Hz
- Consumption: 169 watts max (17" monitor), 30 watts @ 115 VAC (base only)

Certification

- MPRII compliant
- Energy Star compliant
- Environmental Operating Range
- Temperature: 10 to 40° C – Non-operating range -10° to 60° C
- Humidity: 10 to 90% non-condensing
- Altitude: Up to 3000 meters above sea level

Physical Dimensions

17" Monitor	*Base*
Height: 470 mm	Height: 61 mm
Width: 500 mm	Width: 429 mm
Depth: 510 mm	Depth: 320 mm
Weight: 34 Kg	Weight: 5,2 Kg

Software

- Window system: X11R5 server
- Font service: TFTP, NFS, DAP, Font Server,
- Protocols: TCP/IP, Telnet, SLIP, LAT, MOP, BOOTP, RARP
- Name service: Domain, IEN 116
- Local clients: Telnet, LAT, Serial, Set up, NCDwm (window manager with OSF Motif look and feel and OPEN LOOK features)
- Boot options: PROM resident, download from central host, flash memory
- Network management: Information menus, SNMP (MBII compliant with NCD extensions), PING utility, Ethernet or token-ring statistics, protocol statistics, packet received LED configurable on keyboard, remote reset
- Configuration: Local, remote or download from central host, remote reset

2.3. 3Com's CS/2600 Terminal Server

The 3Com's CS/2600 Terminal Server is used on Escala EPC as Console Concentrator.

Refer to the Console Concentrator description.

3. Bull Line Matrix Printers

3.1. PR802A Line Matrix Printers

The PR802A is a high performance line matrix impact printer that is designed for heavy-duty dot-matrix printing applications. The PR802A allows to combine text, graphic, bar codes, logos ...

The PR802A features the following:

- 900/662/353 lines per minutes (high speed draft/Data processing/Near letter quality)
- 150 OCR A/B per minutes
- P-series protocol and various emulations (Serial Matrix, Proprinter, Epson FX)
- Dynamic font selection
- Major usual character sets are resident, including Arabic, Cyrillic, Greek, Hebrew, Turkish, etc...
- Up to 6 parts, continuous fan folded forms, with variable width from 3 to 17"
- 136 characters per line at 10 CPI
- VFU: 14 channels Electrical Vertical Format Unit used on P-Series emulation
- Parallel Centronics and serial EIA 232 / RS 422 interfaces
- Quiet cabinet allowing less than 52 dBA acoustic noise
- Energy saving mode feature

The PR802A can be equipped with an Intelligent Graphic Processor (IGP) which allows to use PGL and VGL languages in order to generate forms overlay, variable bar codes, expanded characters, graphics, logos, reverse printing, rotated printing, etc. The IGP is available as an option.

The PR802A is available in two versions: First version uses a gravity paper stacking, the second version is equipped with a powered paper stacking, which insure a perfect stacking of printed paper for heavy duty applications.

The PR802A provides Euro support.

System attachment

The PR802A attaches to the system unit using one of the following:

- parallel printer cable to the standard parallel port (see cable catalog for more information)
- asynchronous cables EIA-232C to a standard serial port or to an 8, 16 or 64 ports EIA-232C adapter port
- asynchronous cables RS-422A to a standard serial port or to an 8, 16 or 64 port RS-422A adapter port (available through a DPNS or a RPQ)
- Ethernet LAN (10BaseT and 10Base2)

3.2. PR902A Line Matrix Printers

The PR902A is a very high performance line matrix impact printer that is designed for heavy-duty dot-matrix printing applications. The PR902A allows to combine text, graphic, bar codes, logos ...

The PR902A features the following:

- 1400/1050/560 lines per minutes (high speed draft/Data processing/Near letter quality)
- 253 OCR A/B per minutes
- P-series protocol and various emulations (Serial Matrix, Proprinter, Epson FX)
- Dynamic font selection
- Major usual character sets are resident, including Arabic, Cyrillic, Greek, Hebrew, Turkish, etc...
- Up to 6 parts, continuous fan folded forms, with variable width from 3 to 17"
- 136 characters per line at 10 CPI
- VFU: 14 channels Electrical Vertical Format Unit used on P-Series emulation
- Parallel Centronics and serial EIA 232 / RS 422 interfaces
- Quiet cabinet allowing less than 52 dBA acoustic noise
- Energy saving mode feature

The PR902A can be equipped with an Intelligent Graphic Processor (IGP) which allows to use PGL and VGL languages in order to generate forms overlay, variable bar codes, expanded characters, graphics, logos, reverse printing, rotated printing, etc. The IGP is available as an option.

The PR902A is available in two versions: First version uses a gravity paper stacking, the second version is equipped with a powered paper stacking, which insure a perfect stacking of printed paper for heavy duty applications.

The PR902A provides Euro support.

System attachment

The PR902A attaches to the system unit using one of the following:

- parallel printer cable to the standard parallel port (see cable catalog for more information)
- asynchronous cables EIA-232C to a standard serial port or to an 8, 16 or 64 port EIA-232C adapter port
- asynchronous cables RS-422A to a standard serial port or to an 8, 16 or 64 port RS-422A adapter port (available through a DPNS or a RPQ)
- Ethernet LAN (10BaseT and 10Base2)

3.3. Printers Summary Table

	Line Matrix Printers, Graphics, Barcodes, Interfaces // and RS232C				
PRUF005-000A	PR802A	270/900	lpm	Cabinet Model	Stacking Gravity
PRUF008-000A	PR802AS	270/900	lpm	Cabinet Model	Powered Paper Stacker
PRUF006-000A	PR902A	432/1400	lpm	Cabinet Model	Stacking Gravity
PRUF007-000A	PR902AS	432/1400	lpm	Cabinet Model	Powered Paper Stacker
	Options for all Line Matrix Printers				
PRFF003-0000	Network (10-Base-T)				
PRFF005-0000	Graphic interface PRX02 and Euro				

	Line Matrix Printers Performances - lpm	
	Upper characters Draft/Data processing/Near letter quality	Mixed characters Draft/Data processing/Near letter quality
PR802/802A	900/662/353	770/529/270
PR902/902A	1400/1050/560	1197/840/432

4. Graphics Monitors

4.1. 15-inch Color Monitor

The 15" Color Display is intended for graphics applications. It provides sharp, bright and realistic colors with minimum distortion. The anti-reflective CRT surface treatment eliminates screen reflections while optimizing image quality.

The 15" Display is a high resolution multisync graphics raster scan color Display.

Main characteristics are:

Picture tube	Type and size	15", Diagonal, Flat
	Dot Pitch:	0.28 mm
	Face treatment	Non Glare, Anti-Static
Input	Signal	R.G.B. Analog
	Connector	15Pin, D-Type
Synchronization Range	Horizontal	30KHz to 70KHz (Automatic)
	Vertical	50Hz to 150Hz (Automatic)
Video Bandwidth		85MHz (-3dB)
Display	Area (H x V)	260 x 195 mm
	Color	Unlimited colors, depends on graphics board
	Resolution	Up to 1280x1024 at 60 Mhz
Compatibility	VGA, S-VGA, XGA, VESA	
Power Source	100-240VAC (Universal Power) 1.8A 80W (Max.)	
Dimensions	365(W)x370(H)x384(D)mm	
Weight	12.9 Kg	
Environment	Operating	+5°C to +35°C, Humidity 35% to 80%
	Storage	-30°C to +60°C, Humidity 30% to 85%

The 15" Display meets the following electromagnetic emissions and safety standards:

Emissions:

- Nordic MPR-II Basic
- FCC Part 15, Subpart J, Class B
- CE
- CSA C108.8, Class B
- CISPR 22, Class B EN (55022)
- EPA ENERGY STAR

Safety:

- US recognized, UL 1950
- CSA Certified, CSA C22.2 No. 220
- NEMKO, DEMKO, FIMKO, SEMKO
- IEC 380/950 Safety (TUV) EN (60950)
- ISO 9241 parts 3 recommendations for VDT ergonomics
- DHHS

4.2. Power GXT130P Graphics Accelerator (GTFG048-0000)

The POWER GXT130P is a versatile, low-priced 2D graphics accelerator for Escala servers. This accelerator delivers exceptional 2D graphics performance for AIX systems at a low price .
The POWER GXT130P is supported on the Escala S, E230, E250, T430 and T450.

Advantages

- Meets the performance and functional requirements of demanding 2D graphics for X Windows applications.
- Displays graphics and text for workstation applications that require very rich and complex visual information simultaneously.
- Provides an exceptional performance level of visual interaction for servers at an affordable price.

Hardware

- Utilizes a half-length PCI slot
- Concurrent colors: 256 out of 16.7 million
- RAM DAC frequency: 250MHz
- Maximum resolution: 1600 x1200 8-bit pixels
- Maximum refresh rate: 85Hz
- Memory bandwidth: 640MB/sec.
- Memory type: 8MB SDRAM
- Display Power Management Signaling (DPMS)

Features

- Supports 60 to 85Hz monitor refresh rates, including those that comply with ISO 9241 Part 3.
- Video acceleration features such as scaling and color space conversion.
- Supports screen resolutions of 640x480, 800x600, 1024x768, 1280x1024, 1600x1200 at 8-bits per pixel.
- Satisfies the ISO 9241 standard of visual quality, refreshing the screen at up to 85Hz for all resolutions.
- Provides a standard 15-pin DIN output connector for half-length PCI card slot.
- Supports:
  - Multisync monitors with at least a 64KHz horizontal scan capability.
  - DDC-2B-compliant multisync monitors with at least a 38KHz horizontal scan capability.

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Server HX4600

User's Guide

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PN: 456-01502-001

Contents

Using This Guide

This User's Guide provides a quick reference to information about your system. Its goal is to familiarize you with your system and the tasks necessary for system configuring and upgrading.

This guide contains the following information:

- Chapter 1, "System Overview" provides an overview of your system and describes your system's major system components. See this chapter to familiarize yourself with your system.
- Chapter 2, "Setting Up Your System" tells you how to select a site, unpack the system, make cable connections, and power on your system.
- Chapter 3, "Configuring Your System" tells you how to configure the system and provides instructions for running the BIOS Setup Utility and the Symbios Configuration Utility. It also provides information on configuring system jumpers and switches.
- Chapter 4, "Upgrading Your System" provides you with instructions for upgrading your system with additional processors, optional memory, option cards, and peripheral devices.
- Chapter 5, "Problem Solving" contains helpful information for solving problems that might occur with your system.
- Appendix A, "System Cabling" includes cabling information for the RAID controller installed in your system.
- Appendix B, "Memory Configurations" defines the allowable memory configurations for your system.
- Appendix C, "Management Workstation Application (MWA)" provides you with information on using MWA for managing your server remotely in a network environment.
- Appendix D, "Hardware Event Log" helps you locate a hardware component in your system that the Hardware Event Log listed as causing an error in your system.
- "Glossary" defines the standard acronyms and technical terms used in this manual.
- "Equipment Log" provides you with a sample equipment log for documenting the system configuration and future updates you may make to your system.

Text Conventions

This guide uses the following text conventions.

Warnings, cautions, and notes have the following meanings:

⚠ WARNING

Warnings alert you to situations that could result in serious personal injury or loss of life.

⚠ CAUTION

Cautions indicate situations that can damage the system hardware or software.

Note: Notes give important information about the material being described.

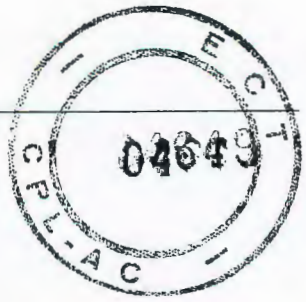
- Names of keyboard keys are printed as they appear on the keyboard. For example, **Ctrl**, **Alt**, or **Enter**.
- Text or keystrokes that you enter appear as boldface type. For example, type **abc123** and press **ENTER**.
- File names are printed in uppercase letters. For example, AUTOEXEC.BAT.

Related Documents

In addition to this guide, the following system documentation is included with your server either as electronic files on EXPRESSBUILDER or as paper copy shipped with your server.

- *System Release Notes*
  Release Notes provide you with the latest information about your system. This information was not available at the time your user's guide was developed.
- *Getting Started Sheet*
  The Getting Started Sheet provides several easy-to-follow steps to become familiar with your server documentation and to complete your installation successfully.
- *Network Operating System Configuration Guide*
  This guide contains supplemental instructions needed to install and configure your server Windows NT v4.0, Novell NetWare v4.2, Santa Cruz Operation (SCO) OpenServer Release 5.05, and SCO UnixWare 7.01 Network Operating Systems. This document is intended to complement the more detailed procedural documents available from the vendor of the network operating system.

Safety Notices



- **Caution:** To reduce the risk of electric shock which could cause personal injury, follow all safety notices. The symbols shown are used in your documentation and on your equipment to indicate safety hazards.
- **Warning:** Lithium batteries can be dangerous. Improper handling of lithium batteries may result in an explosion. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists.
- **Warning:** The detachable power supply cords are intended to serve as the disconnect devices.
- **Warning:** This equipment has two 3-wire, grounded power cords. To prevent electrical hazards, do not remove or defeat the ground prong on the power cords. Replace any power cord that gets damaged. Contact your dealer for an exact replacement.
- **Warning:** The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, +5vdc is present on the system board whenever the AC power cord is connected between the system and an AC outlet. Before doing the procedures in this manual, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

In the U.S.A. and Canada, each power cord must be a UL-listed detachable power cord (in Canada, CSA-certified), type ST or SJT, 16 AWG, 3-conductor, provided with a molded-on NEMA type 5-15 P plug cap at one end and a molded-on cord connector body at the other end. The cord length must not exceed 9 feet (2.7 meters).

Outside the U.S.A. and Canada, the plug must be rated for 250 VAC, 10 amp minimum, and must display an international agency approval marking. The cord must be suitable for use in the end-user country. Consult your dealer or the local electrical authorities if you are unsure of the type of power cord to use in your country. The voltage change occurs via a switch in the power supply.

- **Warning:** Under no circumstances should the user attempt to disassemble the power supply. The power supply has no user-replaceable parts. Inside the power supply are hazardous voltages that can cause serious personal injury. A defective power supply must be returned to your dealer.

- **PELV (Protected Extra-Low Voltage) Integrity:** To ensure the extra-low voltage integrity of the equipment, connect only equipment with mains-protected electrically-compatible circuits to the external ports.
- **Remote Earths:** To prevent electrical shock, connect all local (individual office) computers and computer support equipment to the same electrical circuit of the building wiring. If you are unsure, check the building wiring to avoid remote earth conditions.
- **Earth Bonding:** For safe operation, only connect the equipment to a building supply that is in accordance with current wiring regulations in your country. In the U.K., those regulations are the IEE.

Care and Handling

Use the following guidelines to properly handle and care for your system.

Protect the system from extremely low or high temperatures. Let the system warm (or cool) to room temperature before using it.

Keep the system away from magnetic forces.

Keep the system dry. Do not wash the system with a wet cloth or pour fluid into it.

Protect the system from being bumped or dropped.

Check the system for condensation. If condensation exists, allow it to evaporate before powering on the system.

Keep the system away from dust, sand, and dirt.

1

System Overview

- Overview
- Chassis
- System Board Features
- Peripheral Devices
- System Power
- Software Locks via the BIOS Setup

Overview

The server is a modular, multiprocessing server based on the Intel® Pentium® II Xeon chip set. The chip set incorporates a modular scaleable architecture that integrates a 64-bit bus interface with three Peripheral Component Interconnect (PCI) buses and an Industry Standard Architecture (ISA) bus. The architecture supports Symmetrical Multiprocessing (SMP) and a variety of operating systems. The chassis and system boards are designed to meet the needs of the server marketplace.

The combination of computing performance, memory capacity, and integrated I/O provides a high performance environment for many applications including network servers and multi-user systems. The server is designed for use in applications where downtime must be minimized. To this end, the server includes or has the option to include the following.

- Power system redundancy; in a system configured with redundant power supplies, the system will continue to operate with a single power supply failure.
- Self-contained power supply units that can be easily installed or removed from the back of the chassis.
- Hot-swap Ultra2 SCSI-3 hard drive bays accessible from the front of the chassis; a failed drive can be removed, and a new drive installed without system power being turned off.
- High degree of SCSI hard disk fault tolerance and advanced disk array management features through the use of RAID (Redundant Array of Independent Disks) technology.
- Hardware monitors (temperature and voltage) and software monitors to indicate failures.
- Easy access to all parts for service.

System Feature Summary

A summary of the system features is included in Table 1-1.

Table 1-1. System Features

Feature	Description
Modular board set	System is intended for use with a modular board set based on Pentium III Xeon processor technology; from one to four 500 MHz processors and up to 8 GB of memory.
Add-in board support	System I/O board supports up to 11 add-in boards (ten PCI boards, including four slots supporting 64-bit PCI boards, and one combination PCI/ISA board slot).
3 1/2-inch diskette drive	3 1/2-inch diskette drive is externally accessible.
One location for a 3 1/2-inch removable media device	One externally accessible 3 1/2-inch half-height bay is available for server expansion.
5 1/4-inch SCSI CD-ROM	5 1/4-inch CD-ROM drive is externally accessible.
Three locations for 5 1/4-inch removable media devices	Three externally accessible 5 1/4-inch half-height bays are available for server expansion (diskette, CD-ROM, and/or tape drives).
12 locations for 3 1/2-inch Ultra2 Wide SCSI-2 hard drives	Three hard disk drive cages; each holding up to four 3 1/2-inch hot-swappable Ultra2 wide SCSI-3 hard drives. Each cage is secured behind a metal EMI door; drives can be swapped in or out of the system without powering it down. The array of drives allows easy setup of RAID applications.
Hot swap-capable backplane	A hot swap-capable backplane is part of each drive cage assembly for SCSI hard drives. The backplane is designed for Ultra2 wide SCSI-3 devices that use the industry standard 80-pin Single Connector Attach (SCA) connector. The backplane consists of a row of four drive connectors.
Power supply	From two to three 560 Watt autoranging power supplies are easily removed/installed for service. In a three-supply system, the third supply is redundant.
Software: utilities, setup	BIOS Setup and Symbios Configuration Utility. The EXPRESSBUILDER CD-ROM contains utilities and drivers. The ESMPRO CD-ROM contains the server management software.
Security	Mechanical: Key lock at the front door. One intrusion sensor for front door to secure diskette, hard disk, removable media device, power on/off switch, reset switch, top cover, and left/right panel access. Three power inter-lock sensors one on each side of the chassis and one on top of the chassis. BIOS: Password enable.

Expanding the Server as Needs Grow

A typical minimum system configuration may include the following:

- Board set consisting of system I/O board, CPU baseboard with one 500 MHz Pentium® III Xeon processor, and one memory board containing 128MB of memory.
- Diskette drive and SCSI CD-ROM drive
- Three SCSI hard drive cages with one hard drive and a RAID controller installed
- Integrated Network Interface Controller (NIC)
- Two 560 watt power supplies (an optional third power supply provides redundant power)
- Onboard 2 MB video memory
- System I/O board has one combination PCA/ISA slot and ten PCI slots for add-in boards. The system I/O board also has a riser board for external I/O (serial, parallel, video) interfaces.
- Chassis can hold six removable media drives: four 5 1/4-inch half-height bays with a CD-ROM drive installed in one bay; and two 3 1/2-inch half-height bays with a diskette drive installed.

As server/client needs grow, you can expand system processor capacity, memory, drives, option boards, and the number of power supplies.

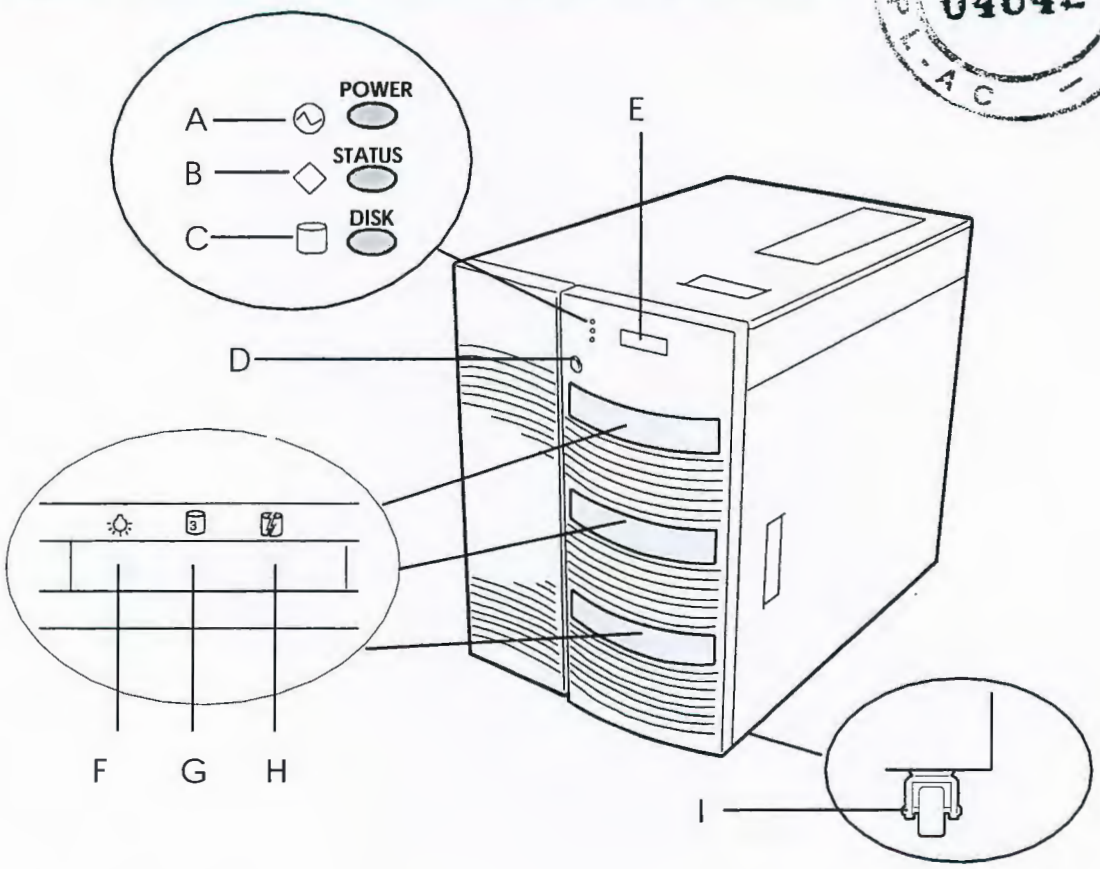
- CPU baseboard has four slots for CPUs, for a configurable range of one, two, three, or four processors.
- Two memory board support 32 DIMM devices for up to a maximum memory size of 8 GB of memory.
- System I/O board has eleven option board slots (ten PCI and one combination PCI or ISA slot).
- Chassis can hold six removable media drives.
- Three SCSI hard drive cages support up to 12 hot-swap bays for 3 1/2-inch Ultra2 wide SCSI-3 hard drives.

Configuration Constraints

The system has four 5 1/4-inch half-height bays accessible from the front. These bays are convenient for diskette, tape, and CD-ROM drives (removable media). Because of the EMI generated by hard drives, the increased susceptibility to ESD, and cooling requirements, hard drives should not be installed in the 5 1/4-inch half-height bays.

Chassis

Figure 1-1 shows the server front chassis features and controls.



A	Power LED	When green, power is present in system. When off, power is turned off or power source is disrupted. See Table 1-2 for a list and description of the system LEDs.
B	Status LED	When green the system is OK. See Table 1-2 for a list and description of the system LEDs.
C	Disk LED	When green, internal disk drives are being accessed. See Table 1-2 for a list and description of the system LEDs.
D	Key lock	Secures both front external doors.
E	LCD panel	Displays information about BIOS and system failures (error and diagnostic information).
F **G** **H**	Drive present/power on Drive active Drive faulty.	Each drive has three LEDs visible above the bay from the front. See Table 1-3 for a list of SCSI disk drive status LED indicators.
I	Casters (4)	Used when moving the server. Fixed by the caster holders.

Figure 1-1. Front Chassis Features and Controls

Status LED Indicator Descriptions

Table 1-2 lists the system status LED indicators along with a description of each LED indicator. Table 1-3 lists the disk drive status LED panel indicators along with a description of each LED indicator. Table 1-4 lists system status abnormal conditions.

Table 1-2. System Status LED Indicators

LED	Status	Description	Response
Power	Off	Power OFF	None required (normal)
	Green	Power ON	None required (normal)
	Amber	Sleep Mode	Power saving mode (This feature must be supported by your operating system).
Status	Off	Power OFF	None required (normal)
	Green	No alarms	None required (normal)
	Amber	Abnormal condition (see Table 1-4)	Check condition
Disk	Off	Not accessing disk drives	None required (normal)
	Amber	Internal disk drive failure	Check disk drive status LEDs
	Green	Accessing disk drives	None required (normal)

Table 1-3. Disk Drive Status LED Panel Indicators

LED	Status	Description	Response
Disk Drive Present	Off	Disk drive not present	None required (normal)
	Green	Disk drive present	None required (normal)
Disk Drive Activity	Off	Not accessing disk drive	None required (normal)
	On	Accessing disk drive	None required (normal)
Disk Drive Status	Off	No alarms	None required (normal)
	Amber	Disk drive failure	Replace disk drive.

Table 1-4. System Status Abnormal Conditions

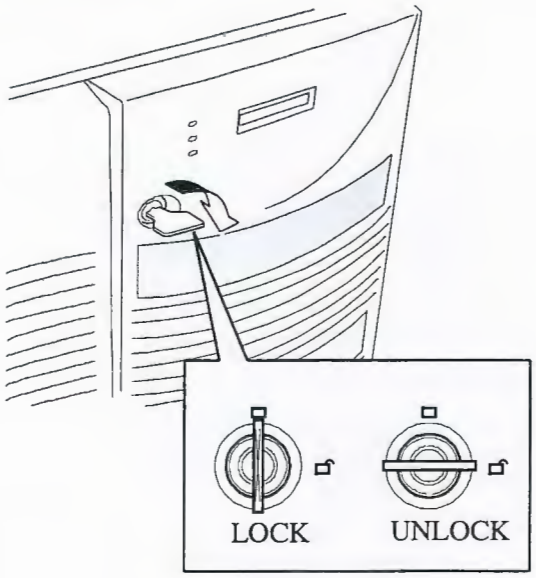
LED (Amber)	Conditions
System Status	Chassis intrusion (front cover) Unit fan alarm Memory multi-bit error (SERR) Temperature Voltage CPU thermal trip CPU, memory or option board error or failure Power supply failure

Opening the Front Doors

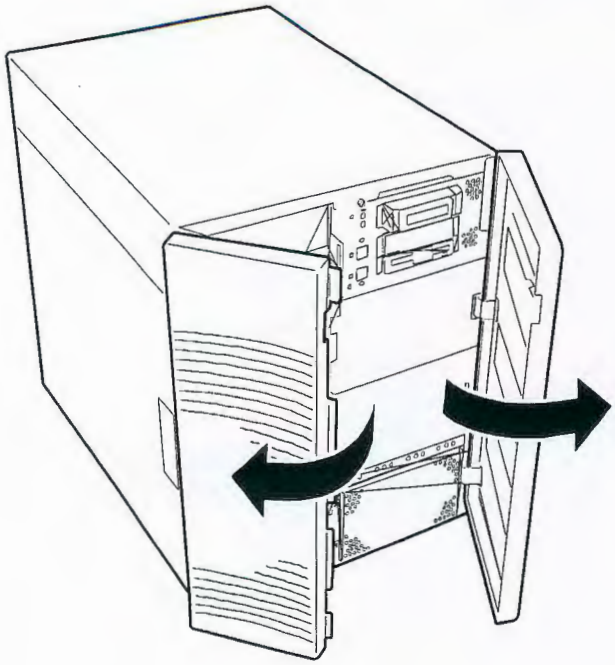
You must open the right front door to turn the server power on or off, mount or dismount a floppy disk, or mount or dismount a hard disk drive. Open the left front door to mount or dismount 5 1/4-inch removable media devices.

Open the front doors as follows.

1. To open the front doors, you need to use the security key provided with the server. Insert the security key into the key slot and turn the key to the right (see the following figure).



2. First open the right front door, then open the left door (see the following figure).



Chassis Features and Controls

Figure 1-2 shows the server front chassis features and controls. Figure 1-3 shows the server rear chassis features and controls.

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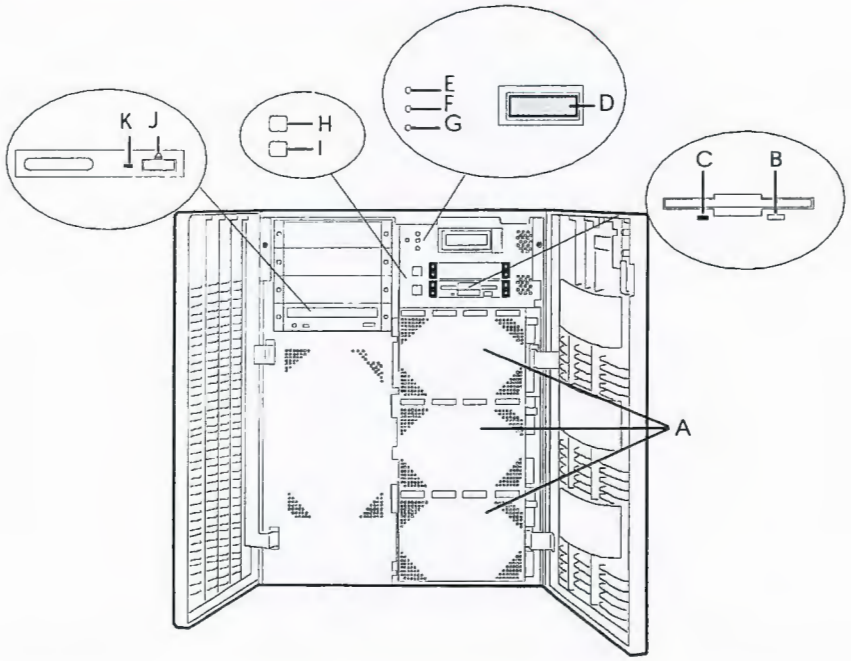
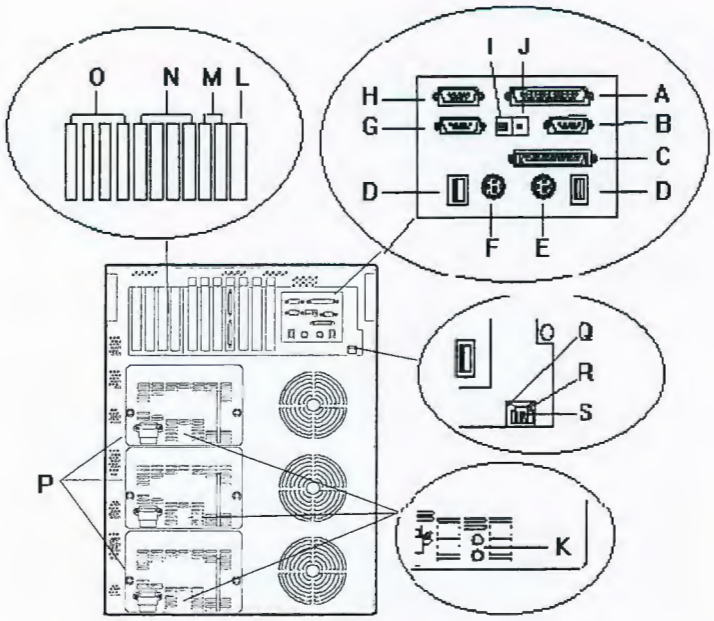


A	SCSI hard drive cages (3)	Each cage contains four disk drives. Above each drive are three status LEDs. Refer to Table 1-3 for information on disk drive status LEDs.
B	Ejector button, 3 1/2-inch diskette drive	Press to eject diskette.
C	Activity light, 3 1/2-inch diskette drive	When lit, drive is in use.
D	LCD panel	Displays information about BIOS and system failures (error and diagnostic information).
E	Power LED	When green, power is present in system. When off, power is turned off or power source is disrupted. See Table 1-2 for a list and description of the system LED indicators.
F	Status LED	When green the system is OK. See Table 1-2 for a list and description of the system LED indicators.
G	Disk LED	When green, internal disk drives are being accessed. See Table 1-2 for a list and description of the system LED indicators.
H	DC power switch	Press to turn system DC power on or off.
I	Sleep switch	Press to enter power saving (sleep) mode. Press again to enter normal mode of operation. This feature must be supported by your operating system.
J	Load/eject button, CD-ROM drive	Press to load CD and eject CD.
K	Activity light, CD-ROM drive	When lit, drive is in use.

Figure 1-2. Front Chassis Features and Controls (front doors opened)

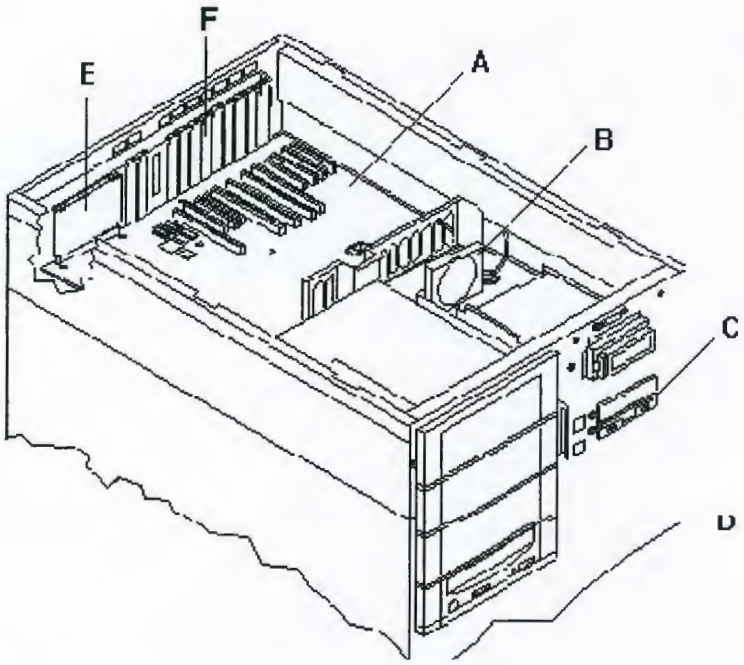


A	Printer	LPT1 25-pin parallel port connector.
B	Monitor	VGA monitor 15-pin connector.
C	External-SCSI	Narrow-SCSI 50-pin connector
D	USB	USB interface connector. Appropriate driver required.
E	Keyboard	PS/2-compatible 6-pin mini-DIN connector.
F	Mouse	PS/2-compatible 6-pin mini-DIN connector.
G	COM2	COM2 serial port 9-pin connector.
H	COM1	COM1 serial port 9-pin connector.
I	Function select switches	See *Configuring Switch and Jumper Settings* in Chapter 3 of this User's Guide.
J	Reset Button	Press to reset system.
K	Power status LEDs	Both indicators are green during normal operation. Either or both indicators go off when power supply fails.
L	ISA/PCI slots	One ISA/PCI (PCI#11) combination add-in board slot.
M	PCI Slots	Two PCI add-in board slot locations (PCI #12 and PCI #13).
N	PCI Slots	Four 64-bit add-in board slot locations (PCI # 31, PCI #32, PCI#33, and PCI#34).
O	PCI slots	Four PCI add-in board slot locations (PCI #21, PCI #22, PCI #23, and PCI #24).
P	Power supplies (three shown)	Possible configurations, installed from bottom most bay: 2 supplies (nonredundant), 3 supplies (one redundant). Each power supply has a separate AC input power connector.
Q	Status LED	Lit when system is connected to a 10Base-T LAN Network; not lit when system is connected to a 100Base-TX LAN Network
R	Active LED	Lit when information packets are exchanged between the system and the network.
S	LAN	10Base-T/100Base-TX network LAN connector.

Figure 1-3. Rear Chassis Features and Controls

System Board Features

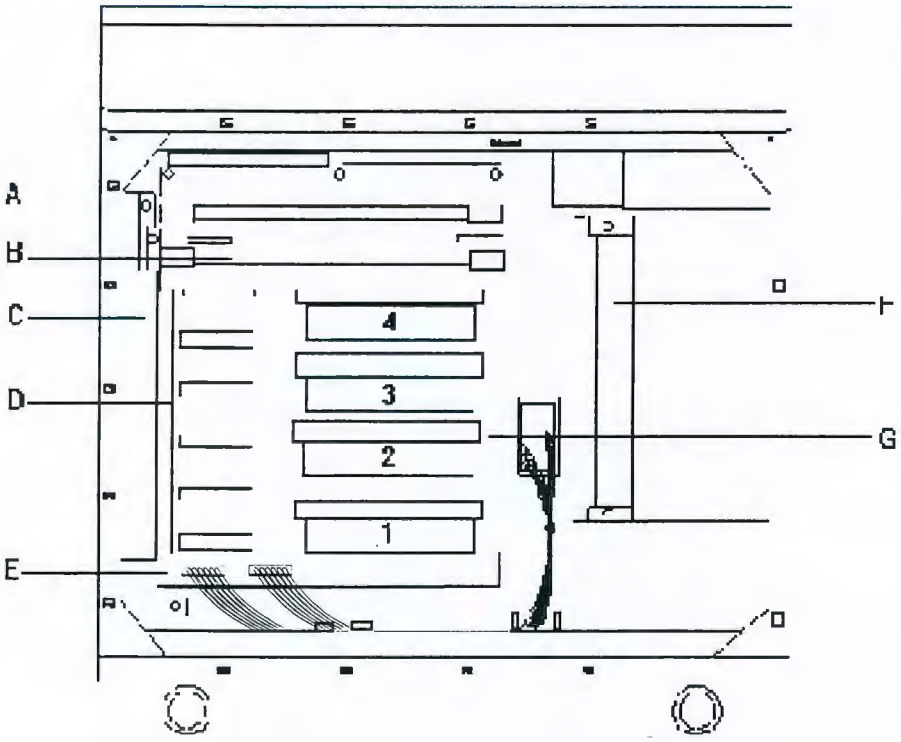
The board set includes the system I/O board, CPU baseboard, and one or two memory board. The system I/O board is mounted at the top of the system. Figure 1-4 shows the system with the top cover removed.



A	System I/O Board
B	Option board Fan
C	Diskette drive
D	Four 5 1/4-inch half-height bays with a CD-ROM drive installed in bottom bay
E	I/O riser board
F	Expansion slot covers

Figure 1-4. System I/O Board Location

The CPU base board plugs into the underside of the system I/O board and the memory board plugs into the CPU base board. Figure 1-5 shows the system with the left side cover removed.



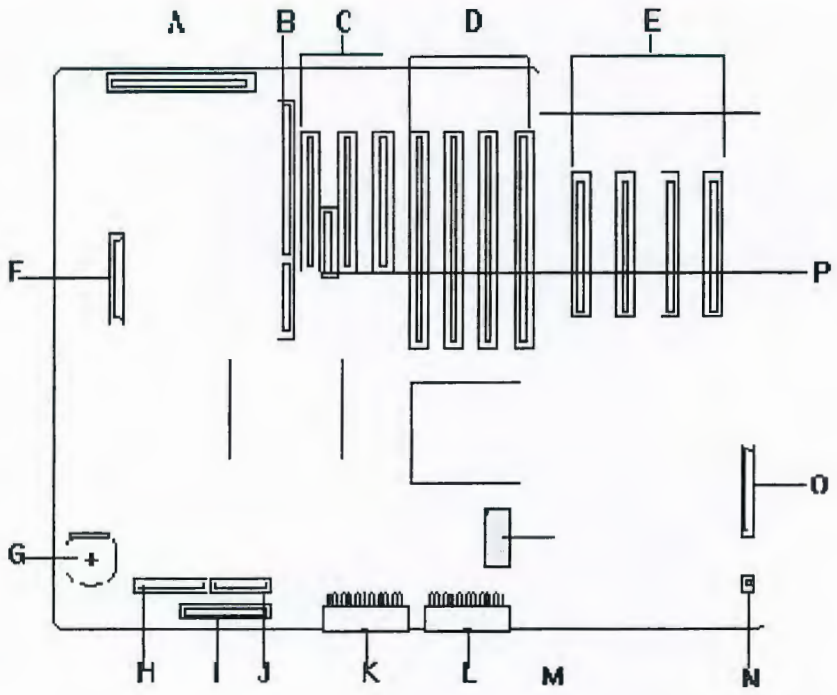
A	Memory Board #2 or Memory Terminator Board
B	Memory Board #1
C	Rear Fans (3) Top fan cools memory; bottom two fans cool CPUs
D	Voltage Regulator Module sockets (VRM1 - VRM6)
E	CPU Baseboard
F	Front Fans (3) Top fan cools memory; bottom two fans cool CPUs
G	Pentium III Xeon processors (1 - 4)

Figure 1-5. CPU Base Board and CPU Board Location

Figures 1-6, 1-7, and 1-8 show the major components on the system I/O board, CPU baseboard, and memory board. Table 1-5 summarizes the features of the board set.

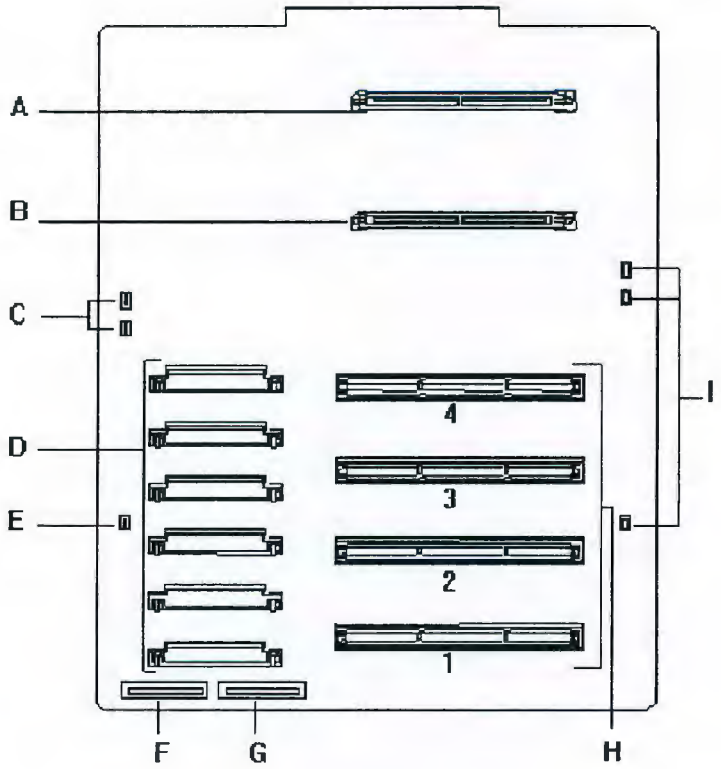
Table 1-5. Features of the Board Set

Feature	Description
Multiple processor slots	Four processor sockets on the CPU baseboard.
Upgradable memory	Sixteen DIMM sockets on each of two memory board, supporting up to 8 GB memory using 256 MB DIMMs.
Add-in board support	One combination ISA/PCI bus slot, four dedicated 64-bit PCI bus slots and six 32-bit PCI bus slots on the system I/O board.
SCSI controller	Dual onboard SCSI-2 controller (PCI-based).
BIOS	Flash memory-based BIOS (Basic Input/Output System) and Setup utilities.
Video	Integrated super VGA controller ships with either 2 MB of video memory.
External device connectors	Onboard connectors for two serial ports, parallel port, narrow SCSI port, PS/2-compatible keyboard, mouse, VGA monitor and 10/100Base-TX Network LANs.
Clock	Real-time clock/calendar (RTC).
System hardware monitoring	Detects chassis intrusion and contains sensors for temperature, voltage, fan failure and Power supply failure.
Configuration utilities	BIOS Select and Symbios Configuration Utility.



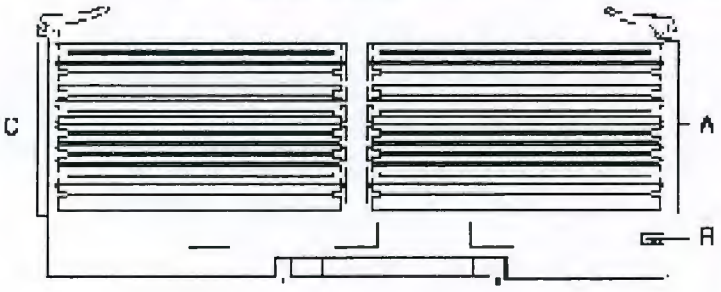
A	Riser Card Connector
B	ISA Board Slot
C	First PCI Board Slots (32-bit) (PCI #11, PCI #12 and PCI#13 from the left).
D	Third PCI Slots (64-bit) (PCI #31, PCI #32, PCI #33 and PCI #34 from the left).
E	Second PCI Board Slots (32-bit) (PCI #21, PCI #22, PCI #23 and PCI#24 from the left).
F	Ultra2 SCSI-3 SCSI Ch1 Connector for 5 ¼" Removable Media Devices
G	Battery (lithium)
H	Power PB Connector
I	Floppy Disk Drive Connector
J	Front Panel Connector
K	Power Connector 1
L	Power Connector 2
M	Non-volatile Memory (NVRAM)
N	Fan Connector
O	Ultra2 SCSI-3 SCSI Ch2 Connector (not used)
P	Server Management Board Connector

Figure 1-6. System I/O Board Connector and Component Locations



A	Memory board connector (Optional)
B	Memory board connector (Standard)
C	Rear Fan Connector (2)
D	Voltage module socket (VRM1 - VRM6)
E	Rear Fan Connector (1)
F	Power Connector 1
G	Power Connector 2
H	Pentium III Xeon Processors sockets (1 - 4)
I	Front Fan Connectors (3)

Figure 1-7. CPU Base Board Component Locations



A	DIMM sockets
B	Configuration jumper
C	DIMM sockets

Figure 1-8. Memory Board Component Locations

Processor

Each Pentium III Xeon processor is packaged in a single edge contact (S.E.C.) cartridge. The cartridge includes the processor core with an integrated 16 KB primary (L1) cache; the secondary (L2) cache (512K, 1MB or 2MB); a thermal plate; and a back cover. The cartridge is secured by a retention module attached to the baseboard. Depending on configuration, your system has one to four processors (see Figure 1-7). Additional Pentium processors enhance performance and enable symmetric multiprocessing (SMP). All processors access the same memory and I/O space and tasks can run on either CPU if your operating system (OS) supports SMP.

Memory

The system supports a maximum of two memory boards. Each memory board contains sixteen 168-pin DIMM sockets (see Figure 1-8, A and C). A minimum system configuration includes 128 MB (using four 32 MB DIMMs) of system memory. Sixteen DIMM sockets on each memory board allow for system memory expansion up to 8 GB (using sixteen 256 MB DIMMs on each memory board). ECC generation/checking is provided for detection and correction of memory errors.

> ***Note:*** Only use DIMMs approved for use in this server system. Call your customer service representative for information.

Bus Master I/O Expansion Slots

The server's expansion capabilities meet the needs of high performance I/O servers by providing a combination of PCI local bus and ISA connectors. The system I/O board offers ten dedicated PCI slots, four of which are 64-bit, and one combination slot that may be configured as a PCI slot or an ISA slot. The ISA architecture supports 32-bit memory addressing and 16-bit data transfers for the CPU, DMA, and bus masters.

Real-Time Clock/Calendar

The real-time clock provides system clock/calendar information stored in a non-volatile memory (NVRAM) (Figure 1-6, M). The real-time clock battery (see Figure 1-6, G) provides power backup for the real-time clock.

BIOS

A BIOS and Setup Utility are located in the Flash memory on the system I/O board and include support for system setup and PCI/ISA Plug-and-Play auto-configuration. A number of security, reliability, and management features are also incorporated to meet vital server needs.

Video

The onboard super VGA controller (PCI) is a high-performance SVGA subsystem that supports:

- BIOS compatibility with VGA, EGA, CGA, Hercules Graphics, and MDA
- 2 MB of Video Memory
- 16-bit bus for high-speed display memory access
- Hardware accelerated bit block transfers (BITBLT)
- 72Hz refresh, non-interlaced at: 640x480, 800x600, or 1280x1024 resolutions
- Up to 16M colors at 640x480 and 800x600 resolutions, 64K colors at 1024x768 resolutions and 256 colors at 1280x1024 resolutions with the optional 2 MB video memory.

> ***Note:*** SVGA drivers may be required to use the high-performance video modes.

SCSI Controller

The system I/O board includes a dual Symbios Ultra2 wide SCSI-3 controller integrated as a PCI bus master. This controller supports data paths of 8-bit (fast/narrow SCSI) at a data transfer rate of 10 MB/sec and 16-bit (fast/wide or ultra /wide SCSI) at a data transfer rate of 20 MB/sec or 40 MB/sec. As a PCI bus master, this controller supports burst data transfer rates up to the maximum of 133 MB/sec.

On this server, Channel 1 is cabled to SCSI devices in the removable media drive bays. Channel 2 is available for optional external SCSI devices.

Peripheral Controller

The advanced integrated peripheral controller supports two serial ports and one parallel port through the I/O riser board (see Figure 1-6, A). The advanced integrated peripheral controller also supports the connection of two diskette drives (see Figure 1-6, I).

External Device Connectors

The I/O panel provides connectors for a PS/2 compatible mouse and a keyboard, connectors for VGA monitor, two serial port connectors, a parallel port connector and two USB interface connectors. It also provides a narrow SCSI external connector.

Keyboard and Mouse

The keyboard/mouse controller is PS/2-compatible.

Fans

In addition to the power supply fans, the system has an option board fan cabled to the I/O board and six fans cabled to the CPU baseboard. The six fans (front and rear) are redundant in configuration. If one fan fails, its associated fan changes its rotating speed to high.

Peripheral Devices

The following paragraphs describe the Ultra2 wide SCSI-3 hard drive bays and 5 1/4-inch removable media drive bays.

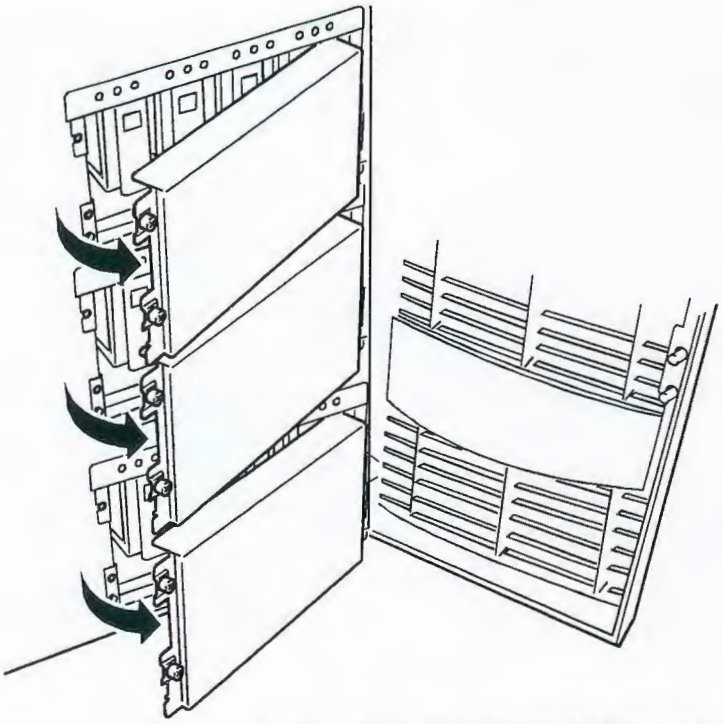
Ultra2 Wide SCSI-2 Hard Drive Bays

The right side of the system contains three Ultra2 SCSI-3 hard drive cages for

3 1/2-inch SCSI-3 hard drives (see Figure 1-9). Each hard drive cage has a hot-swap backplane that supports four drives. The backplanes require an 80-pin single connector attachment (SCA) connector on the drives you install.

A drive carrier is required as part of the hot swap implementation. A 3 1/2-inch peripheral between 1.0 and 1.6 inches high can be accommodated in each carrier. A drive is mounted in the carrier with four fasteners, and the carrier is retained in the chassis by a locking handle.

A fault light on the front panel board gives a general indication that there has been a fault on a hot-swap drive. Each drive has a set of three lights to indicate the fault or other status: power-on (green LED), activity (green LED), or fault (yellow LED).



Three hard drive cages

(EMI panel and exterior door shown open)

Figure 1-9. Ultra2 Wide SCSI-2 Hard Drive Bays

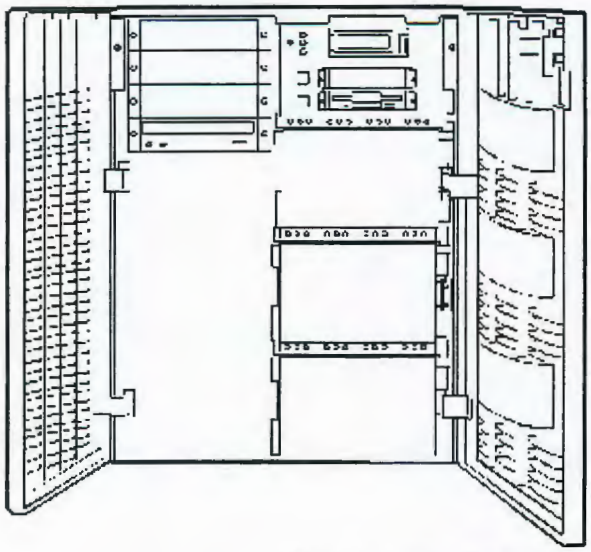
The backplane has two main functions: SCSI drive control and system data logging. Drive status is monitored to detect failing drives and to control LED indicators. The backplane features include the following:

- insertion and removal of hard drives while power is on (referred to as "hot swap")
- simplified cable management
- SCA connectors to simplify inserting and removing hard drives
- SCSI management of fault LEDs.

Each backplane supports SCSI drives with SCA connectors.

Removable Media Drive Bays

On the upper left side of the system, four 5 1/4-inch half-height bays (see Figure 1-10) are designed for peripherals with removable media (diskette, CD-ROM, tape). Two available adjacent 5 1/4-inch bays can be converted to a single full-height bay. The 5 1/4-inch drives can be removed directly from the front of the chassis. Removal of the system top cover may be required to install/remove the device cables. Cosmetic filler panels are installed over all unused 5 1/4-inch bays.



Factory-installed CD-ROM reader plus three bays for removable media drives.

Factory-installed 3 1/2-inch diskette drive plus second bay for removable 3 1/2-inch drive.

(Exterior doors shown open)

Figure 1-10. Removable Media Drive Bays

On the upper right side of the system, below the LCD panel, are two built-in 3 1/2-inch bays. One contains a 3 1/2-inch diskette drive that supports both 720 KB and 1.44 MB media (see Figure 1-10).

> ***Note:*** The SCSI termination resistors must be installed in the last SCSI drive of the daisy chain cabling (bottom media bay). All other devices must have terminators removed.

System Power

The system may be configured with up to three 560 Watt power supplies. Each supply automatically switches between these input voltage ranges:

- 100-125 VAC at 50/60 Hz; 10.5 A maximum current
- 200-240 VAC at 50/60 Hz; 5.5 A maximum current

Each power supply provides DC outputs of +5 V, +12 V, +3.3 V, -5 V, and -12 V. All output grounds connect to the power supply chassis and to earth ground through the AC line cord. Each supply has:

- Individual AC input line cord that plugs into the external side of the power supply
- Isolating device on each DC output so that the failure of one supply does not affect the operation of the others
- Cooling fan integral with each power supply enclosure. The fan circuit implements fan failure detection.

In a system, power is drawn equally from all supplies installed. A system with two power supplies can be fully loaded (all drive bays and add-in board slots filled). The supplies use a forced current-sharing technique that ensures the supplies share within 10 percent at full load. In a high-access system with three power supplies, the third supply gives redundancy, because the load is redistributed if one supply fails.

Software Locks via the BIOS Setup

The BIOS Setup has software features that let you control access to one or more parts of the system:

- Set and enable an administrative password
- Set and enable a user password
- Enable password on boot
- Disable writing to the diskette drive when secure mode is set.

If only a supervisor password is set and enabled, enter this password to boot the server.

If both the user and administrative passwords are set and enabled, enter either one to boot the server. Enter the administrative password to access the BIOS Setup to change the system configuration.

2

Setting Up Your System

- Selecting a Site
- Unpacking the System
- Moving the System to the Site
- Getting Familiar With the System
- Making Connections
- Connecting the Power Cords
- Powering On Your System

Selecting a Site

The system operates reliably in a typical office environment. Choose a site that meets the following requirements.

- Site the system near grounded, three-pronged power outlets.

> ***Note:*** For the United States and Canada, this means NEMA 5-15R outlets for 100-120 VAC or NEMA 6-15R outlets for 200-240 VAC. For other international sites, this means three-pronged power outlets applicable for the electrical code of the region.

> **⚠ CAUTION**
> Be sure the power service connection is through a properly grounded outlet.

Each power cord can be plugged into a separate phase of a main AC supply, assuming the circuit is rated for that load.

> ***Note:*** For Denmark, the system must be connected to an AC power source rated at 16 amps.

- Select a site that is clean, dust-free, and well ventilated. Keep front and rear ventilating openings free of obstructions. Locate the system away from sources of heat, vibration, or physical shock
- Isolate the system from strong electromagnetic fields and electrical noise produced by electrical devices (such as air conditioners, large fans, large electric motors, radio and TV transmitters, and high-frequency security devices)
- The site should be spacious enough to provide at least five inches (13 centimeters) behind the system and three inches (eight centimeters) on each side of the system for proper cooling, airflow, and cable clearance.
- Allow at least 11 inches (27 centimeters) in front of the system for proper front door clearance.
- Position the system for easy access for system maintenance and installation of system upgrades.

Unpacking the System

⚠ CAUTION

Your system weighs between 132 pounds (60kg) and 220 pounds (100 kg) with optional equipment. To avoid personal injury, make sure you have someone help you lift or move the system.

When you receive your system, inspect the shipping containers prior to unpacking. If the shipping boxes are damaged, note the damage, and if possible, photograph it for reference. After removing the contents of the containers, keep the cartons and the packing materials. If the contents appear damaged when you unpack the boxes, file a damage claim with the carrier immediately. To unpack your system, see the unpacking instructions on the shipping carton.

Moving the System to the Site

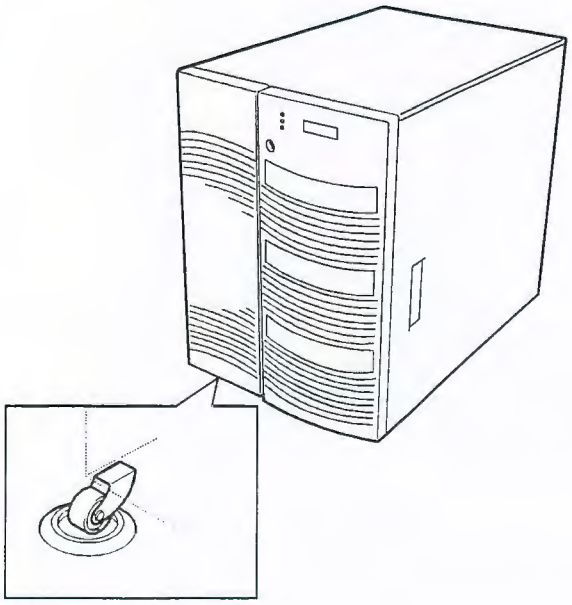
Once you have selected the system installation site, move it as follows.

1. Casters are provided on the bottom of the server. Slowly push the server to the selected installation location.

⚠ CAUTION

For safety reasons, be sure to attach the caster holders on the casters when the system is at the selected site.

2. To stabilize the system, attach the caster holders on the casters as shown below.



Getting Familiar With the System

Before setting up your system, see Chapter 1, "System Overview," to become familiar with system features, such as the location of your system's security keylocks and front and rear panel switches, indicators and connectors, etc.

Making Connections

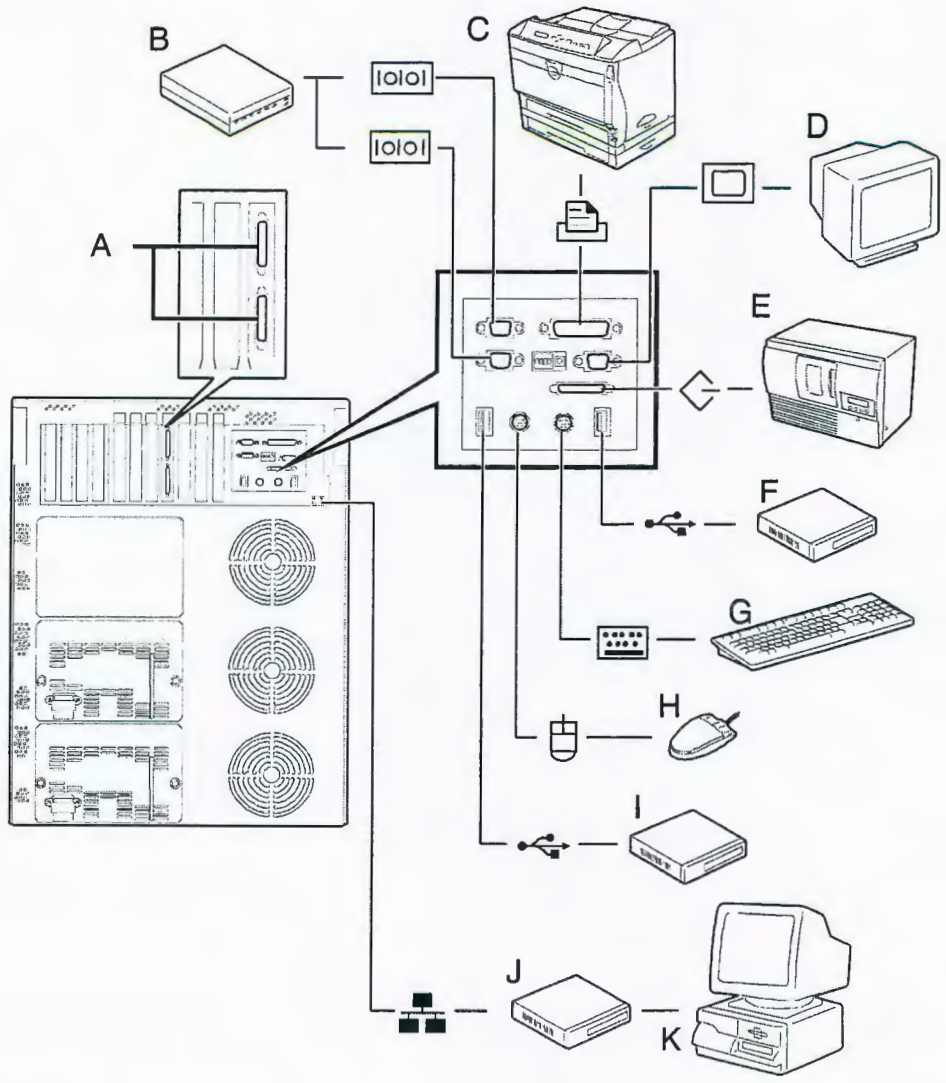
Connect your keyboard, monitor, and mouse (see Figure 2-1). Connect any external peripheral devices such as a printer or modem by following the instructions included with these devices. To connect external SCSI cables, refer to *Cabling* in Appendix A.

⚠ CAUTION

Damage to the system may result if the keyboard cable is inserted or removed when power is applied to the system.

⚠ CAUTION

Inserting a telephone line connector into a LAN board RJ-45 port may result in personal injury and equipment damage.



A. Connections to optional disk cabinet

B. Device with the serial interface such as modem

C. Printer with the parallel interface

D. Monitor display unit

E. External SCSI device

F. Device with the USB interface such as terminal adapter. Requires NOS supporting USB interface.

G. Keyboard

H. Mouse

I. Device with the USB interface* such as terminal adapter

J. Hub (multi-port repeater)

K. Network system on LAN (to be connected via a hub)

Figure 2-1. Making Connections

Connecting the Power Cords

Plug the female end of each AC power cord into the input receptacles on the rear of the power supplies (see Figure 2-2). Plug the male end of each power cord into NEMA 5-15R outlet for 100-120 VAC or NEMA 6-15R outlet for 200-240 VAC. If the power cords supplied with the system are not compatible with the AC wall outlet in your region, obtain a suitable power cord that meets the following criteria.

- The power cord must be rated for the available AC voltage and have a current rating that is at least 125% of the current rating of the system.
- The power cord connector that plugs into the wall outlet must be terminated in a grounding-type male plug designed for use in your region. It must have certification marks showing certification by an agency acceptable in your region.
- The power cord connector that plugs into the system must be an IEC-type CEE-22 female connector.
- The power cord must be less than 1.8 meters (6.0 feet) long.

⚠ WARNING

Your system shipped with two AC power cords. Do not attempt to modify or use the supplied AC power cords if it not the exact type required.

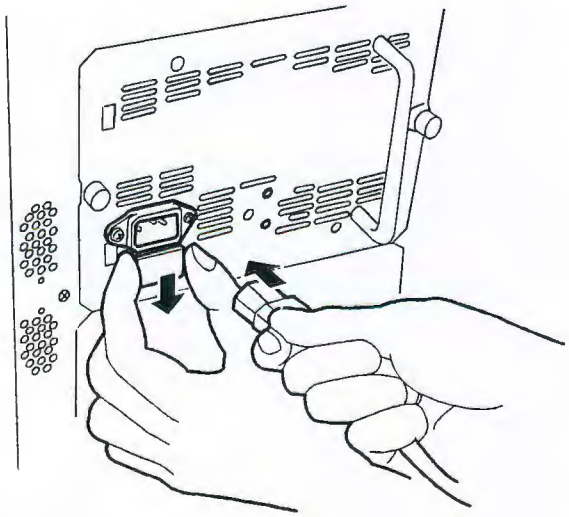


Figure 2-2. Connecting the AC Power Cord

Powering On Your System

Power on your system as follows.

1. Make sure all external devices, such as a video display, keyboard, and mouse (optional) have been connected, and the power cords are connected.
2. Power on the video display and any other external devices.
3. Open the right front door and press the power on/off switch on the front panel (see Figure 2-3).
4. Verify that the Power LED is lit. If it is not lit, ensure the AC power cords are connected to functional AC power sources.

After a few seconds your system begins the internal Power-On Self Tests (POST). POST automatically checks the system, CPU module, memory, keyboard, and most installed peripheral devices. If you have problems powering on your system, refer to *Problem Solving* in Chapter 6.

After you have successfully powered on your system, verify that the system boots to a DOS prompt. You can now run the EXPRESSBUILDER CD-ROM.

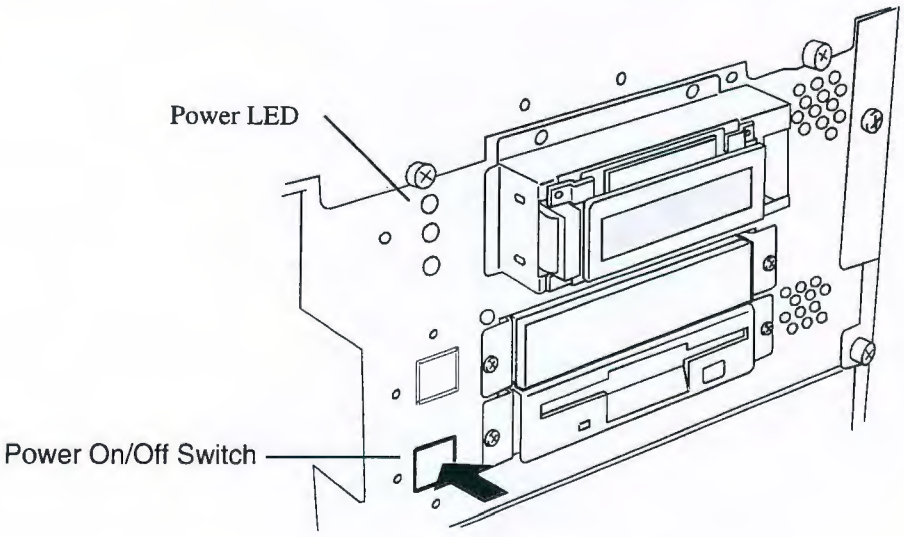


Figure 2-3. Powering On Your System

3

Configuring Your System

- Configuring Your System
- BIOS Setup Utility
- Symbios Configuration Utility
- Configuring the RAID Controller
- Configuring System Jumpers and Switches

Configuring Your System

Configuration and setup utilities are used to change your system configuration. You can configure your system, as well as any option boards you may add to your system, using the BIOS Setup (stored in the system FLASH memory). A diskette is not needed to run BIOS Setup.

The SCSISelect Utility, also stored in the system FLASH memory, is used if you need to configure the SCSI controller in your system or to perform a SCSI disk format or verify disk operation of these drives. A diskette is not needed to run SCSISelect.

A Utilities diskette contains the Event Log Utility. The Event Log Utility is used to read stored system event information.

If your system has been factory configured, the BIOS Setup or SCSISelect utilities do not need to be run unless you want to change the password or security features, add option boards or devices, or upgrade the boards in your system.

There are some system configuration parameters that are set by jumpers. However, these parameters do not usually require change. The following sections provide procedures for running the BIOS Setup, and the Utilities diskette. Also, a section describing the system jumper configurations is presented. Several configuration tables are also provided to record changes you make to the default system configuration.

You use the EXPRESSBUILDER CD-ROM to create the Utilities diskettes.

BIOS Setup Utility

The BIOS Setup Utility, is used to change system configuration parameters. The utility is resident in the system FLASH memory and does not require a diskette or an operating system present to run.

When to Use the BIOS Setup Utility

In most cases, it is not necessary to run the BIOS Setup Utility to change the default parameters, since the default settings support most system configurations. In the following cases, however, you should initiate this utility to change the default settings.

When the set parameters are incorrect: The parameters set with the BIOS Setup Utility are stored to the nonvolatile memory called CMOS. If the contents of this CMOS have been destroyed due some reason, an error message appears on the display during the execution of POST (Power On Self-Test). When an error message appears, press the F2 key to enter the BIOS Setup Utility.

When the CMOS is cleared: A jumper, with which you can clear the contents of the CMOS, is provided on the system I/O board. If this jumper is used to clear the contents of the CMOS, a message appears requesting you to run the BIOS Setup Utility during the execution of POST. Run the BIOS Setup Utility according to the instructions displayed on the screen and provide necessary settings.

When the boot device priority is changed: The defaults instruct the your server to search the boot devices in the following order: floppy disk drive, CD-ROM drive, then the hard disk drive. If you want to change the boot order priority, run the BIOS Setup Utility to change the settings.

When you replace a processor or memory: Your server has a degradation function allowing continuation of operation in the event of a processor or memory error. After replacing the failed processor or memory, run the BIOS Setup Utility to clear the error information.

When you change cache memory configuration: Run the BIOS Setup Utility to enable or disable the memory cache, or to set the cache in memory areas such as system BIOS or video BIOS.

When you change a setup for a PCI or ISA board: Run the BIOS Setup Utility to configure the interrupt request (IRQ) for PCI/ISA devices and PCI and ISA bus slots.

When using the remote power-on function: Enable or disable the remote power-on (Wake On LAN) function, which is used to power up your server remotely through a network.

When using the AC link function: AC link allows you to configure the power ON/OFF state of your server when AC power is restored after a power failure. Run the BIOS Setup Utility to change the power ON/OFF state of your server after a power failure.

When enabling and changing password and other security features: The BIOS Setup Utility includes password setup features and related security features. Run BIOS Setup to enable and change these features. (Do not set the password and security features before installing the operating system.)

When installing an ISA board (not Plug and Play): Run the BIOS Setup Utility to reserve system resources, including IRQ, memory addresses, and I/O addresses used by the board. This ensures that there will not be a conflict with any Plug and Play controllers in your system.

Other: You can also change other BIOS settings including date/time, keyboard features, and standard I/O (serial Port and printer port) interrupt. However, these features can also be changed from your operating system menus.

Using the BIOS Setup Utility

You access the BIOS Setup Utility when you turn on or reboot your system. To run the BIOS Setup Utility, perform the following procedure.

1. Power on or reboot the system. BIOS displays the following:

   Press <F2> to enter SETUP

2. Press **F2**. After BIOS POST completes, the BIOS Setup Utility starts and the Main Menu is displayed. The menu bar at the top of the Main Menu lists the following selections.

Menu	Use
Main	Use this menu for basic system configuration.
Advanced	Use this menu for setting the Advanced Features available on your system.
Security	Use this menu to set User and Supervisor Passwords and the Backup and Virus-Check reminders.
System Hardware	Use this menu for configuring unique Server Features.
Boot	Use this menu to change the boot order of devices in your system.
Exit	Exits the current menu.

Use the arrow keys to select a menu or an item on a displayed menu. Press the value keys (listed in the table below) to cycle through the allowable values for the selected field. Use the Exit menu's "Save Values" selection to save the current values on all the menus.

To display a submenu, position the cursor on a selection that has a submenu and press **Enter**. Selections with submenus are preceded by an arrow.

See the following table for information on the keys you use with Setup. These keys are also listed at the bottom of the Setup menu.

Key	Function in Setup Menu
F1 or Alt-H	General Help window.
ESC	Exit the current menu.
← or → arrow keys	Select a different menu.
↑ or ↓ arrow keys	Move cursor up and down. The cursor moves only to the settings that you can change.
HOME or END	Move cursor to top or bottom of window.
F5 or -	Select the previous value for the field.
F6 or + or SPACE	Select the next value for the field.
F9	Load default configuration values for this menu.
F10	Save current values and exit.
ENTER	Execute command or Select ➨ submenu.

BIOS Setup Configuration Settings

Table 3-1 shows the normal settings for the BIOS Setup Utility and provides a place for you to record any changes you make to these settings.

Table 3-1. BIOS Setup Configurations, Main Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
MAIN MENU		
Processor Type	Displays the type of processor installed.	
Processor Speed	Displays the processor speed.	
Cache RAM	Displays the cache RAM size.	

Table 3-1. BIOS Setup Configurations, Main Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
Cache Memory Press Enter for menu.		
Memory Cache	Enabled	
Cache System BIOS Area	Write Protected	
Cache Video BIOS Area	Write Protected	
Cache Base 0 - 512K	Write Back	
Cache Base 512K - 640K	Write Back	
Cache Extended Memory Area	Write Back	
Cache C800-CBFF	Disabled	
Cache CC00-CFFF	Disabled	
Cache D000-D3FF	Disabled	
Cache D400-D7FF	Disabled	
Cache D800-DBFF	Disabled	
Cache DC00-DFFF	Disabled	
System Memory	640KB (display only) Indicates the total capacity of the basic memory.	
Extended Memory	XXXMB (display only) Indicates the total capacity of the extended memory.	
Language	English	
BIOS Version	Indicates the version of the system BIOS. (display only)	
System Time Enter current time (hour, minutes, seconds on 24 hour clock).	Current Time	
System Date Enter current date.	Current Date	
Floppy Options		
Diskette A: Use +/- to change values; indicates the type of diskette drive installed.	1.44MB, 3 1/2"	
Diskette B: Use +/- to change values; indicates the type of diskette drive installed (Not Installed in your system).	Not Installed	

Table 3-1. BIOS Setup Configurations, Advanced Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
ADVANCED MENU		
Advanced Press **Enter** for menu.		
Plug & Play OS	No	
Reset Configuration Data	No	
Address Bit Permuting	Enabled	
ROMPilot Support	Disabled	
Memory Reconfiguration Press **Enter** for menu.		
Memory Reconfiguration	Enabled	
DIMM Group #1 Status	Normal (display only)	
DIMM Group #2 Status	None (display only)	
DIMM Group #3 Status	None (display only)	
DIMM Group #4 Status	None (display only)	
DIMM Group #5 Status	None (display only)	
DIMM Group #6 Status	None (display only)	
DIMM Group #7 Status	None (display only)	
DIMM Group #8 Status	None (display only)	
Clear DIMM Error	Press **Enter** to clear DIMM error	
DIMM Error Pause	Disabled	
CPU Reconfiguration Press **Enter** for menu.		
CPU Reconfiguration	Enabled	
CPU #1 Status	Normal (display only)	
CPU #2 Status	Normal (display only)	
CPU #3 Status	None (display only)	
CPU #4 Status	None (display only)	
Clear CPU Errors	Press **Enter**	
CPU Error Pause	Enabled	

Table 3-1. BIOS Setup Configurations, Advanced Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
Peripheral Configuration Press **Enter** for menu.		
Serial Port 1:	Enabled	
Base I/O Address:	3F8	
Interrupt:	IRQ4	
Serial Port 2:	Enabled	
Base I/O Address:	2F8	
Interrupt:	IRQ 3	
Parallel Port:	Enabled	
Parallel Mode:	Bi-directional	
Base I/O address:	378	
Interrupt:	IRQ 7	
Diskette Controller:	Enabled	
Mouse	Auto Detect	
SCSI controller 1	Enabled	
SCSI controller 2	Disabled	
LAN controller	Enabled	
Monitoring Configuration Press **Enter** for menu.		
POST Monitoring Observation	POST-END	
Boot Monitoring	Disabled	
PCI Device Press **Enter** for menu.		
PCI IRQ line 1 to PCI IRQ line 17*	Auto Select	
PCI Parity Error		
PCI Bus#1 Parity Error	Enabled	
PCI Bus#2 Parity Error	Enabled	
PCI Bus#3 Parity Error	Enabled	

* See Table 3-2 for PCI IRQ assignments to PCI bus slot or controller.

Table 3-1. BIOS Setup Configurations, Advanced, Security, and System Hardware Menus

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
ISA Device		
Press **Enter** for menu.		
IRQ	None	
DMA Channel	None	
Memory Size	None	
Memory address	None	
Enable Extended Memory Gap	Disabled	
Numlock		
Press **Enter** for menu.		
Numlock	On	
Key Click	Disabled	
Key Board auto-repeat rate	10/sec	
Key Board auto-repeat delay	1 sec	
SECURITY MENU		
Supervisor Password is	Disabled (display only)	
User Password is	Disabled (display only)	
Set Supervisor Password	Press **Enter**	
Set User Password	Press **Enter**	
Password on boot	Disabled	
Diskette Write	Normal	
Power Switch Mask	Unmasked	
Option ROM Menu Mask	Unmasked	
Processor Serial Number	Disabled	
SYSTEM HARDWARE MENU		
Thermal Sensor		
Press **Enter** for menu.		
Thermal Sensor	Enabled	
Upper Limit	45	
Lower Limit	4	
Wake On LAN	Disabled	
AC-LINK	Last State	
ESM IRQ	IRQ 13	
SMI	Yes	
Error Log Initialization	No	

Table 3-1. BIOS Setup Configurations, Boot Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
BOOT MENU		
First boot device	Diskette Drive	
Second boot device	CD-ROM Drive	
Third boot device	Hard Drive	

Table 3-2. PCI IRQ Bus and Controller Assignments

PCI IRQ Line	Assignment
PCI IRQ Line 1	SCSI Channel 1 on system I/O board
PCI IRQ Line 2:	SCSI Channel 2 on system I/O board
PCI IRQ Line 3:	LAN Controller and video controller on system I/O board
PCI IRQ Line 4:	PCI #11 (Int A)
PCI IRQ Line 5:	PCI #12 (Int A)
PCI IRQ Line 6:	PCI #13 (Int A)
PCI IRQ Line 7:	PCI #21 (Int A)
PCI IRQ Line 8:	PCI #22 (Int A)
PCI IRQ Line 9:	PCI #23 (Int A)
PCI IRQ Line 10:	PCI #24 (Int A)
PCI IRQ Line 11:	PCI #31 (Int A)
PCI IRQ Line 12:	PCI #32 (Int A)
PCI IRQ Line 13:	PCI #33 (Int A)
PCI IRQ Line 14:	PCI #34 (Int A)
PCI IRQ Line 15:	PCI #11 (Int B) PCI #12 (Int C) PCI #13 (Int D) PCI #21 (Int D) PCI #22 (Int B) PCI #23 (Int C) PCI #24 (Int D) PCI #31 (Int C) PCI #32 (Int D) PCI #33 (Int B) PCI #34 (Int C)
PCI IRQ Line 16:	PCI #11 (Int C) PCI #12 (Int D) PCI #13 (Int B) PCI #21 (Int B) PCI #22 (Int C) PCI #23 (Int D) PCI #24 (Int B) PCI #31 (Int D) PCI #32 (Int B) PCI #33 (Int C) PCI #34 (Int D)

Table 3-2. PCI IRQ Bus and Controller Assignments

PCI IRQ Line	Assignment
PCI IRQ Line 17:	PCI #11 (Int D) PCI #12 (Int B) PCI #13 (Int C) PCI #21 (Int C) PCI #22 (Int D) PCI #23 (Int B) PCI #24 (Int C) PCI #31 (Int B) PCI #32 (Int C) PCI #33 (Int D) PCI #34 (Int B)

Exiting BIOS Setup

To exit Setup, select Exit from the menu bar to display the Exit Setup menu.

The following describes the options on this menu. Note that ESC does not exit this menu. Select one of the items from the menu or menu bar to exit this menu.

Selection	Description
Save changes and Exit	Stores the selections displayed in the menus in CMOS and exits the Setup program.
Exit without Saving Changes	Exits the program without saving any changes you have made in this session. Previous selections remain in effect.
Get Default Values	Sets default values for all Setup menus. Useful if BIOS detects a problem with the values stored in CMOS.
Load Previous Values	Reverts to previously saved values if the new values have not been saved to CMOS.
Save Changes	Stores the current selections without exiting the Setup program.

Symbios Configuration Utility

The Symbios Configuration Utility detects the two SCSI host adapters located on the system board. Use the utility to:

Change adapter and SCSI device default values

Check and/or change SCSI device settings that may conflict with those of other devices in the server.

Perform low-level formatting or verify operations on SCSI disk drives.

Running the Symbios Configuration Utility

1. Power-on the system. The system boots up.
2. When this message appears on the video monitor:

   Press Ctrl-C to start the Symbios Configuration Utility

   Press **Ctrl+C** to run this utility.
3. The utility starts and the Main Menu displays.

Symbios Configuration Utility Main Menu

Adapter	Port Number	IRQ Level	Status		NVRAM Found
			Current	Next Boot	
SYM53C895 (SCSI 1 - 5 ¼" removable media devices)	4000	11	On	On	Yes
SYM53C895 (SCSI 2 - not used)	5000	15	On	On	Yes

Change Adapter Status – Press ENTER to select and change adapter status.

Adapter Boot Order – Press ENTER to select and change boot order of each SCSI adapter. (not required)

Additional Adapter Configuration – Not used.

Display Mode-Verbose – Press ENTER to change display mode.

Mono/Color – Press ENTER to change display from black/white to color.

Language – Not used.

Help/Quit

The following keys are active for all SCSI Configuration screens:

Key	Action
Arrows	Up and down arrows move from one parameter to another within a screen.
ENTER	Displays options for a configurable parameter. Selects an option.
ESC	Moves back to previous screen or parameter or EXIT if at the Main menu.

Changing the Adapter and Device Configurations

The Symbios Configuration Utility Main Menu lists the two onboard SCSI adapters and shows their current settings. The first adapter listed (SCSI 1) controls the operation of the removable media devices in your system; the second adapter listed normally controls the hard disk drives in the system, however hard disk drives in your system are controlled by a RAID controller.

To configure SCSI devices, perform the following procedure:

1. Using the arrow keys, select the adapter you want to reconfigure. Press **ENTER**.
2. Select "Adapter Setup" and press **ENTER**. The Adapter Setup screen displays.

Adapter Setup Screen

Description	Recommended Setting or Display Only	Your Configuration	
		SYM53C895 1	SYM53C895 2
SCAM Support	Off		
Parity	On		
Host SCSI ID	7		
Scan Order	Low to High		
Removable Media Support	None		
CHS Mapping	SCSI Plug and Play Mapping		
Spinup Delay (Secs)	2		

Help
Restore Default Setup
Exit this menu

3. Highlight the function you want to change and press **ENTER**. You will be prompted to save changes when you exit the configuration utility.

To change device configuration parameters, perform the following steps:

1. At the Symbios Configuration Utility Main Menu, select the adapter which connects to the SCSI device you are reconfiguring. The first adapter listed controls the operation of any SCSI removable media devices installed in your system; the second adapter is not used.

   Press **ENTER**.
2. Select "Device Selections" and press **ENTER**. The Devices 0 to 7 screen displays.
3. Select the SCSI device you are reconfiguring and press **ENTER**.
4. Highlight the function you want to change and press **ENTER**. You will be prompted to save changes when you exit the configuration utility.

SYM53C875 Adapter 1 – SCSI Removable Media Devices

Description	Recommended Setting or Display Only	Your Configuration	
Device Selections	Select device and press ENTER.	Device	Setting
Sync Rate	80		
Width (bits)	16		
Disconnect	On		
Read/Write I/O.timeout (secs)	10		
Scan for device at boot time	Yes		
Scan for SCSI LUNS	Yes		
Queue Tags	Enabled		
Initial Boot Device	No		

Format – Format a disk
Verify – Verify disk media
Help
Restore Default Setup
Exit this Menu

Configuring the RAID Controller

The system includes a three channel SecuRAID 530 Redundant Array of Inexpensive Devices (RAID) Controller board (Mylex eXtremeRAID 1100). This board gives your system the added security of fault tolerance and is pre-configured at the factory. Use Table 3-2 to determine how your RAID controller was configured at the factory. If you want to change the RAID level or add additional hard disks to the array, use the RAID Configuration Utility.

If you are adding the RAID controller to an existing system, the RAID Configuration Utility allows you to configure your disk array before installing your network operating system.

Table 3-2. RAID Configurations

Number of Hard Drives	RAID Level Configured	Hard Drives in Array	Description
1	JBOD	1	**JBOD (Mylex RAID 7)** JBOD is an acronym for Just a Bunch Of Disks. Each drive can operate independently as with a common host bus adapter; or multiple drives may be spanned and seen as a single very large drive. No redundancy is provided.
2	1	2	**Mirroring (RAID 1)** Drives are paired and mirrored. All data is 100% duplicated on an equivalent drive (fully redundant).
3	5	3	**Striping with Parity (RAID 5)** Data is striped across several physical drives. Parity protection is used for data redundancy.
4 or more	5	4 (one standby drive)	**Striping with Parity (RAID 5) with a standby drive** The array consists of three ON-LINE drives and one STANDBY drive. The standby replacement drive, or hot spare, is one of the most important features RAID provides to achieve automatic, non-stop service with a high degree of fault-tolerance.

The RAID Configuration Utility utility is included with the RAID controller. The SecuRAID 530 controller supports various versions of RAID technology (referred to as RAID levels). To use any RAID level, you must configure the RAID controller using the RAID Configuration Utility configuration utility prior to installing your Network Operating System. For an explanation of this utility, refer to the *RAID Configuration Utility Utilities Installation Guide and User Manual* that was shipped with the controller. Chapter 2 of the manual (*Configuration Strategies)* describes RAID technology and provides tips on making your array perform well in your specific application. Chapter 3 (*Preparing the Array)* covers array hardware preparation, configuration, and initialization. After completing the steps in Chapter 3, you can install your Network Operating System.

If you want to remotely configure the array (from a PC client); increase array capacity online; or monitor statistics on disk and controller activity, you must install the Global Array Manager (GAM) option provided with your RAID subsystem. The GAM option includes diskettes and user documentation. Use of GAM is documented in the *Global Array Manager 2 Server Installation Guide*. Increasing array capacity is covered in the *MORE User Guide*. This user guide covers enhancements to both the Global Array manager and RAID Configuration Utility utilities software that implement online RAID expansion (MORE) technology.

Configuring System Jumpers and Switches

This section describes the jumpers and switches used on the I/O riser board, memory board, and system I/O board.

Before You Begin

Only a qualified technical person should perform the procedures in this section.

Note: Electrostatic discharge (ESD) can damage the system boards. Modify the boards only at an ESD workstation. Otherwise, wear an antistatic wrist strap attached to chassis ground.

The system jumpers enable you to set specific operating parameters for your system. A jumper is a small plastic-encased conductor (shorting plug) that slips over two jumper pins.

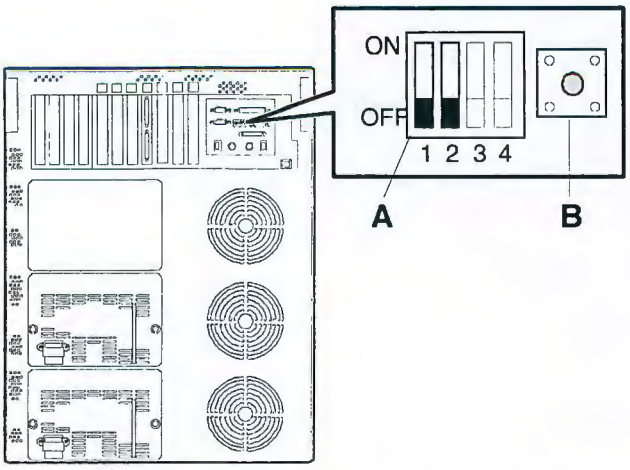
Configuring I/O Riser Board Function Select Switches

The following describes how to configure and set the I/O riser board function select switches for specific operating parameters. The function select DIP switches configure the use of the rear panel reset/dump button.

CAUTION

Before doing the procedures in this section, make sure that your system is powered off. Unplug all AC power cords from the back of the chassis. Failure to disconnect power before setting switches and moving jumpers can result in personal injury and equipment damage.

Figure 3-1 shows the DIP switches. The switches consist of a block of four switches, accessible on the I/O panel located on the I/O riser board at the rear of the chassis.



Function Select Switches and Reset/Dump Button

A Function select switches

B Reset/Dump Button

(Switches shown in factory default position.)

Figure 3-1. Function Select Switches

> ***Note:*** The switches are set correctly at the factory for your system configuration. If your system requires a switch change, change only the switch setting for that condition. Otherwise keep the switches at their factory settings.

Table 3-3 shows the switch configurations and functions. Set the switches per Table 3-3 and the following steps. To change a switch setting, use the following procedure.

> ***Note:*** Power must be completely off before setting the switches, otherwise the settings will not be recognized.

1. At the front of the server, press the power switch off.
2. At the rear of the server, locate the Function Select DIP switch (see Figure 3-1) that you want to change.
3. Set the appropriate switch on or off, according to Table 3-3.
4. Press the main power switch on.

Table 3-3. Function Select Switch Settings

Switch	Description	Settings	Function
SW1	Dump/Reset pushbutton control	Off (factory setting)	Enables the Reset/dump button.
		On	Disables the Reset/dump button.
SW2	Dump/Reset pushbutton mode control	Off (factory setting)	Sets the Reset/dump button to Reset mode. Pressing the button resets the system.
		On	Sets the Reset/dump button to Dump mode. Pressing the button dumps the system memory. This function used only by qualified technical personnel.
SW3	Reserved for future use.	Off (factory setting) On	
SW4	Reserved for future use.	Off (factory setting) On	

Configuring Memory Board Function Jumpers

The system memory board jumpers enable you to specify the DIMM speed parameter. Figure 3-3 shows the location of the jumpers. The jumpers should be configured for 50ns as shown in Figure 3-2.

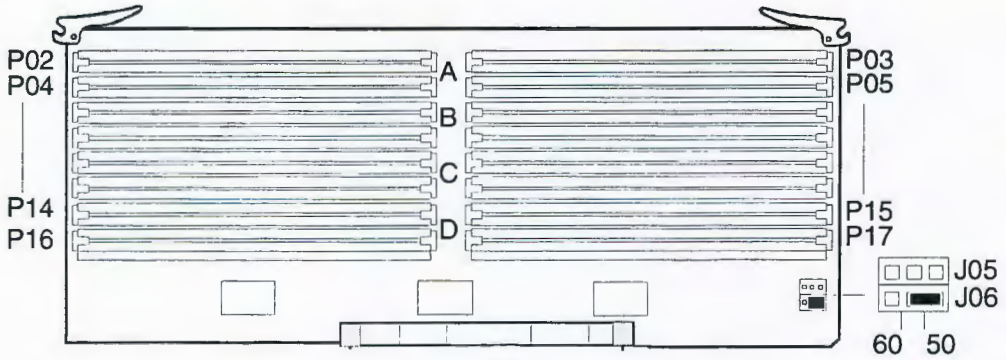


Figure 3-2. Memory Board Jumpers

Configuring System I/O Board Switches and Jumpers

The system I/O board jumpers enable you to set specific operating parameters for your system. Figure 3-3 shows the location of the jumpers. Table 3-4 lists the system I/O board switches and jumpers and their factory default settings.

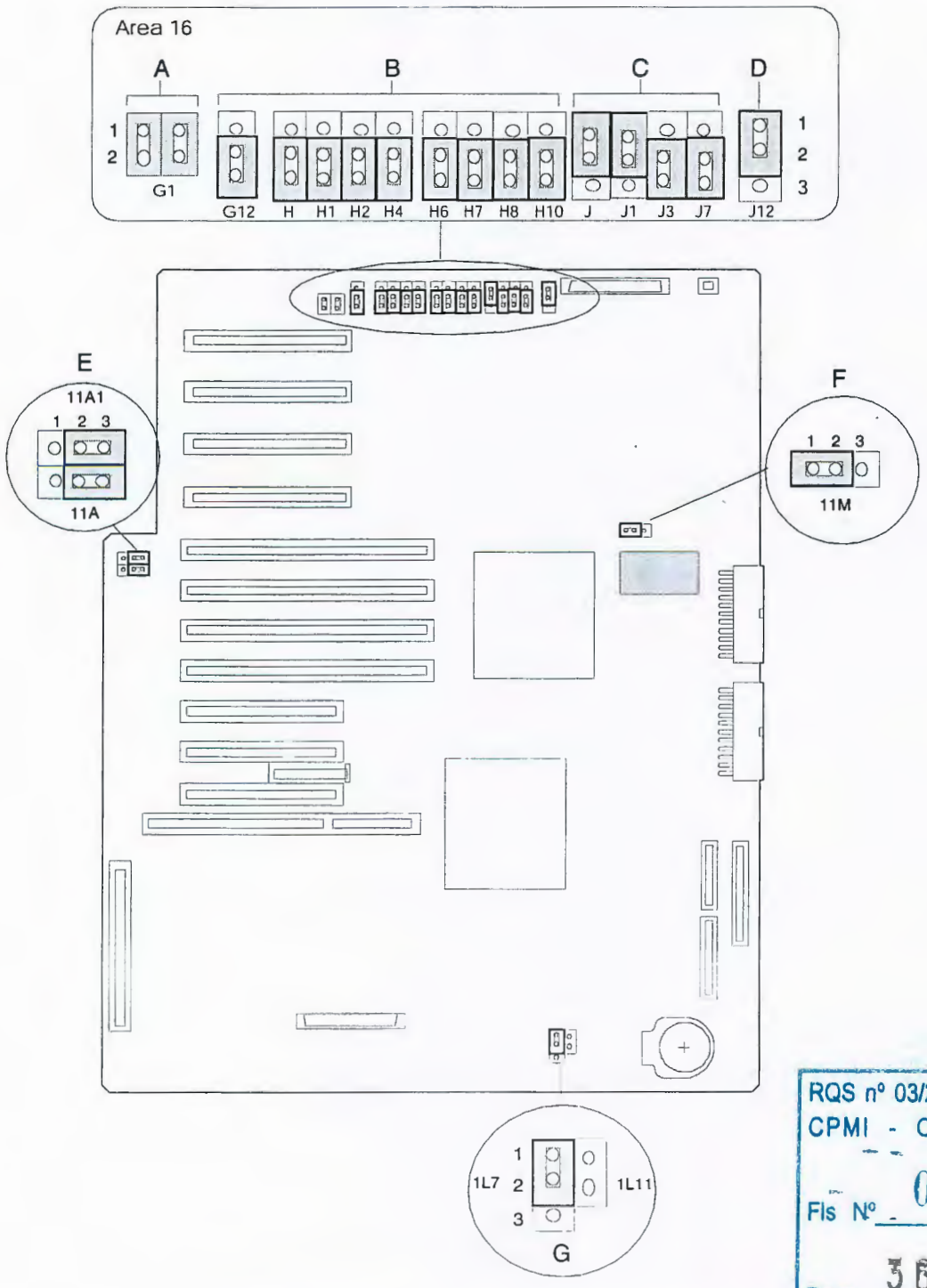


Figure 3-3. System I/O Board Switches and Jumpers

Table 3-4. System I/O Board Jumper Configurations

Figure 3-3 Callout	Description	Option	Jumper	Setting	Factory Default	Your Setting
A	Reserved	Required on factory default (1-2)	16G1	1-2	1-2	1-2
B	Reserved	Required on factory default (2-3)	16G12, 16H, 16H1, 16H2, 16H4, 16H6, 16H7, 16H8, 16H10	2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3	2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3	2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3
C	Processor Speed	500MHz	16J 16J1 16J3 16J7	1-2 1-2 2-3 2-3	1-2 1-2 2-3 2-3	1-2 1-2 2-3 2-3
D	TEST Mode	Required on factory default (1-2)	16J12	1-2	1-2	1-2
E	CMOS Clear	**Disable** Enable	11A	2-3 1-2	2-3	
E	Password Clear	**Disable** Enable	11A1	2-3 1-2	2-3	
F	CMOS Erase/Write	Required on factory default (1-2)	11M	1-2	1-2	1-2
G	RTC Power Supply	Required on factory defaults	1L7 1L11*	1-2 OFF	1-2 OFF	1-2 OFF

*Used on system I/O Board G7BNF; not used on G7BZJ/G7CEQ.

Setting Switches and Jumpers

⚠ CAUTION

Before doing the procedures in this section, make sure that your system is powered off. Unplug the AC power cords from the back of the chassis. Failure to disconnect power before moving the jumpers can result in personal injury and equipment damage.

Note: Observe static precautions. Use an antistatic wrist strap.

Change the setting of any of the configuration switches or jumpers on the system boards as follows.

1. Power off the system and remove the covers as described in Chapter 4, "Upgrades and Options."
2. Check to ensure the system power cords are removed from the back of the system.
3. Locate the switch or jumper you are changing.
4. To change a switch setting, use a pen or your finger to move the switch to the desired setting. To change a jumper setting, use a pair of needle-nose pliers or your fingers to remove the jumper from its current location. Position the jumper over the two pins for the desired setting and press it onto the pins. Be careful not to bend the pins. Record changes to the board settings.
5. Install the system covers and power up the system.

BIOS

The following contains procedures for updating your BIOS .

Updating the BIOS

You should use this procedure when you receive a BIOS FLASH diskette from your service representative. Update the system BIOS as follows.

> **Note:** This procedure clears the event log contents. If you want to save the event log contents, run the Event Log Reader Utility.

1. Insert a bootable DOS diskette into Drive A and power up the system.
2. Remove the MS-DOS diskette and insert the BIOS FLASH diskette into Drive A.
3. Enter PHLASH and press **Enter**.
4. After the system reboots, load the default values by pressing **F2** to enter setup. At the Exit Menu, select *GET DEFAULT VALUES*.
5. Clear the event log by selecting *CLEAR EVENT LOG* at the Server Menu. Press space bar to change NO to YES and press **Esc**. Select *SAVE CHANGES & EXIT* and press **Enter** to continue. The system reboots.

Resetting the CMOS NVRAM

Reset the CMOS NVRAM as follows.

1. Power off the system and remove the panels as described in chapter 5 of this guide.
2. Move the CMOS Clear jumper 11A to ENABLE (1-2). See Figure 3-3 and Table 3-4).
3. Turn the system on and wait for the POST to complete. This automatically reprograms the CMOS NVRAM to the default settings.
4. Power off the system.
5. Move the CMOS Clear jumper 11A back to DISABLE (2-3).
6. Replace the panels and power on the system.
7. Run the Setup Utility to configure your system.

Clearing and Changing the Password

Clear and change the password as follows.

1. Power off the system and remove the panels as described in the Upgrades and Options chapter.
2. Move the Password Clear jumper 11A1 to ENABLE (1-2). See Figure 3-3 and Table 3-4.
3. Power on the system and wait for POST to complete. This automatically clears the old password.
4. Power off the system.
5. Move the Password Clear jumper 11A1 back to DISABLE (2-3).
6. Replace the panels and power on the system.
7. To specify a new password run the Setup Utility.

4

Upgrading Your System

- Precautions
- Preparing Your System for Upgrade
- Modifying the System I/O Board
- DIMMs
- Processors
- Option Boards
- Power Supply
- Removable Media Devices
- Hard Disk Drives

This section contains step-by-step instructions for removal and installation of all the major system components. When you disassemble the server, note the orientation and placement of any cables or shielding that you remove.

⚠ WARNING

The DC push button on/off switch on the front panel does not turn off system AC power. Also, +5vdc is present on the system board whenever the AC power cord is connected between the system and an AC outlet. Before performing any procedures, first power off the DC push button switch located on the front panel. Make sure your system is powered off and the AC power cord is unplugged from the system. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

⚠ CAUTION

The server management logic on the system board monitors system voltage changes. When powering down your system, you may experience a 1- to 5-second delay from the time you press the push button power on/off switch and your system powering down. This is normal system operation and is required by the server management logic.

⚠ CAUTION

Operating your system with the access cover removed can damage system components. For proper cooling and airflow, always replace the access cover before powering on.

Precautions

The following warnings and cautions apply throughout this chapter. Only a technically qualified person should integrate and configure the system.

The only procedure that can safely be done with the system power on is installing (or hot-swapping) an SCA drive/carrier assembly in one of the SCSI hot-swap drive cages or hot-swapping a failed power supply. For any other procedures inside the system, turn off system power and disconnect the AC power cord s.

⚠ WARNING

Before doing the procedures in this chapter, make sure that your system is powered off and unplug all AC power cords. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

System power on/off. The DC push-button on/off switch (a convex button) on the front panel DOES NOT turn off the system AC power. To remove power from system, you must unplug the AC power cords (from wall outlets or power supply).

Hazardous conditions, power supply. Hazardous voltage, current, and energy levels are present inside the power supply. There are no user serviceable parts inside it; servicing should be done by technically qualified personnel.

Hazardous conditions, devices & cables. Hazardous electrical conditions may be present on power, telephone, and communication cables. Turn off the system and disconnect the power cords, telecommunications systems, networks, and modems attached to the system before opening it. Otherwise, personal injury or equipment damage can result.

⚠ CAUTION

Electrostatic discharge (ESD) and ESD protection. ESD can damage disk drives, boards, and other parts. This system can withstand normal levels of environmental ESD while you are hot-swapping SCSI hard drives or hot-swapping a failed fan module or power supply. However, we recommend that you do all procedures in this chapter only at an ESD workstation. If one is not available, provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground (any unpainted metal surface) on your system when handling parts.

ESD and handling boards. Always handle boards carefully. They can be extremely sensitive to ESD. Hold boards only by their edges. After removing a board from its protective wrapper or from the system, place it component-side up on a grounded, static-free surface. Use a conductive foam pad if available but not the board wrapper. Do not slide board over any surface.

Chassis covers, proper cooling and airflow. For proper cooling and airflow, always install the chassis side and top covers before turning on the system. Operating it without these covers in place can damage system parts.

Contact your sales representative or dealer for a list of approved optional peripheral devices.

Preparing Your System for Upgrade

Have the following tools available:

- Phillips screwdriver (#1 bit and #2 bit)
- flat-head screwdriver
- small needle nose pliers
- pen or pencil
- utility knife
- ESD workstation or antistatic wrist strap (recommended)
- IC removal tool.

Equipment Log

Use the equipment log form located at the end of this guide to record the model and serial number of your system, all installed options, and any other pertinent information specific to your system. You need this information when configuring your system.

Removing the Front Doors

You must remove the front doors to remove the side panels on your system. To remove the front doors.

1. Open the front doors and power off the system. Ensure the power cords are unplugged from the AC wall outlet.
2. Lift one of the front doors and pull it towards you (see Figure 4-1). The mounting pins of the front door are disengaged from their mounting holes on the front of the system.
3. Remove the other front door in the same manner.

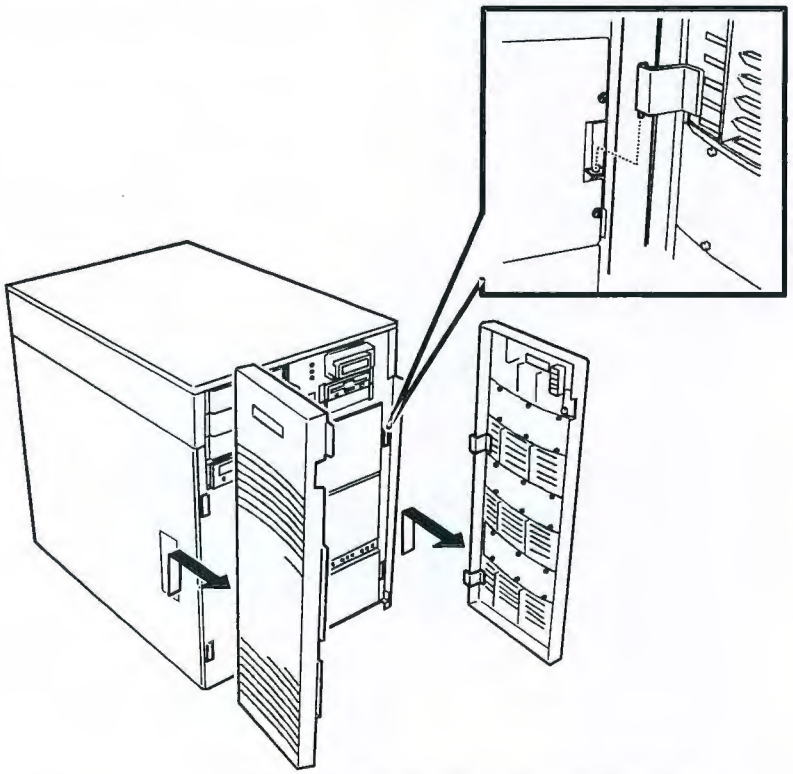


Figure 4-1. System Front Doors

Installing the Front Doors

Install the front doors as follows.

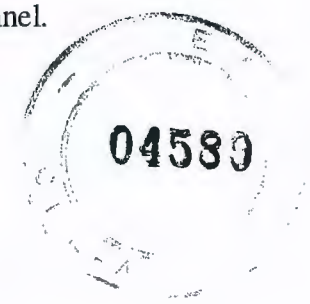
1. Position one of the front doors so the mounting pins of the front door are aligned with their mounting holes on the front of the system. Slide the lower mounting pin into its mounting hole and then slide in the upper pin.
2. Install the other front door in the same manner.

Removing the Top Cover and Side Panels

To install options in your system, you should do the following.

- To modify the system I/O board, add an option board, or add a removable media device, remove the top cover

- To add memory or a processor, remove the left side panel
- To install a hard disk cage, remove the top cover and right side panel.



⚠ CAUTION

For proper cooling and airflow, do not operate the system with the top cover or side panels removed. Always replace them before powering on the system.

Do not damage or bend the EMI fingers that are located along the edges of the top cover and side panels, as you remove and install them, or your system may not meet EMI requirements.

⚠ WARNING

If you are removing the top cover or side panels after the system is set up, you must first power off the system and all external devices. **Unplug** the system power cords.

Remove the top cover or a side panel as follows.

1. Power off the system and ensure the power cords are unplugged from their AC wall outlet.
2. Observe the safety and ESD precautions listed at the beginning of this chapter.
3. The top cover and side panels are secured from the front edge with two thumb lock screws. Loosen the thumbscrews (see Figure 4-2).

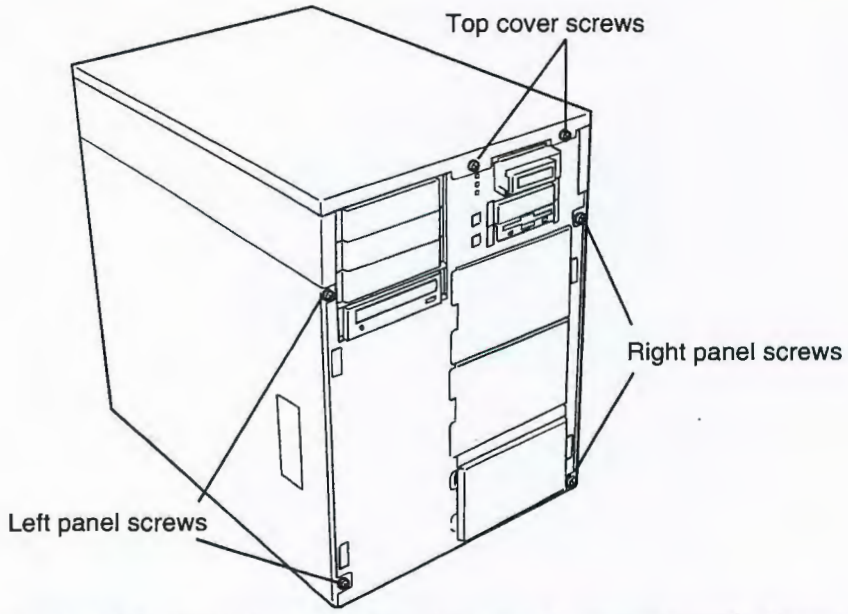


Figure 4-2. Mounting Screws for Top Cover and Side Panels

4. Slide the top cover or side panel toward the front of the chassis about an inch until it stops (see Figure 4-3).
5. Pull the top cover or side panel out and away from the chassis.
6. Set the cover or panel aside for reattaching later.

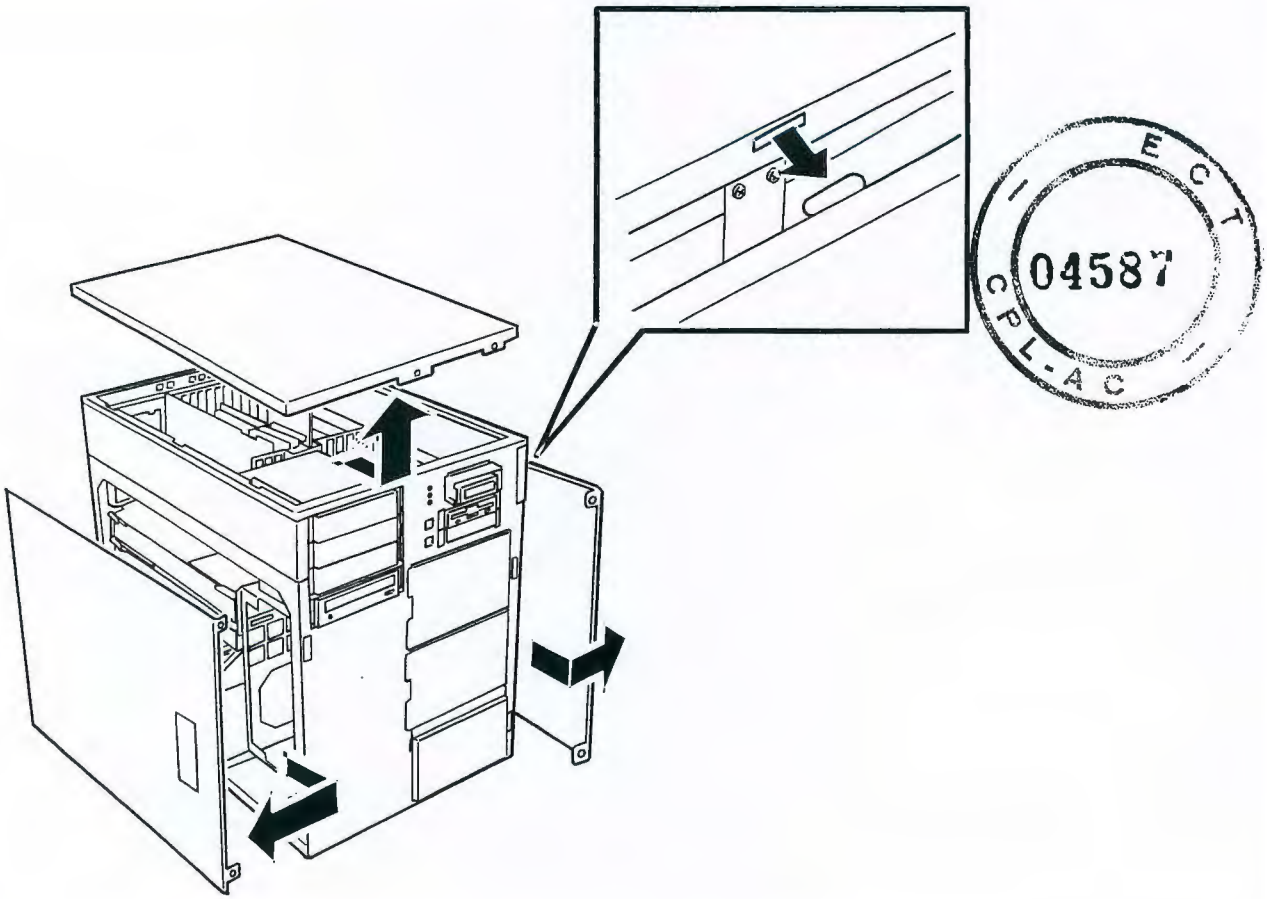


Figure 4-3. Top Cover and Side Panels Removal

Installing the Top Cover and Side Panels

Install the top cover and side panels as follows.

1. Before replacing the top cover or side panel, make sure no tools or loose parts have been left inside the system chassis.
2. Make sure all option boards are firmly seated in their respective slots and that all interior cables are properly connected.
3. The top cover and side panels have tabs that align with the slots in the chassis (see Figure 4-3). Align the tabs with the slots in the chassis and carefully push inward.
4. Slide the cover or panel toward the rear of the chassis so the tabs firmly engage in the slots.
5. Attach the cover or panel to the chassis by firmly tightening the two thumbscrews.

Note: If your system is already set up, plug the system back in, reconnect the peripherals, and power on the peripherals and system.

Modifying the System I/O Board

The following provides procedures for upgrading and configuring the system I/O board in your system. Topics covered include:

- Replacing the non-volatile memory
- Replacing the real-time clock battery.

> ***Note:*** Electrostatic discharge (ESD) can damage add-in boards and other components; place them on an antistatic surface. Wear an antistatic wrist strap attached to chassis ground.

Replacing the Non-Volatile Memory (NVRAM)

You may need to replace the non-volatile memory because of its internal integral lithium battery life span. Contact your sales representative or dealer for a list of approved devices. The NVRAM is located on your system I/O board (see Figure 4-4). Notice the dot on the chip. Use the dot to correctly position the chip on the system board.

> **⚠ CAUTION**
>
> Danger of explosion if the battery is incorrectly replaced. Replace only with same or equivalent type recommended by manufacturer. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists. Do not expose the component to excessive heat or fire. Keep all batteries away from children.

Replace the non-volatile memory as follows.

> ***Note:*** Observe static precautions. Use an antistatic wrist strap.

1. Power off the system and remove the top cover as described earlier.
2. If the non-volatile memory is secured by a tie-wrap, remove the tie-wrap. Note the position of the dot on the NVRAM in relation to its socket. Using a IC removal tool or a small pointed tool, gently pry up each end of the non-volatile memory and pull it straight up out of its socket (see Figure 4-4).
3. Position the new chip over its socket so the dot is properly oriented. Carefully insert the chip into its socket connectors.
4. Press down on the chip until it is firmly seated in its socket.
5. Replace the side panel and turn on the system.
6. Run the BIOS Setup to restore proper configuration settings.

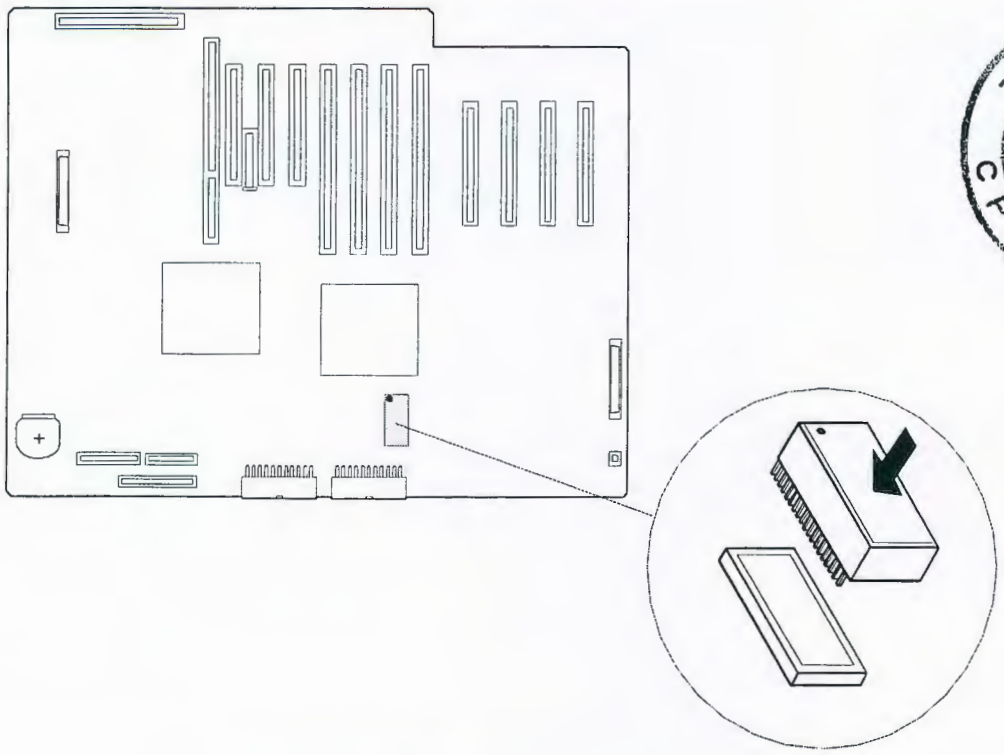


Figure 4-4. Non-Volatile Memory Location

Replacing the Real-time Clock Battery

You may need to replace the real-time clock (RTC) battery because of its battery life span. The battery powers the clock in the absence of power. When the battery starts to weaken, it loses voltage, and the system settings stored in CMOS RAM (for example, the date and time) may be wrong.

The battery (Vendor Part No. CR2450) is available through many vendors. It is located on your system I/O board (see Figure 4-5). Notice the plus (+) sign on the battery. The sign assists in correctly positioning the battery on the system board. Contact your sales representative or dealer for a list of approved devices.

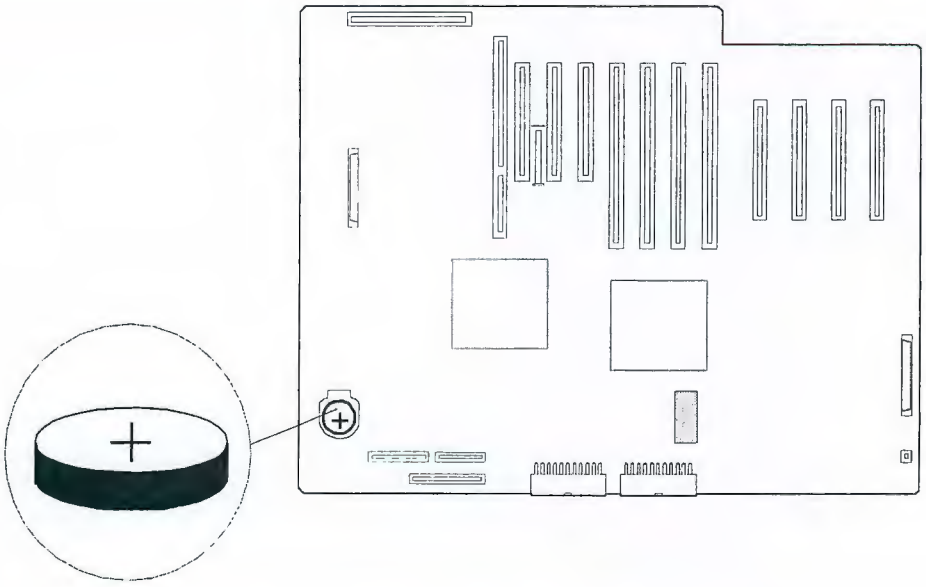


Figure 4-5. Location of the Real-Time Clock Battery

⚠ CAUTION

Danger of explosion if the battery is incorrectly replaced. Replace only with same or equivalent type recommended by manufacturer. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists. Do not expose the component to excessive heat or fire. Keep all batteries away from children.

Replace the battery as follows.

Note: Observe static precautions. Use an antistatic wrist strap.

1. Power off the system and remove the top cover as described earlier.
2. If the battery has a protective plastic cover, remove the cover by lifting it away from the battery. Use your finger nail or a small pointed tool to gently push up the bottom edge of the battery. See Figure 4-5 for socket location.
3. Position the new battery over its socket with the plus (+) sign on the battery facing up.
4. Carefully insert the top of the battery into the socket connectors and gently push the battery into the socket until it is firmly seated in the socket.
5. Replace the top cover and turn on the system.
6. Run the BIOS Setup to restore configuration settings to the real-time-clock.

DIMMs

The memory board contains sixteen DIMM sockets arranged in four banks (see Figure 4-6). Each 168-pin socket can hold a single 72-bit DIMM module with 32MB, 64MB, 128MB, or 256MB of memory. When all sixteen sockets are populated, the memory board supports a maximum of 4GB of memory with 256MB DIMMs. Your system supports a second memory board for a maximum system memory of 8GB. DIMMs must be identical within a bank on each board.

The first bank of DIMMs should be installed in Bank A sockets P02, P03, P04 and P05 (see Figure 4-6). When you install additional DIMMs, you must start with Bank B and continue to Bank D. When you remove DIMMs, you must start with the highest populated bank of DIMMs.

The following provides procedures for adding memory DIMMs to your system.

⚠ WARNING

If the system was running, any processor and heat sink installed is hot. To avoid the possibility of a burn while configuring memory, let the components cool for 10 minutes before continuing with the procedures described here.

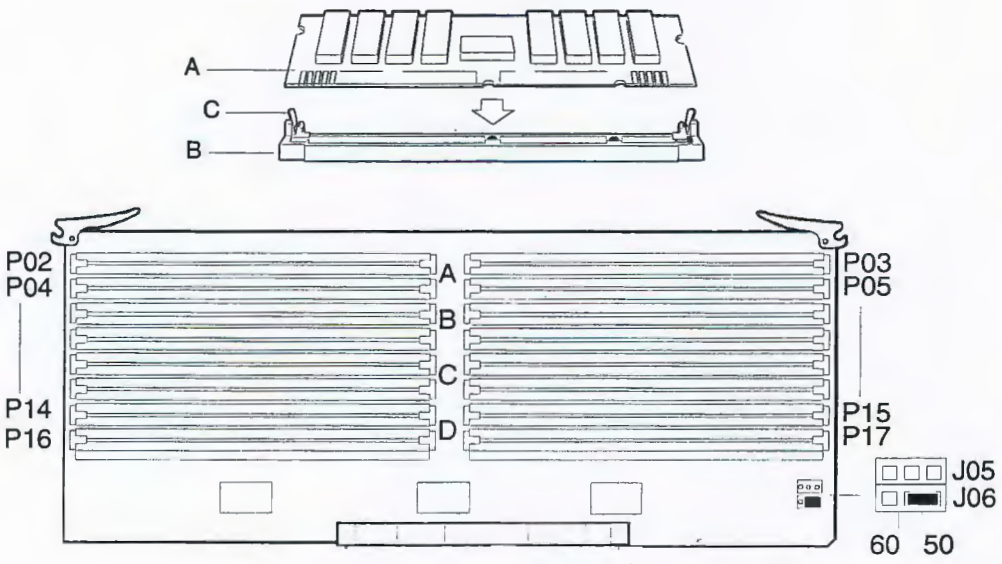


Figure 4-6. Inserting Memory DIMMs

Installing DIMMs

When properly installed, the DIMM module is oriented at an angle of 90 degrees relative to the memory board.

1. Power off the system and remove the left side panel as described earlier.
2. Remove the metal panel supporting the memory board. The support panel is secured to the chassis by a black fastener. Release the fastener by slowly pulling it towards you (listen for two clicks). Grasp the left side of the support panel and swing it away from the chassis to remove it. Set the support panel aside for later installation.

> ***Note:*** Observe static precautions. Use an antistatic wrist strap. Hold DIMMs only by their edges.

3. Open the ejectors on both sides of the memory board (see Figure 4-7). Holding the memory board by its edges, carefully pull it out until the edge connectors are free. Place the memory board on an antistatic surface.

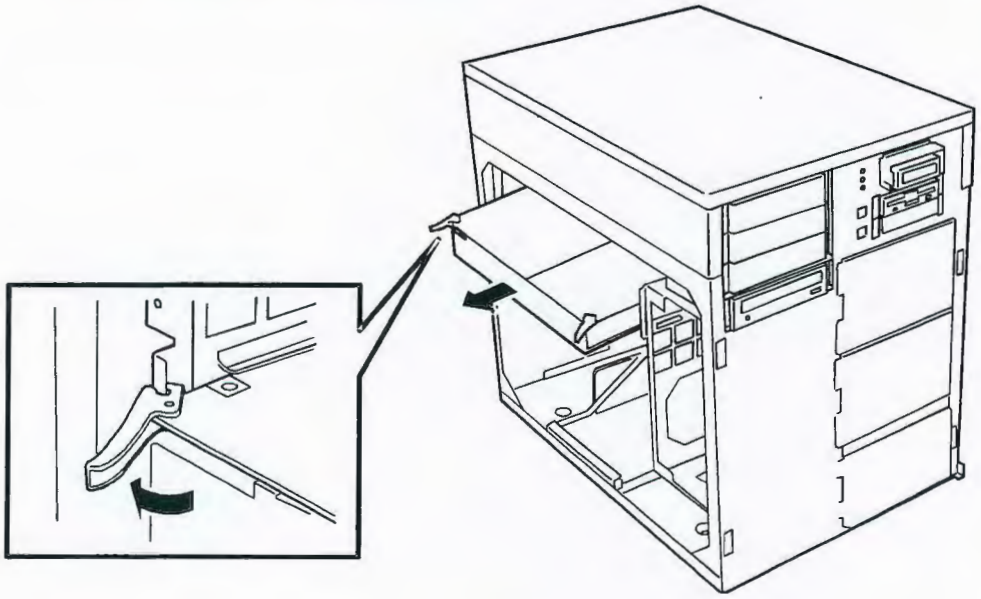


Figure 4-7. Memory Board Ejectors

4. Holding the DIMM module only by the edges, remove it from its antistatic package.
5. DIMMs are keyed so they can only be inserted one way. Position the DIMM over the socket on the board (see Figure 4-6, A and B). The notches in the bottom edge of the DIMM mate with the raised bumps in the DIMM socket.
6. Press down evenly on the DIMM until it seats correctly. The white levers on the sockets are not "tools" to aid in the insertion, only to keep the DIMM in place and to aid in extraction. The levers should click in place once the DIMM is fully inserted.
7. Repeat the above steps to install any remaining DIMMs.

8. Ensure the memory board jumper is positioned on J06 as shown in Figure 4-6 (50ns).

9. Hold the memory board by its edges and start to insert it into the slot guides. On the CPU baseboard, locate the memory board connector. Do not press in on the board yet! Ease board into the slot guides until it is just touching the connector on the CPU baseboard.

10. Be sure the ejector levers are extended so they can engage the chassis frame. Press the board carefully but firmly into the CPU baseboard connector to seat the board. Close the ejectors on both sides of the memory board. Be sure the ejector is firmly hooked in the chassis frame before closing the ejector.

11. Hook the right side of the support panel into the chassis frame and swing the support panel into position so that the rear edge of the memory boards fits snug against the panel. The support panel is secured to the chassis by a black fastener. Push in on the support panel fastener until it clicks in the locked position.

12. Replace the left side panel and turn on the system.

13. Run the BIOS Setup to confirm the DIMMs are installed correctly.

Removing DIMMs

Remove DIMMs from their sockets as follows.

1. Power off the system and remove the left side panel as described earlier in this chapter.

2. Remove the metal panel supporting the memory board. The support panel is secured to the chassis by a pin. Release the support panel by pulling the black fastener towards you (listen for two clicks). Grasp the left side of the support panel and swing it away from the chassis to remove it. Set the support panel aside for later installation.

3. Open the ejectors on both sides of the memory board (see Figure 4-7). Holding the memory board by its edges, carefully pull it out until the edge connectors are free. Place the memory board on an antistatic surface.

> ***Note:*** Use extreme care when removing a DIMM. Hold DIMMs only by their edges. Place them on an antistatic surface; do not slide them across any surface. Applying too much pressure can break the retaining clips or damage the socket slot. Apply only enough pressure on the retaining clips to release the DIMM.

4. Remove the DIMM modules one at a time starting from the highest numbered sockets.

5. To remove each DIMM, gently spread the retaining clips (see Figure 4-6) just enough so that you can pull the top edge of the DIMM away from the clips.

6. Carefully lift the DIMM away from the socket and store it in an antistatic package.

7. Repeat the above steps to remove the remaining DIMMs.

8. Hold the memory board by its edges and start to insert it into the slot guides. On the CPU baseboard, locate the memory board connector. Do not press in on the board yet! Ease board into the slot guides until it is just touching the connector on the CPU baseboard.
9. Be sure the ejector levers are extended so they can engage the chassis frame. Press the board carefully but firmly into the CPU baseboard connector to seat the board. Close the ejectors on both sides of the memory board. Be sure the ejector is firmly hooked in the chassis frame before closing the ejector.
10. Hook the right side of the support panel into the chassis frame and swing the support panel into position so that the rear edge of the memory boards fits snug against the panel. The support panel is secured to the chassis by a black fastener. Push in on the support panel fastener until it clicks in the locked position.
11. Replace the left side panel and turn on the system.

Processors

The following sections provide procedures for installing and removing the Pentium III Xeon Processor Single Edge Contact (S.E.C.) cartridge. Use these procedures when upgrading or replacing your processor(s). Each processor is packaged in a S.E.C. cartridge. The cartridge includes the processor core with an integrated 16 KB primary (L1) cache, secondary (L2) cache, heat sink, and a back cover. The processors are supported by one or more voltage regulator modules (VRM) on the CPU baseboard, depending on the number of installed processors.

Each S.E.C. cartridge installs in a Slot 2 connector on the CPU baseboard. Each slot must contain either a processor cartridge or a termination board (if there are less than four processors installed). The VRM modules are installed in a bank of VRM sockets adjacent to the processors.

Note: Your system may have up to four processors. All installed processors must be matched for speed. If replacing a processor, the replacement processor must match the speed and cache size of all installed processors. If upgrading a processor, all processors must be upgraded to match.

⚠ CAUTION

Electrostatic discharge (ESD) can damage components; place them on an antistatic surface. Update the CPU baseboard using an antistatic wrist strap attached to chassis ground.

⚠ WARNING

If the system was running, any processor and heat sink installed is hot. To avoid the possibility of a burn, let the components cool for 10 minutes before continuing with these procedures.

Installing a Processor Cartridge

Use the following procedure to install a processor cartridge.

Note: All systems ship with a processor cartridge installed in the bottom slot and termination boards in the remaining slots. Some systems may have more processors, depending on configuration. All processors must be matched in speed and cache size.

1. Power off the system and remove the left side panel as described earlier.

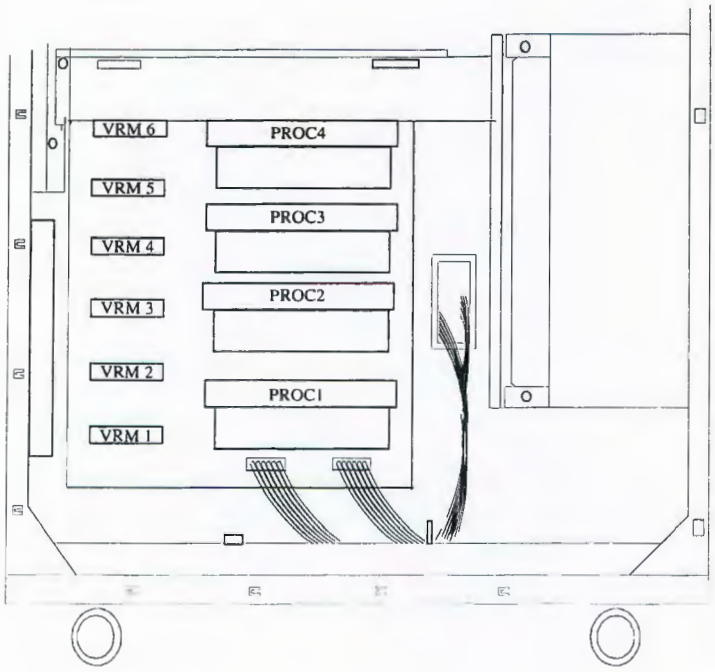


Figure 4-8. Processor and VRM Loacations

Note: Observe static precautions. Use an antistatic wrist strap. Hold processors only by their edges.

2. Remove the termination card from the slot above the installed processor cartridge(s).

   - Remove the retention arm locking the termination card in place by pressing in on the right side of the bar to release the arm.
   - Pull the retention arm towards you to release the arm from the module (see Figure 4-9, 1 and 2).

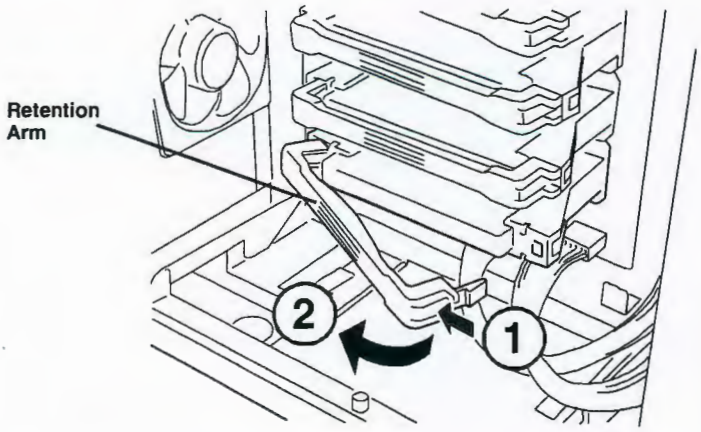


Figure 4-9. Removing the Retention Arm

   - Open the two card ejectors (one on each side) and pull the card out of the system (see Figure 4-10).

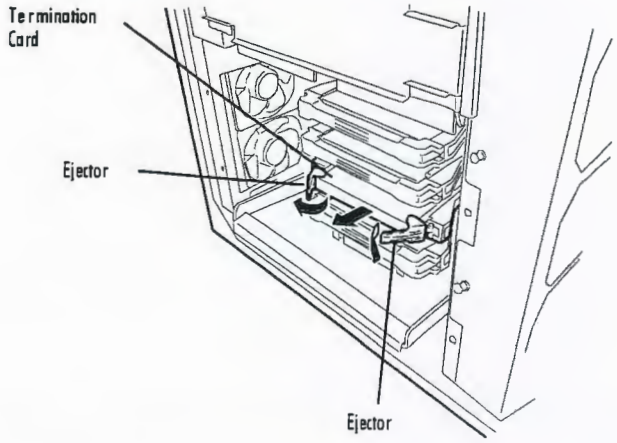


Figure 4-10. Removing the Termination Card

3. Remove a new processor cartridge from its antistatic package and place it on a grounded static-free surface or conductive foam pad.

   If tabs are not attached to the cartridge, remove them from the termination card and install on the cartridge.

   - Slightly spread open each tab so that the two pegs on the tab fit into two holes at the corner of the cartridge. Use care in opening the tab to prevent breakage.

4. Open the tabs on the cartridge and align the cartridge with the slot so that the heat sink faces down.

   If installing a termination card, align the card so that the embossed logo on the card faces up.

5. Insert the cartridge into the guide rails of the retention module (see Figure 4-11) and carefully push it into the module until resistance is felt. Three distinct clicks should be heard as the processor module seats in the retention module. Check that it is firmly seated (tabs should be closed).

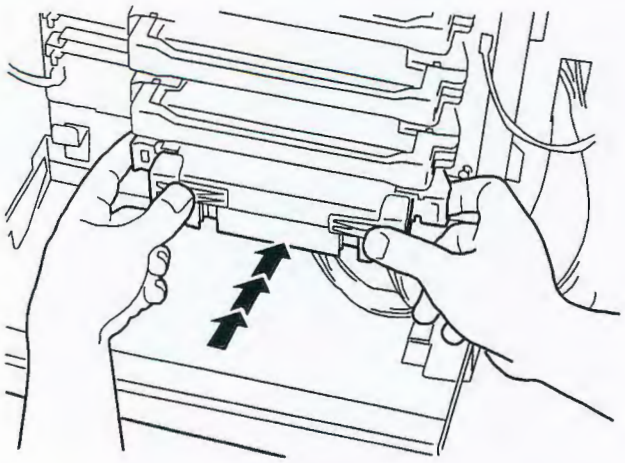


Figure 4-11. Installing the Processor

6. Reattach the retention arm as follows.
   - Align the end of the retention arm with a single alignment dot to the left and the end with the two dots to the right. The dots should match corresponding dots on the cartridge or terminator board.
   - Push the left end of the retention arm into its slot on the on the left side of the retention module.
   - Turn the retention arm to the right and snap it into place on the right side of the retention module.
7. Install the required VRM modules (single processor systems come with two VRM modules installed in VRM sockets 1 and 2). As you add processors, you need to install additional VRM modules.
   - For a second processor, install a VRM module in sockets 3 and 4 (for a total of four VRM modules for two processors).
   - For a third processor, install a VRM module in sockets 5 and 6 (for a total of six VRM modules for three processors).
   - For a fourth processor, no additional VRM modules are required.

8. Replace the left side panel and turn on the system.
9. After you have installed a new processor, run the BIOS Setup Utility to configure its speed.

Removing a Processor Cartridge or Termination Board

Use the following procedure to remove a processor cartridge or termination board.

1. Power off the system and remove the left side panel as described earlier.

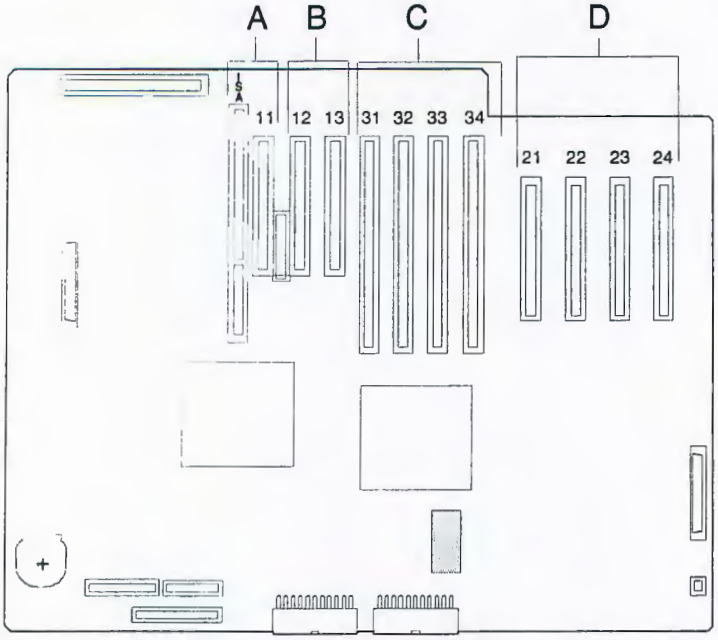
> ***Note:*** Observe static precautions. Use an antistatic wrist strap. Hold processors only by their edges.

2. On the processor or termination card being removed, push in the right end of the retention arm to unlock the arm.
3. Pull the retention arm toward you and remove the arm (see Figure 4-9).
4. Pull the two tabs on the cartridge or termination board straight out to disengage the cartridge or board from the CPU baseboard (see Figure 4-10).
5. Pull the cartridge or termination board straight out of the retention module. Place on a grounded, static-free surface or conductive foam pad.
6. Put the old cartridge in conductive foam and store in an antistatic package.
7. Install a new processor cartridge or termination card (see "Installing a Processor Cartridge or Termination Card"). If not installing a processor, install a termination card the same way as a cartridge and remove the appropriate VRM module(s).
8. Replace the left side panel and turn on the system.

Option Boards

The following sections describe how to install and remove ISA and PCI option boards. The system I/O board has four dedicated 64-bit PCI bus expansion slots, six dedicated 32-bit PCI expansion slots and one combination expansion slot that may be used as an ISA expansion slot or a 32-bit PCI expansion slot. (see Figure 4-12).

The high-performance PCI local bus allows the adoption of newer networking technology, such as 100 Mega-bit/second Ethernet NICs, with a minimum of effort and without concern for I/O bottlenecks. The PCI local bus offers up to 266 Mega-byte/second bandwidth (64-bit slots).



A Combination ISA/PCI #11Board Slot

B First PCI Bus Board Slots (32-bit) (PCI PCI #12 and PCI#13 from the left).

C Third PCI Bus Slots (64-bit) (PCI #31, PCI #32, PCI #33 and PCI #34 from the left).

D Second PCI Bus Board Slots (32-bit) (PCI #21, PCI #22, PCI #23 and PCI#24 from the left).

Figure 4-12. PCI and ISA Slot Locations

Installation Considerations

Newer adapters, designed for Plug-and-Play systems, are automatically configured by the system without any user intervention. Older ISA adapters must be manually configured as detailed below. Once the manual configuration is complete, the Plug-and-Play adapters are configured around the manually configured adapters without causing any resource conflicts.

ISA adapters can be Plug-and-Play. ISA adapters that are not Plug-and-Play must be manually configured following the instructions supplied with the board. The configuration is defined to the system in BIOS Setup. If you are adding a non-Plug-and-Play ISA option board, run the BIOS Setup Utility before installing the board. For details on running the BIOS Setup Utility, see Chapter 3, "Configuring Your System".

On system power-up and reboot, BIOS initiates a scan sequence looking for Plug-and-Play option boards installed since the last power up or reboot. The Plug-and-Play scan sequence is as follows.

- First - BIOS scans for any Plug-and-Play ISA option board installed in the ISA slot.

- Second - BIOS scans for any Plug-and-Play PCI option board installed in slots PCI #11 through #13, PCI #21 through #24 and PCI #31 through #34.

Always install option boards in the first available slot in the scan sequence. For example, if there are PCI option boards installed in slots PCI #11 and PCI #12 of your system, install your Plug-and-Play option board into slot PCI #13.

The SecuRAID 530 (Mylex 1100) is a 64-bit PCI controller and should be installed in PCI #31 slot. See Figure 4-12. Additional SecuRAID 530 PCI controllers should be installed in slots PCI #32 through PCI #34.

Controller/Adapter Hardware Configurations

Table 4-1 lists the option boards you may add to your system and provides information on slot location.

Table 4-1. Option Board Hardware Configurations

Option Board	IRQ[2]	Memory Address	I/O Address
Intel 10/100 (1st)[3]	Set by BIOS	Set by BIOS	Set by BIOS
Intel 10/100 (2nd)[3]	Set by BIOS	Set by BIOS	Set by BIOS
3COM 3c905B (1st)[3]	Set by BIOS	Set by BIOS	Set by BIOS
3COM 3c905B (2nd)[3]	Set by BIOS	Set by BIOS	Set by BIOS
Adaptec 3940UW[1, 4]	Set by BIOS	Set by BIOS	Set by BIOS
SecuRAID 530 (Mylex 1100)[1, 4]	Set by BIOS	Set by BIOS	Set by BIOS
Onboard SCSI	Set by BIOS	Set by BIOS	Set by BIOS

1 For disk controllers plugged into slots and the onboard disk controllers, the sequence for BIOS scanning to determine the primary (Boot) disk controller is:

ISA slots P11 and P12
PCI slot P2 and P3 (first PCI bus)
Onboard 7895 SCSI (first PCI bus)
PCI slot P4 through P6 (second PCI bus)
PCI slot P7 through P10 (third PCI bus).

It's recommended that the BIOS be disabled on all SCSI controllers except for the controller with the boot disk drive attached (seeSymbios Configuration Utility in Chapter 3, " Configuring Your System". This saves memory address resources and provides control over the boot device independent of board slot locations.

2. Additional IRQs can be made available as follows:

Disabling Comm Port 1 = IRQ4 is available
Disabling Comm Port 2 = IRQ3 is available
Disabling Parallel Port = IRQ7 is available.

3. A maximum of five LAN channels consisting of any combination of single or dual channel. Install PCI LAN card in the first available PCI slot from the top.

4. A maximum of four SCSI controllers may be installed. Install the first controller card in PCI slot #31 and the second controller in PCI slot #32.

Installing an Option Board

Install an option board as follows.

1. Power off the system and remove the top cover as described earlier in this chapter.

   Note: Observe static precautions. Use an antistatic wrist strap.

2. Remove the option board from its protective wrapper, holding the board only by the edges. Do not touch the board components or the gold connectors.
3. Record the option board serial number in the equipment log.
4. Set any board jumpers or switches as described in the documentation that comes with the option board.

   Note: Refer to the documentation accompanying the option board for information on whether the board is to be installed in a PCI or ISA expansion slot.

5. If the PCI board has a handle attached to one end, remove the handle (see Figure 4-13).

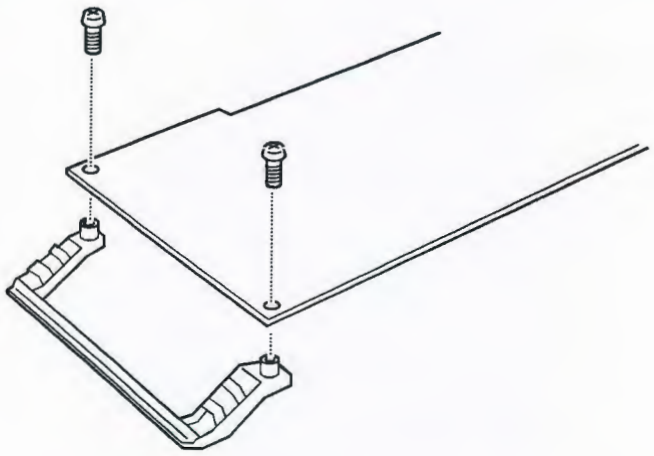


Figure 4-13. Removing the Board Handle

6. See Table 4-1 to determine the recommended option board slot assignment and configuration parameters. See Figure 4-12 to determine system board slot locations.
7. Determine the expansion slot cover that corresponds to the desired expansion slot. Release the cover lock by pressing on the cover tab and remove the expansion slot cover (see Figure 4-14).

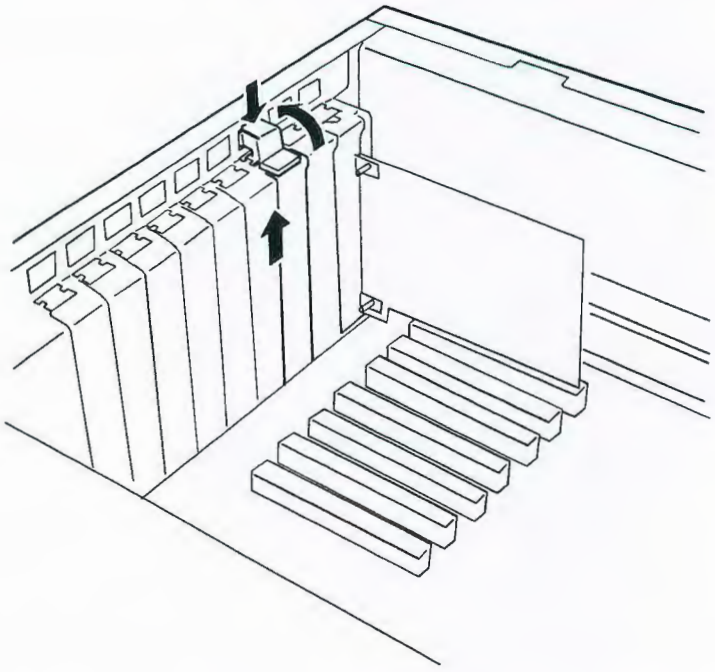


Figure 4-14. Removing the Expansion Slot Cover

8. Holding the board by its top edge or upper corners, firmly press the board into an expansion slot on the system I/O board. The tapered foot of the option board retaining bracket must fit into the mating slot in the expansion slot frame.
9. The retaining bracket fits into the space that was occupied by the expansion slot cover. Secure the expansion board by pushing down on the cover tab (see Figure 4-15).
10. If you have installed a SCSI host adapter board, go to Appendix A, "Cabling," for procedures on cabling these boards into the system. For all other boards, continue with step 11.

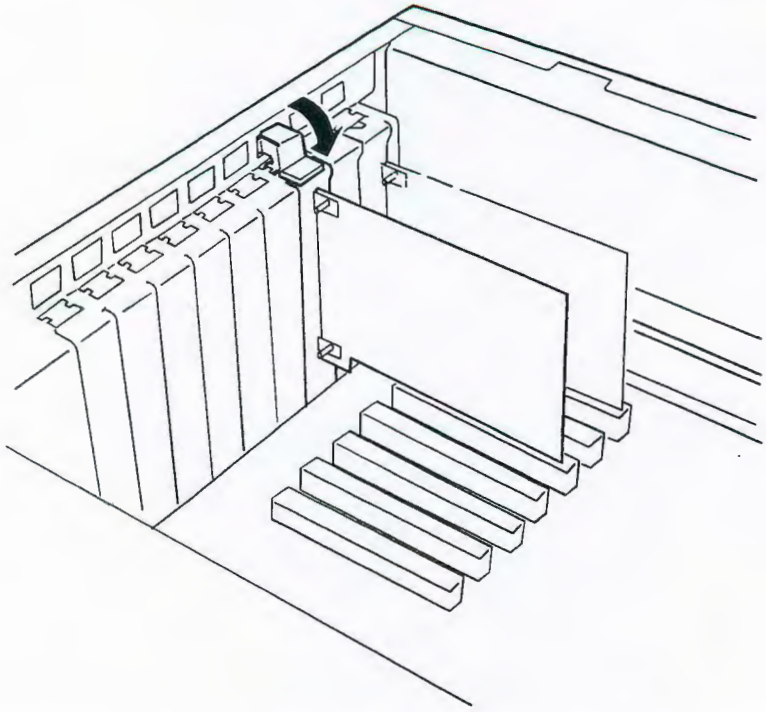


Figure 4-15. Installing an Option Board

11. Connect any external cables (if they are needed) to the installed option board.
12. Replace the top cover and power on the system.

Removing an Option Board

> ***Note:*** Expansion slot covers must be installed on all vacant slots to maintain the electromagnetic emissions characteristics of the system and to assure proper cooling of the system components.

1. Power off the system and remove the top cover as described earlier.
2. Unplug any cables attached to the option board you are removing.
3. Determine the expansion slot retaining bracket that corresponds to desired expansion slot and release the cover lock by pressing on the cover tab (see Figure 4-14).
4. Hold the board at each end, and carefully rock it back and forth until the edge connectors pull free. Make sure that you do not scrape the board against other components.
5. Remove the board from the expansion slot and place it in an antistatic wrapper.
6. If you are replacing a board, go to "Installing an Option Board," otherwise continue.
7. Install an expansion slot cover over the vacant slot. Secure the cover by pushing down on the cover tab (see Figure 4-15).
8. Replace the top cover and power on the system.

9. If you removed an non-Plug-and-Play ISA option board, run the BIOS Setup Utility to remove the ISA board configuration.

Power Supply

The following sections provide procedures for installing an additional power supply, removing a power supply, or swapping out a faulty power supply.

Installing a Power Supply

Use this procedure to add the optional power supply to your system.

1. Power off the system.
2. The empty power supply expansion bay has a blank cover. If you are installing the optional power supply, remove the two screws securing the blank cover (see Figure 4-17, B).
3. Slide the new power supply into the chassis and tighten the thumbscrews (see Figure 4-16, A) that secures the power supply.
4. Connect the power cord to the AC wall outlet and to the input receptacle on the rear of the new power supply.
5. Power on the system.

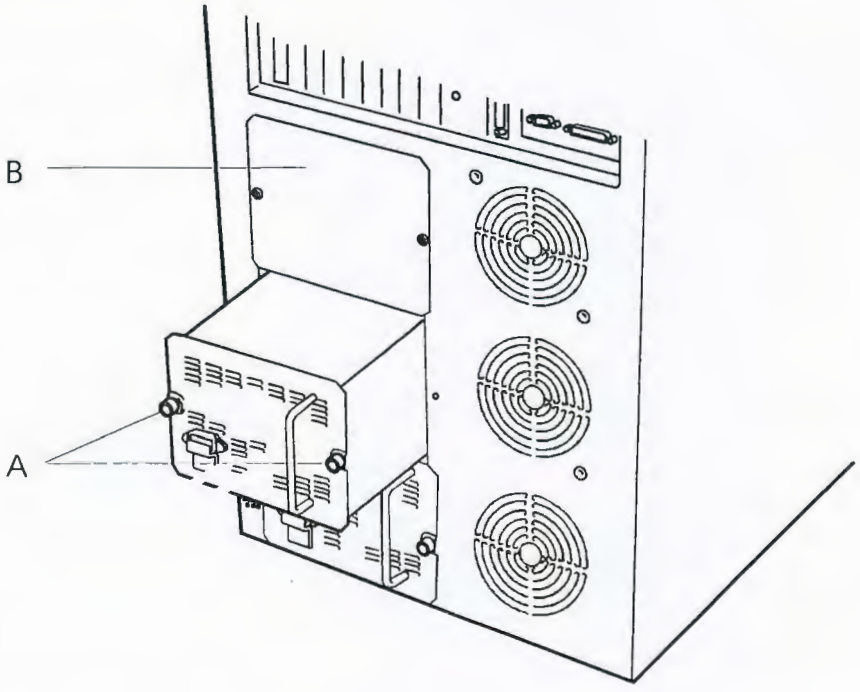


Figure 4-16. Power Supply

Removing a Power Supply

If both LED indicators on a power supply are lit, it's recommended that power to the system be turned off before removing the power supply. To remove a power supply, perform the following steps.

1. Power off the system.
2. Unplug the power cord from the AC wall outlet and from the input receptacle on the rear of the power supply you are removing.
3. Loosen the thumb lock screws (see Figure 4-16, A) that secure the power supply.
4. Hold the handle on the power supply and pull the power supply out of the system.
5. If you are replacing a power supply, go to "Installing a Power Supply," otherwise power on the system.

Hot-Swapping a Power Supply

If you are swapping out a faulty power supply, you can pinpoint which one to remove by checking the status LED indicators on each supply. If either or both of the LED indicators are off, the power supply can be hot-swapped.

If both LED indicators on a power supply are lit, it's recommended that power to the system be turned off before removing the power supply. To remove a power supply, perform the following steps.

1. Unplug the power cord from the AC wall outlet and from the input receptacle on the rear of the power supply.
2. Loosen the thumb lock screws (see Figure 4-16, A) that secure the power supply you want to replace.
3. Hold the handle on the power supply and pull the power supply out of the system.
4. Slide the replacement power supply into the chassis and tighten the thumbscrews (see Figure 4-16, A) that secure the power supply.
5. Connect the power cord to the AC wall outlet and to the input receptacle on the rear of the new power supply.

Removable Media Devices

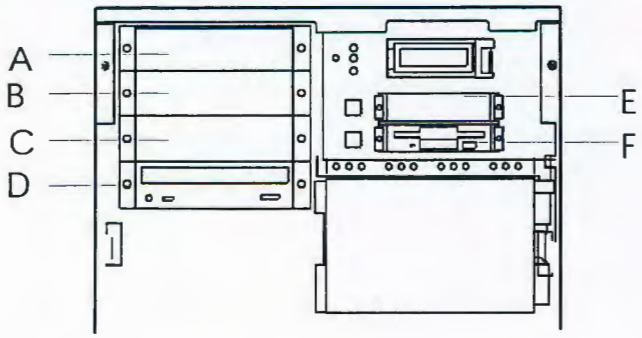
A CD-ROM drive is always mounted in bay D. Any SCSI removable media devices can be installed in peripheral bays A, B, and C. The SCSI devices should be installed in the first available bay from the bottom (bay D).

Figure 4-17 illustrates the recommended removable media configuration. The bays are intended to hold tape, CD-ROM, or other removable media drives. Narrow SCSI drives in the 5 1/4-inch bays receive control signals from channel 1 of the SCSI-3 controller on the system I/O board.

> **Note:** The SCSI termination resistors must be installed in the last SCSI drive of the daisy chain cabling (bottom media bay D). All other devices must have terminators removed.

Hard disk drives cannot be installed in a 5 1/4-inch external bay because the drive generates EMI, is more susceptible to ESD, and does not have sufficient cooling.

A 1.44 MB diskette drive is always mounted in bay F. A second 3 1/2-inch device can be installed in bay E.



Removable Media Device Bays

A. 5 1/4-inch expansion bay
B. 5 1/4-inch expansion bay
C. 5 1/4-inch expansion bay
D. CD-ROM drive
E. 3 1/2-inch expansion bay
F. 1.44 MB diskette

Bay A Removable media narrow SCSI device. Device must have the internal SCSI terminators **removed**.
BAY B Removable media narrow SCSI device. Device must have the internal SCSI terminators **removed**.
Bay C Removable media narrow SCSI device. Device must have the internal SCSI terminators **removed**.
Bay D SCSI CD-ROM (always installed). Device must have the internal SCSI terminators **installed.**
Bay E Second 3 1/2-inch device.
Bay F 1.44 MB diskette drive (always installed).

Figure 4-17. Removable Media Device Bays

Installing a 5 1/4-Inch Device or 3 1/2-Inch Diskette Drive

Install a 5 1/4-inch device or 3 1/2-inch diskette drive as follows.

⚠ CAUTION

CD-ROM devices contain a laser system and are classified as CLASS 1 LASER PRODUCTS. In case of any trouble with a CD-ROM, please contact your nearest service representative. To prevent direct exposure to the laser beam, do not try to open the enclosure.

Use of controls or adjustments or performance of procedures other than those recommended by the manufacturer may result in hazardous radiation exposure.

Note: If you are replacing a diskette drive in Bay F or installing a diskette drive in bay E, use the internal diskette drive cables provided with the system. If you are installing a SCSI device in bays A, B, or C, you must use the internal SCSI cables. Contact your sales representative or dealer for a list of approved optional peripheral devices.

1. Power off the system. Remove the left front door and the top cover as described earlier.
2. Each empty media or diskette drive bay has a blank panel tray. From the bay where you want to install a drive, remove the two screws securing the blank panel tray to the chassis (see Figure 4-18).

   Note: When installing a full height 5 1/4-inch device, remove two blank panels.

3. Grasp the blank panel tray and slide it out of the bay.
4. Remove the two screws securing each side rail to the blank panel tray (see Figure 4-19).
5. Save the blank panel tray and screws to reuse if you remove a drive from a bay later and do not reinstall one.

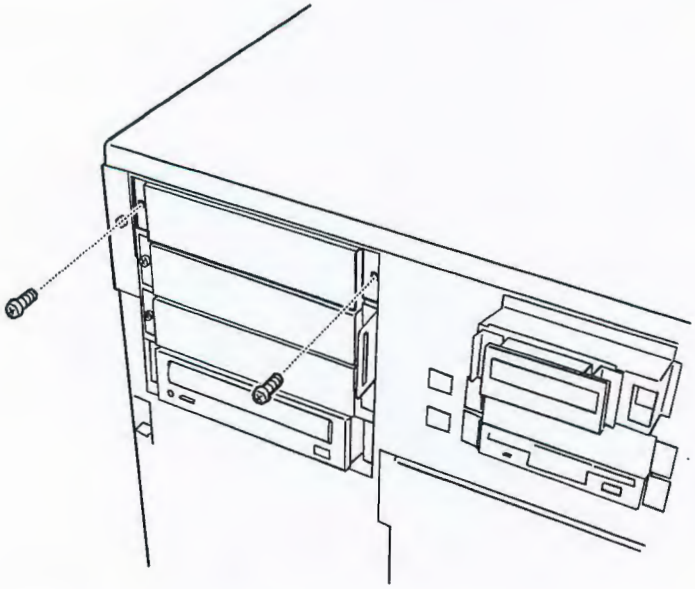


Figure 4-18. Removing Blank Panel Tray

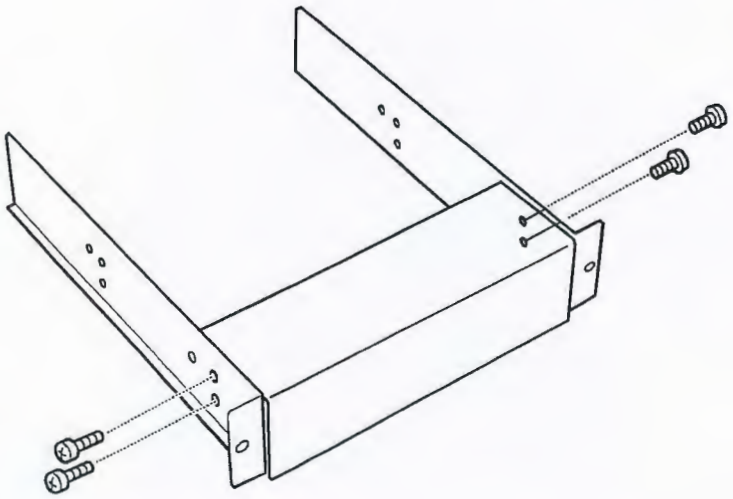


Figure 4-19. Removing Side Rails

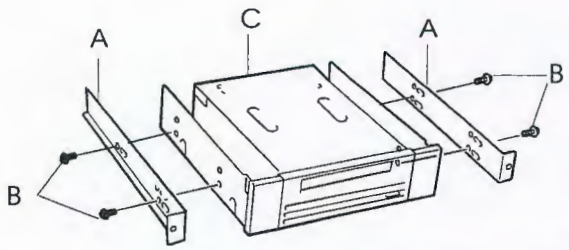
6. Remove the device from its protective wrapper and place it on an antistatic surface. Record the drive model and serial number in the equipment log.

7. Set any device jumpers or switches on the device. Refer to the installation procedures that come with the device.

> ***Note:*** SCSI termination resistors for the 5 1/4-inch devices must be installed in the last SCSI device of the daisy chain cabling (bottom media bay D). All other 5 1/4-inch devices must have terminators removed.

8. Using the four screws supplied with the drive, reinstall the side rails just removed from the blank panel tray (see Figure 4-20, A).

Note: Do not use the screws used to secure the blank panel tray.



Attaching side rails to removable media drive

A Side rails

B Four drive mounting screws

C Drive

Figure 4-20. Attaching Side Rails to a Device

9. Engage the device side rails into the bay guide rails (see Figure 4-21). Ensure that the device side rails (see Figure 4-22, A) are inside the bay guide rails exactly as shown in Figure 4-22, B.

10. Push the drive into the bay until the screw holes of the side rails are directly in front of the chassis screw holes and secure with the screws previously removed.

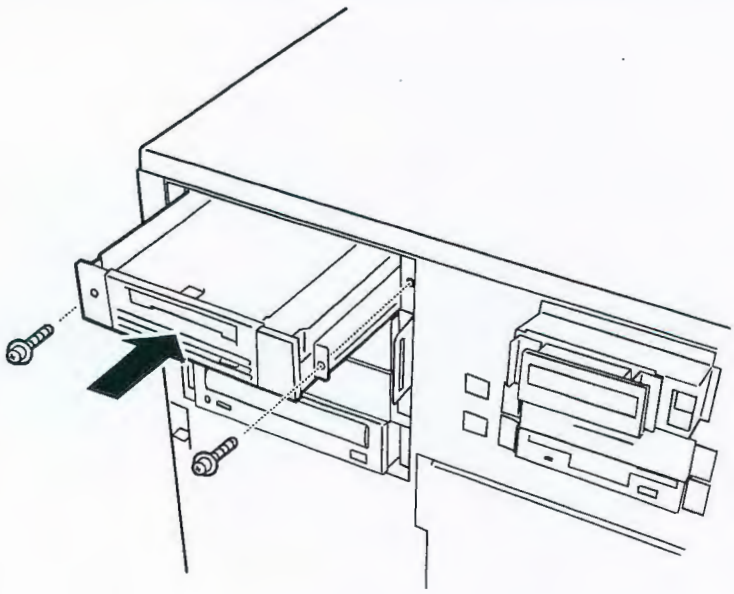


Figure 4-21. Installing a Device

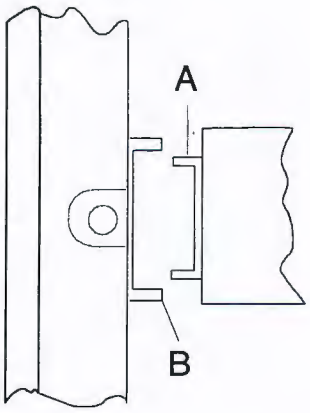


Figure 4-22. Engaging the Device Side Rails to the Bay Guide Rails

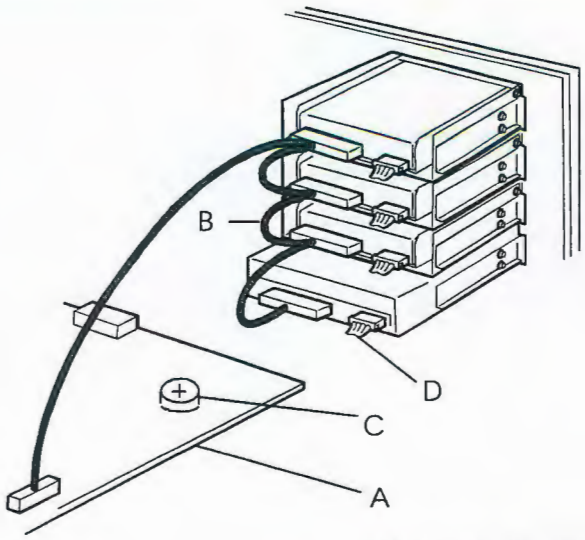
11. Connect a power cable to the back of the drive (see Figure 4-23).

> ***Note:*** For 5 1/4-inch devices, power cables are provided in the chassis for removable 5 1/4-inch media drives (including the CD-ROM that is factory-installed). These power cables are interchangeable for 5 1/4-inch devices only; you can connect any one of them to any device you install in the 5 1/4-inch media bays. The connectors are keyed and can be inserted in only one way.
>
> For 3 1/2-inch diskette drives power cables are provided in the chassis (including the diskette drive that is factory-installed). The connectors are keyed and can be inserted in only one way.

12. Connect the data cable (see Figure 4-23) to the device; the SCSI connector is keyed and can be inserted only one way.

> ***Note:*** For the 5 1/4-inch devices, be certain that you are using the 50-pin SCSI data cable. This cable comes from the system I/O board to the removable media bays and ends at the CD-ROM drive in bay D. Do not confuse this cable with the 34-pin diskette drive cable which begins on the system I/O board and ends at the diskette drive in bay F.

13. Reinstall the top cover and the left front door. Power on the system.



A System I/O board

B Signal cable

C Battery

D Power cable

Figure 4-23. Installing Device Cables

Removing a 5 1/4-Inch Device or 3 1/2-Inch Diskette Drive

Remove a 5 1/4-inch device or a 3 1/2-inch diskette drive as follows.

1. Power off the system. Remove the left front door and the top cover as described earlier in this chapter.
2. Disconnect the signal and power cables from the back of the drive (see Figure 4-23).
3. Remove the two screws securing the device to the front of the chassis (see Figure 4-21).
4. Slide the drive out the front of the bay, and place on an antistatic surface.
5. Remove and save the side rails and screws (see Figure 4-20).
6. Place the drive in an antistatic wrapper.
7. Cover an empty bay by installing a blank panel tray in the bay (see Figure 4-18 and 4-19).
8. Reinstall the top cover and the left front door. Power on the system.
9. Remove the drive serial number from the equipment log.

Hard Disk Drives

The following sections provide procedures for installing an additional disk drive, removing a disk drive, or swapping out a faulty disk drive from one of the three hot-swap drive cages. The 3 1/2-inch SCSI drives must use the industry standard 80-pin Single Connector Attachment (SCA) connector. Each drive must be installed in a carrier.

> ***Note:*** To order a carrier, contact your sales representative or dealer.

- If installing new drives, follow an installation scheme starting with the bottom left drive. Fill the cages in the sequence shown in Figure 4-24.
- If an individual SCSI drive fault LED (yellow light) is on steadily, this indicates that the drive below it has been flagged as faulty. Follow the procedure described in this section to remove the faulty drive and swap in a good one.

> ***Note:*** **Swap SCSI drives without turning off power.** This is one of the few system procedures that is safe to do with the system power left on. This is true only if a Redundant Array of Independent Disks (RAID) controller module is installed and only for the drive/carrier assemblies in the hot-swap cages, *not for drives in any other bays*.

> ***Note:*** ESD can damage disk drives, boards, and other parts. This system can withstand normal levels of environmental ESD while you are hot-swapping SCSI hard drives. However, we recommend that you do all procedures in this chapter only at an ESD workstation or provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground (any unpainted metal surface) on your system when handling parts.

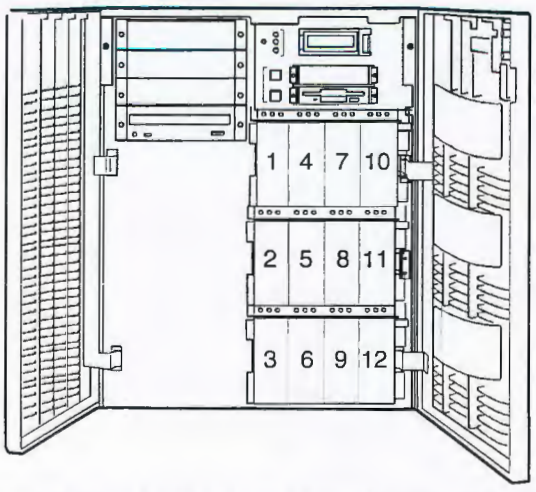
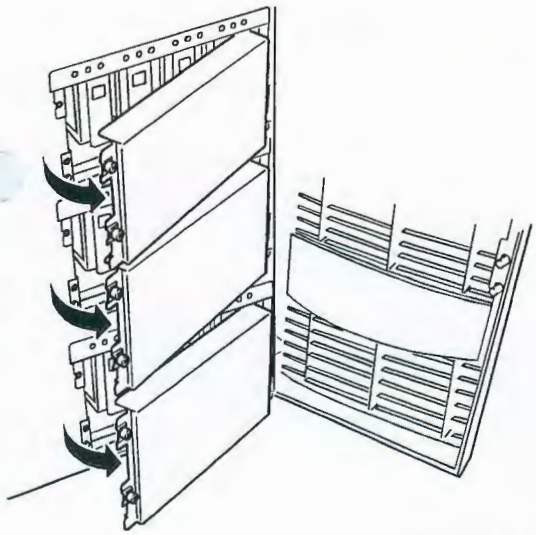


Figure 4-24. Hard Drive Installation Sequence

Installing a Hard Drive

Use this procedure to add an optional hard drive to your system.

1. Power off the system. If locked, unlock and open the right front door.
2. Referring to Figure 4-24, determine which hard drive cage will contain the new hard drive. Open the EMI metal panel in front of the hard drive cage by turning its two thumb lock screws counter clockwise (see Figure 4-25).
3. The hard drive cage has four slots for mounting the hard drives. Confirm which slot of the hard drive cage the hard drive will be mounted. The SCSI ID (0 through 3) is determined by the slot number from left to right.



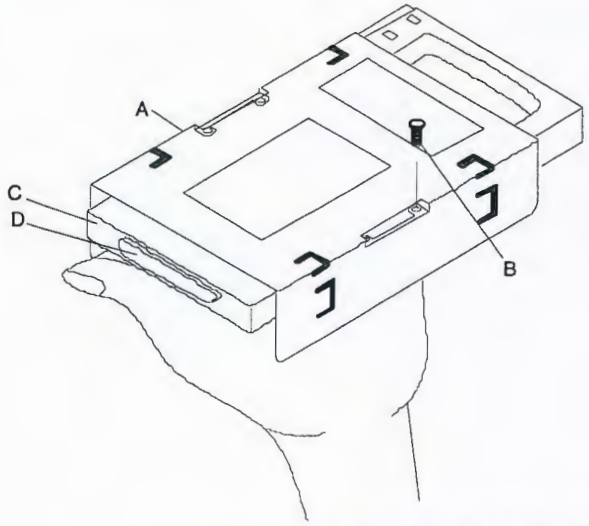
Three hard drive cages

(EMI panel and exterior door shown open)

Figure 4-25. Hard Disk Drive Cages

Note: Observe static precautions. Use an antistatic wrist strap.

4. The drive carrier is shipped with the add-on drive. Remove the new drive from its protective wrapper and place it on an antistatic surface. Record the drive model and serial numbers in the equipment log.
5. Position the drive so its SCA connector is near the top surface of the drive. Place the drive on the antistatic surface again. Slide the drive into the carrier with its SCA connector facing toward the front of the carrier (open end).
6. While holding the drive in the carrier with your left hand, align the drive's screw holes with the carrier's screw holes and insert the four screws of appropriate size and length (see Figure 4-26).
7. Pressing the lock button on the carrier handle, open the handle. Align the drive/carrier assembly so it engages the guide rails in the hard drive cage (see Figure 4-27).



Installing 3 1/2inch hard disk drive in carrier for hot-swap bays

A Carrier

B Four screws

C Hard disk drive

D SCA connector

Figure 4-26. Installing Hard Disk in Carrier

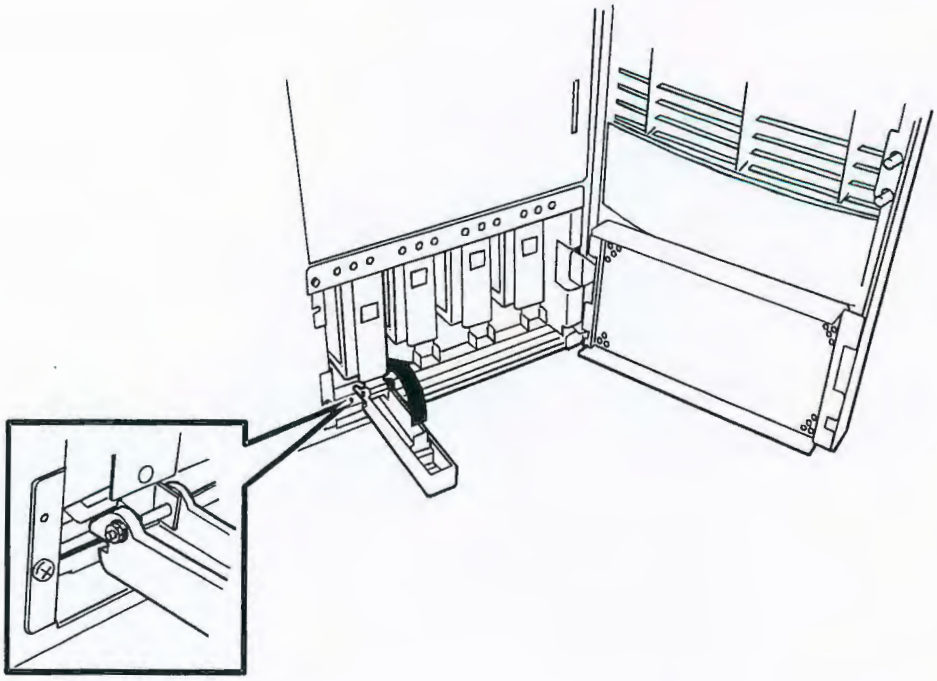


Figure 4-27. Installing Carrier in the System

8. Gently push the assembly into the bay until the drive docks with the backplane connector. Be sure the hook on the bottom of the handle engages the chassis frame and slowly lift the handle. You should hear a click when the handle locks in place.
9. Close the EMI metal panel, and secure with the two thumbscrews.
10. Power on the system and close the front door.

Removing a Hard Drive

Use this procedure to remove a hard drive from your system.

1. Power off the system. If locked, unlock and open the right front door.
2. Determine which hard drive cage contains the hard drive you want to remove. Open the EMI metal panel in front of the hard drive cage by turning its two thumb lock screws counter clockwise (see Figure 4-25).
3. The hard drive cage has four hard drive slots. Confirm which slot of the hard drive cage contains the hard drive to be removed.
4. Grasp the handle of the hard disk's carrier and press down on its thumb-release button (see Figure 4-28).
5. Remove the hard disk and place it in an antistatic wrapper. Close the EMI metal panel, and secure with the two thumbscrews.
6. Power on the system and close the front door.

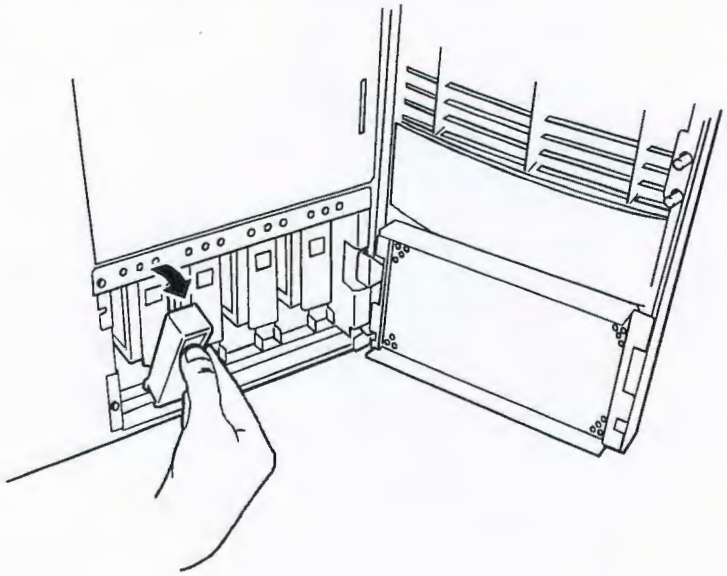


Figure 4-28. Removing the Hard Disk Carrier

Hot-Swapping a Hard Drive

If you are swapping out a faulty hard drive, you can pinpoint which drive to remove by checking the status LEDs that occur in sets of three above each of the four drive bays. See "Status LED Indicator Descriptions" in Chapter 1.

> **Note:** When the SCSI drive fault LED indicates a drive fault (steady yellow light), you can remove the drive and swap in a replacement at any time when the drive is not being accessed, without needing to power down the system. However, drive manufacturers caution against moving a drive that is still spinning because of possible damage to the drive.

1. If locked, unlock and open the right front door.
2. Determine which hard drive cage contains the faulty hard drive. Open the EMI metal panel in front of the hard drive cage by turning its two thumb lock screws counter clockwise (see Figure 4-25).
3. The hard drive cage has four hard drive slots. Check all the drive LEDs to confirm which drive to remove. See "Status LED Indicator Descriptions" in Chapter 1.

> **Note:** Depending on the drive fault, the drive may be still spinning when you remove it. Follow the next step exactly when removing drives.

4. Grasp the handle of the hard disk's carrier and press down on its thumb-release button (see Figure 4-28). Pull the faulty drive out of the bay far enough to disengage the drive connector from the backplane. Wait 30 seconds until the drive spins down, then remove the drive from the drive bay.

> **Note:** Observe static precautions. Use an antistatic wrist strap.

5. Place the removed hard drive on an antistatic surface.
6. Remove the replacement drive from its protective wrapper and place it on an antistatic surface. If a drive carrier was not shipped with the replacement drive, remove the carrier from the removed drive.
7. Place the removed hard drive in an antistatic wrapper.
8. Position the replacement drive so its SCA connector is near the top surface of the drive. Place drive on the antistatic surface again. Slide the drive into the carrier with its SCA connector facing toward the front of the carrier (open end).
9. While holding the drive in the carrier with your left hand, align the drive's screw holes with the carrier's screw holes and insert the four screws of appropriate size and length (see Figure 4-26).
10. Pressing the lock button on the carrier handle, open the handle. Align the drive/carrier assembly so it engages the guide rails in the hard drive cage (see Figure 4-27).

11. Gently push the assembly into the bay until the drive docks with the backplane connector. Be sure the hook on the bottom of the handle engages the chassis frame and slowly lift the handle. You will hear a click when the handle locks in place.

12. Close the EMI metal panel, and secure with the two thumbscrews.

13. Close the front door.

5

Problem Solving

- Resetting the System
- Troubleshooting Checklists
- Diagnostic Testing
- Specific Problems and Corrective Actions
- Error Messages
- Error Code Hardware Reference
- Status LED

This chapter helps you identify and solve problems that may occur during system installation or while using your system. The first section of this chapter tells you how to reset your system in the event of problems. The next few sections provide troubleshooting checklists and procedural steps that help you isolate specific system problems. The last sections include error message and status LED information.

⚠ WARNING

The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, 5 VDC is present on the system board whenever AC power cords are connected to the system. Before doing the following procedures, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

Resetting the System

There are two ways to reset the system.

Reset button

Pushing the reset button located on the rear panel (see Figure 3-1) clears the system memory, restarts the POST, and reloads the operating system.

Power off/on

Turning the power off and then on with the push-button switch on the front panel has the same effect as pushing the reset button, except that power is halted to all peripherals.

Troubleshooting Checklists

The following paragraphs provide troubleshooting checklists for problems that occur at initial system startup, when you run new application software, and after the system hardware and software were running correctly.

Initial System Startup

Problems that occur at initial system startup are usually caused by incorrect installation or configuration. Hardware failure is a less frequent cause. If you have problems during initial system startup, check the following.

- Are the system power cords properly connected to the system and plugged into NEMA 5-15R outlets (100-120 VAC) or NEMA 6-15R outlets (200-240 VAC)?
- Is AC available at the wall outlets?

- Is the power on/off push-button switch on the front panel in the ON position (power on LED should be lit)?
- Are all cables correctly connected and secured?
- Are all the PCI/ISA option boards fully seated in their connector slots on the system board?
- Are all jumper settings on the system I/O board correct? For jumper information, see Chapter 3, "Configuring Your System."
- Are all jumper and switch settings on option boards and peripheral devices correct? If applicable, ensure that there are no conflicts; for example, two option boards sharing the same interrupt, memory or I/O addresses.
- Are the processor(s) and VRMs fully seated in their slots on the system board? See Chapter 4, "Upgrading Your System," for installation procedures.
- Are all DIMMs fully seated and installed correctly? See Chapter 4, "Upgrading Your System," for installation instructions.
- Are all removable media drives and disk drives installed correctly? See Chapter 4, "Upgrading Your System."
- Is the system's hard drive properly formatted or defined?
- Is the operating system properly loaded? Refer to the operating system documentation.
- Are all drivers properly installed? For information about installing drivers, refer to your network operating system configuration guide.
- Are the configuration settings in BIOS Setup correct? For information about running these utilities, see Chapter 3, "Configuring Your System."

If the above items are all correct, but the problem reoccurs, refer to *Diagnostic Testing* in this chapter.

Running New Application Software

Problems that occur when you run new application software are usually related to the software. Faulty equipment is much less likely, especially if other software runs correctly. If you have problems while running new application software, check the following.

- Does the system meet the minimum hardware requirements for the software? Refer to the software documentation.
- Is the software an authorized copy? Unauthorized copies often do not work. Obtain an authorized copy of the software.
- If you are running the software from a floppy disk, is it a good copy?

- If you are running the software from a hard disk drive, is the software correctly installed? Were all necessary procedures followed and files installed?
- Are the correct device drivers installed?
- Is the software correctly configured for the system?
- Are you using the software correctly?
- Try a different copy of the software to see if the problem is with the copy you are using.
- If other software runs correctly on the system, contact your vendor about the failing software.

If the problems persist with the software, contact the software vendor's customer service representative.

After System Has Been Running Correctly

Problems that occur after the system hardware and software have been running correctly often indicate equipment failure. However, many situations that are easy to correct can also cause such problems. If you have problems after the system has been running correctly, check the following.

- If you are running the software from a floppy disk, try a new copy of the software.
- If you are running the software from a hard disk drive, try running it from a floppy. If the software runs correctly, there may be a problem with the copy on the hard disk. Reinstall the software on the hard disk drive and try running it again. Make sure all the necessary files are installed.
- If the problem recurs, you may need to reformat the hard disk drive. The drive, drive controller, or system boards may be defective.
- If the problems are intermittent, there may be a loose cable, dirt in the keyboard (if keyboard input is incorrect), a marginal power supply, or other marginal component failures.
- If you suspect that a transient voltage spike, power outage, or brownout might have occurred, reload the software and try running it again. Symptoms of voltage spikes include a flickering video display, unexpected system reboots, and the system not responding to user commands.

> ***Note:*** Voltage spikes can corrupt or destroy data files on the drive. If you are experiencing voltage spikes on the power line, install a surge suppresser between the power outlet and the system power cords.

If the problem recurs after you have checked and corrected all of the above items, refer to *Diagnostic Testing* in this chapter.

Diagnostic Testing

This section provides a more detailed approach to identification of a system problem and locating its source.

Error Checking

Each time you turn on the system, POST runs automatically and checks the system boards, processors, memory, keyboard, and most installed peripheral devices.

If POST finds an error, it displays an error message. Refer to the *Error Message* section in this chapter for an explanation of each error message.

Troubleshooting Guide

Use the following troubleshooting procedures to help you identify a problem. These general procedures lead you through the following:

- Preparing the system for diagnostic testing
- Monitoring POST while it is running
- Verifying proper operation of key system LEDs
- Confirming loading of the operating system.

Preparing the System for Diagnostic Testing

To prepare the system for diagnostic testing, perform the following:

> **Note:** Before disconnecting any peripheral cables from the system, turn off the system and any external peripheral devices. Failure to do so can cause permanent damage to the system and/or the peripheral devices.

1. Turn off the system and all external peripheral devices. Disconnect all devices from the system except the keyboard and video monitor.
2. Make sure the system power cords are plugged into a properly grounded AC outlets.
3. Make sure your video display monitor and keyboard are correctly connected to the system. Turn on the video monitor. Set its brightness and contrast controls to at least two-thirds of their maximum ranges (refer to the documentation supplied with your video display monitor).
4. If the operating system normally loads from the hard disk drive, make sure there is no diskette in drive A. Otherwise, place a diskette containing the operating system files in drive A.
5. Turn on the system. If the power indicator LED does not light, refer to *Power Light Does Not Light* found later in this chapter.

Monitoring POST While Running

Each time you turn on the system, POST runs automatically and checks the system board, CPU, memory, keyboard, and most installed peripheral devices.

During the memory test, POST displays the amount of memory that it is able to access and test. Depending on the amount of memory, it may take several minutes to complete the memory test. When the memory test completes, the following is displayed:

```
Press <F2> to enter SETUP
```

Press **<F2>** if you want to run BIOS Setup. When the utility appears, follow the instructions on your monitor to configure BIOS. See Chapter 3, "Configuring Your System." If you do not press **<F2>**, the above message remains for a few seconds and the boot process continues.

When this message appears:

```
Press Ctrl-C to start the Symbios Configuration Utility
```

Press **<Ctrl+C>** if you want to configure SCSI devices in your system. When the utility appears, follow the instructions on your monitor to configure the SCSI host adapter settings and run the SCSI disk utilities. See Chapter 3, "Configuring Your System." If you choose not to run the Symbios Configuration Utility, the boot process continues.

If POST finds an error, it displays an error message. This information is useful to your service representative. Refer to the *Error Message* section in this chapter for an explanation of each error code.

The BIOS indicates errors by writing an error code to the PS/2-standard logging area in the Extended BIOS Data Area, and by displaying a message on the screen, which is sometimes preceded by the POST Error Code. The error code will also be logged to the Event Logging area.

Verifying Proper Operation of Key System Indicators

As POST determines the system configuration, it tests for the presence of each mass storage device installed in the system. As each device is checked, its activity indicator should turn on briefly. Check for the following.

- Does the diskette drive activity indicator turn on briefly. If not, refer to Diskette *Drive Activity Indicator Does Not Light* in this chapter.
- If a second diskette drive is installed, does its activity indicator turn on briefly. If not, refer to *Diskette Drive Activity Indicator Does Not Light* in this chapter.
- If there is a hard disk drive or SCSI devices installed in the system, does the hard disk drive activity indicator turn on briefly. If not, refer to *Hard Disk Drive Activity Indicator Does Not Light* in this chapter.

Once the system boots up, the operating system prompt appears on the screen. The prompt varies according to the operating system. If the operating system prompt does not appear, refer to *Running New Application Software* in this chapter.

Specific Problems and Corrective Actions

This section provides possible solutions for the following specific problems:

- Power LED does not light
- System cooling fans do not rotate
- No characters appear on screen
- Characters on the screen appear distorted or incorrect
- Floppy disk drive access LED does not light
- Hard disk drive access LED does not light
- Problems with application software.

Try the solutions in the order given. If you cannot correct the problem, contact your service representative for assistance.

Power LED Does Not Light

Check the following.

- Is the system operating normally? If so, the power LED is probably defective.
- Are there other problems with the system? If so, check the items listed under *System Cooling Fans Do Not Rotate.*

System Cooling Fans Do Not Rotate

Note: In addition to the cooling fans that are an integral part of each power supply, the system has six internal fans. The six fans are redundant in configuration. This means if one fan fails, its associated fan changes its rotating speed to high. There are no serviceable components inside the power supply. If the power supply is opened, the manufacturer's warranty is voided.

Check the following.

- Is AC power available at the wall outlet?
- Are the system power cords properly connected to the system and the AC wall outlets?

- Are the power supply LED status lamps on each supply lit? If either LED on a supply is off, the power supply is defective and must be replaced.
- Is the power connector for the cooling fan connected to the system I/O board (option board fan) and the CPU base board (CPU fans)?
- Is the front panel power on indicator lit? If this LED is amber, a defective power supply is indicated.

If the switches and connections are correct and the power outlet is functioning, a power supply has probably failed. Contact your service representative for assistance.

No Characters Appear On Screen

Check the following.

- Is the riser card fully seated in the system I/O board connector? The riser card is the small card that the mouse and keyboard plug into.
- Is the video display plugged in and turned on?
- Are the brightness and contrast controls properly adjusted?
- Are the video display switch settings correct?
- If you are using an option video controller board, verify that the video controller board is fully seated in the system board connector.
- Is the video display signal cable properly installed?

If there are still no characters on the screen after you check the above, contact your service representative or authorized dealer for assistance.

Characters are Distorted or Incorrect

Check the following.

- Are the brightness and contrast controls properly adjusted on the video display? Refer to the documentation supplied with your video display.
- Are the video display signal and power cables properly installed?
- If the problem persists, the video display may be faulty or it may be the incorrect type. Contact your service representative for assistance.

Floppy Disk Drive Activity LED Does Not Light

Check the following.

- Are the floppy disk drive power and signal cables properly installed?
- Are all relevant switches and jumpers on the floppy disk drive set correctly?
- Is the floppy disk drive properly configured in BIOS Setup?

If you are using the onboard floppy disk controller, use BIOS Setup to make sure that Onboard Floppy is set to Enabled. Conversely, to use an optional fixed/floppy disk controller, make sure that Onboard Floppy is set to Disabled. For information about running BIOS Setup, see Chapter 3, Configuring Your System."

If the problem persists, there may be a problem with the floppy disk drive, system I/O board, or drive signal cable. Contact your service representative for assistance.

Hard Disk Drive Activity LED Does Not Light

If you have installed one or more hard disk drives in your system, check the following.

- Is the optional disk controller board fully seated in the system I/O board connector?
- Is the disk drive seated properly?
- Are the jumpers on the system I/O board set correctly?

If you received error messages, refer to the *Error Message* section for information about error messages.

If the problem persists, there may be a problem with the hard disk drive, the optional controller board, system I/O board, drive signal cable, or LED

Error Messages

The server status is displayed in 16 digits of alphanumeric characters on the liquid crystal display (LCD) on the front of the server. Use this indication together with the status LED indications to solve problems that may occur while using your system.

> ***Note:*** Record the indication of LCD before contacting your service representative. An alarm indication is useful when maintaining the server.

Alarm Indication during POST

Each time you turn on the system, POST runs automatically. During POST, the test that is being executed is displayed on the LCD. If the same code has been displayed for more than 5 minutes, an occurrence of fatal error is assumed. Record the code displayed on LCD, then contact your service representative.

When an alarm that restricts operation (such as degradation function) or that can be recovered by re-setup has occurred, an error code is displayed on the LCD. (An error message is also displayed on the display unit and the error is recorded in the Event Log.)

Table 5-1 lists the error codes and messages you may see during POST.

Table 5-1. POST Error Codes and Messages

Error Code and Message		Explanation	Action
0200	Failure Fixed Disk	Hard disk failure	Replace the hard disk.
0210	Stuck Key	The key is kept on pressed.	Stop pressing the key.
0211	Keyboard error	Keyboard error	Replace the keyboard.
0212	Keyboard Controller Failed	Keyboard controller failed.	Replace the keyboard.
0213	Keyboard locked – Unlock key switch	Keyboard is locked.	Start BIOS Setup to set up the keyboard correctly.
0220	Monitor type does not match CMOS – Run SETUP	The display unit is incorrectly setup.	Start BIOS Setup to set up the monitor correctly.
0230	System RAM Failed at offset	System RAM error. Offset address	Ask you customer service representative to replace memory module.
0231	Shadow RAM Failed at offset	Shadow RAM error. Offset address	Ask you customer service representative to replace memory module.
0232	Extended RAM Failed at address line	Extended RAM error. Offset address	Contact your customer service representative.
0233	Memory type mixing detected	Memory devices of different types are installed.	Install correct memory devices.
0234	Single-bit ECC error	A 1-bit memory error occurred.	Contact your customer service representative.

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0235	Multiple-bit ECC error occurred	A multi-bit memory error occurred.	Contact your customer service representative.
0250	System battery is dead – Replace and run SETUP	No system battery is installed.	Install the battery. (After restarting the computer, start the BIOS Setup Utility to set required values again.)
0251	System CMOS checksum bad – Default configuration used	Checksum of system CMOS is not correct.	The default values were set. Start the BIOS Setup Utility to set required values again.
0260	System timer error	System timer error	Contact your customer service representative.
0270	Real time clock error	Realtime lock error	Contact your customer service representative.
0271	Check date and time setting	Realtime clock is set incorrectly.	Start the BIOS Setup Utility to set the time again. If the same error occurs still, contact your customer service representative.
0280	Previous boot incomplete – Default configuration used	The previous activation has not been terminated normally.	Correct the setup values by using the BIOS Setup Utility and start the system again.
02B0	Diskette drive A error	Error in floppy disk A	Contact your customer service representative.
02B1	Diskette drive B error	Error in floppy disk B	Contact your customer service representative.
02B2	Incorrect Drive A type – run SETUP	The type of drive A is incorrect.	Start the BIOS Setup Utility to set required values again.
02B3	Incorrect Drive B type – run SETUP	The type of drive B is incorrect.	Start the BIOS Setup Utility to set required values again.
02D0	System cache error – Cache disabled	System cache error	No cache can be used. Contact your customer service representative.
0B1B	PCI System Error on Bus/Device/Function	A PCI system error occurred in bus/device/function.	Contact your customer service representative.
0B1C	PCI Parity Error on Bus/Device/Function	A PCI parity error occurred in bus/device/function.	Contact your customer service representative.
0B22	CPUs are installed out of order	CPUs are installed in incorrect order.	This does not indicate an error. However, change the slot in which the CPU is installed.
0B30	Fan 1 Alarm occurred.	Memory cooling fan error	Check whether the fan is clogged. Clean it if the fan is covered with dust. If no error is found or the failure is cleared in spite of cleaning, contact your customer service representative.
0B31	Fan 2 Alarm occurred.	Memory cooling fan error	Follow 0B30 "Action."

0B32	Fan 3 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."
0B33	Fan 4 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."
0B34	Fan 5 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."
0B35	Fan 6 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0B36	Fan 7 Alarm occurred.	Optional board cooling fan error	Check whether the fan is clogged. Clean it if the fan is covered with dust. If no error is found or the failure is cleared in spite of cleaning, contact your customer service representative.
0B40	Invalid System Configuration Data	System configuration data is damaged.	Start the BIOS Setup Utility to set the time again. If the same error reoccurs, contact your customer service representative.
0B41	System Configuration Data Read error	Read error on the data configuring the system	Ask your customer service representative for System I/O board replacement.
0B42	Resource Conflict	The PCI board resource is not properly mapped.	Start the BIOS Setup Utility for reset. If the same error reoccurs, contact your customer service representative.
0B43	WARNING: IRQ not configured	The PCI board interrupt is not properly set.	Follow OB42 "Action."
0B44	Expansion Rom not initialized	The expansion ROM on the PCI board is not initialized.	Check PCI board installation. If the same error reoccurs, ask your customer service representative for System I/O board replacement.
0B45	System Configuration Data Write Error	Write error on the data configuring the system.	Ask you customer service representative for System I/O board replacement.
0B50	CPU#1 with error taken off line.	Because an error was detected in CPU #1, it was disabled.	The CPU is disabled. Contact your customer service representative.
0B51	CPU#2 with error taken off line.	Because an error was detected in CPU #2, it was disabled.	Follow 0B50 "Action."
0B52	CPU#3 with error taken off line.	Because an error was detected in CPU #3, it was disabled.	Follow 0B50 "Action."
0B53	CPU#4 with error taken off line.	Because an error was detected in CPU #4, it was disabled.	Follow 0B50 "Action."
0B58	Forced to use CPU#1 with error	An error was detected in CPU#1.	The system is started forcibly though an error is detected in the CPU displayed. Contact your customer service representative.
0B59	Forced to use CPU#2 with error	An error was detected in CPU#2.	Follow 0B58 "Action."
0B5A	Forced to use CPU#3 with error	An error was detected in CPU#3.	Follow 0B58 "Action."
0B5B	Forced to use CPU#4 with error	An error was detected in CPU#4.	Follow 0B58 "Action."

0B60	DIMM group #1 has been disabled	A memory error was detected in memory board #1, bank A, . Memory is disabled. See Figure 5-3.	Contact your customer service representative.

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0B61	DIMM group #2 has been disabled	A memory error was detected in memory board #1, bank B. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B62	DIMM group #3 has been disabled	A memory error was detected in memory board #1, bank C. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B63	DIMM group #4 has been disabled	A memory error was detected in memory board #1, bank D. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B64	DIMM group #5 has been disabled	A memory error was detected in memory board #2, bank A,. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B65	DIMM group #6 has been disabled	A memory error was detected in memory board #2, bank B. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B66	DIMM group #7 has been disabled	A memory error was detected in memory board #2, bank C Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B67	DIMM group #8 has been disabled	A memory error was detected in memory board #2, bank D. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B6F	DIMM group with error is enabled	Memory error was detected.	Errors are detected in all memory devices. Contact your customer service representative.
0B70	The error occurred during temperature sensor reading	An error was detected in the middle of detection of abnormal temperature.	Contact your customer service representative.
0B71	System Temperature out of the range	Abnormal temperature was detected.	Turn off the power once. Then check whether the fan is clogged. Clean it if the fan is covered with dust. If no error is found or the failure is cleared in spite of cleaning, contact your customer service representative.
0B74	The error occurred during voltage sensor reading	An error occurred during detection of voltage.	Contact your customer service representative.
0B75	System Voltage out of the range	Abnormal system voltage was detected.	Contact your customer service representative.
0B78	The error occurred during fan sensor reading	An error was detected during read of FAN sensor.	Contact your customer service representative.

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0B7C	The error occurred during the redundant power module confirmation	An error occurred while redundant power supply was configured.	Contact your customer service representative.
0B80	IBF or OBF Check Error occurred by the access via System Management Controller	No response was issued for access to System Management Controller.	Contact your customer service representative.
0B81	System Management Controller Firmware CRC check error occurred	An error occurred in firmware of System Management Controller.	Contact your customer service representative.
0B82	Hardware error of System Management Controller occurred	A hardware error was detected in System Management Controller.	Contact your customer service representative.
0B83	All Device of 1st System Management Bus became not able to accessed	SMBus could not be accessed via System Management Controller.	Contact your customer service representative.
0B84	Some Device of 1st System Management Bus became not able to accessed	No device could not be accessed through SMBus access via System Management Controller.	Contact your customer service representative.
0BB0	SMBIOS – SROM data read error	Reading SROM data failed.	Contact your customer service representative.
0BB1	SMBIOS – SROM data checksum bad	SROM data checksum was incorrect.	Contact your customer service representative.
0C00	RomPilot reports error number xx	RomPilot initialization error	Perform the configuration again. If the error occurs, a hardware failure may occur. Contact your customer service representative.

Alarm Indication During System Operation

Table 5-2 lists the alarm indications displayed on LCD during server operation.

Table 5-2. Operational Error Codes and Messages

Error Code and Message		Explanation	Action
15FF	CPU Bus Err	CPU bus error	Check CPU installation or termination board installation. If the same error reoccurs, contact your customer service representative.
0B01	CPU Error 1	CPU#1 error	Follow 15FF "Action."
0B02	CPU Error 2	CPU#2 error	Follow 15FF "Action."
0B03	CPU Error 3	CPU#3 error	Follow 15FF "Action."
0B04	CPU Error 4	CPU#4 error	Follow 15FF "Action."
0B11	CPU Thermal	CPU#1 temperature error	Clean the cooling fan. If the same error reoccurs, contact your customer service representative.
0B12	CPU Thermal	CPU#2 temperature error	Follow 0B11 "Action."
0B13	CPU Thermal	CPU#3 temperature error	Follow 0B11 "Action."
0B14	CPU Thermal	CPU#4 temperature error	Follow 0B11 "Action."
1052	Fan Alarm	Memory cooling fan error	Follow 0B11 "Action."
1053	Fan Alarm	Memory cooling fan error	Follow 0B11 "Action."
1054	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1055	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1056	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1057	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1058	Fan Alarm	Optional board cooling fan error	Follow 0B11 "Action."
2101	Memory Err	A memory error was detected in a DIMM located on memory board #1.	See Figure 5-5 to determine which DIMM caused the memory error on memory board #1. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2102	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2103	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2104	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2105	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."

2106	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2107	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2108	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2109	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210A	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210B	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210C	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210D	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210E	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."

Table 5-2. Operational Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
210F	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2110	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2111	Memory Err	A memory error was detected in a DIMM located on memory board #2.	See Figure 5-5 to determine which DIMM caused the memory error on memory board #2. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2112	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2113	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2114	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2115	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2116	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2117	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2118	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2119	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211A	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211B	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211C	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211D	Memory Err	See 2111 "Explanation."	Follow 2101 "Action."
211E	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211F	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2120	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."

2201	Memory Err	A memory error was detected in a DIMM pair located on memory board #1.	See Figure 5-4 to determine which DIMM pair caused the memory error on memory board #1. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2203	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
2205	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
2207	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
2209	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
220B	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
220D	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
220F	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."

Table 5-2. Operational Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
2211	Memory Err	A memory error was detected in a DIMM pair located on memory board #2.	See Figure 5-4 to determine which DIMM pair caused the memory error on memory board #2. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2213	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
2215	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
2217	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
2219	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
221B	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
221D	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
221F	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
	PCI PERR	PCI bus parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0901	PCI PERR	PCI bus#1 parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0902	PCI PERR	PCI bus#2 parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0903	PCI PERR	PCI bus#3 parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
	PCI SERR	PCI bus system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0A01	PCI SERR	PCI bus#1 system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0A02	PCI SERR	PCI bus#2 system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.

0A03	PCI SERR	PCI bus#3 system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
1012	Power +3.3V	3.3V power failure	Ask your customer service representative for power unit or board replacement.
1013	Power +5V	5V power failure	Ask your customer service representative for power unit or board replacement.
1014	Power +12V	12V power failure	Ask your customer service representative for power unit or board replacement.
1022	Power +1.5V	1.5V power failure	Ask your customer service representative for power unit or board replacement.
1023	Power +5.0VS	5V power failure	Ask your customer service representative for power unit or board replacement.
1010	Power CPU#1	CPU#1 power failure. See Figure 5-1.	Check CPU VRM installation. If the same error reoccurs, contact your customer service representative.
1011	Power CPU#2	CPU#2 power failure. See Figure 5-1.	Follow 1010 "Action."
1020	Power CPU#3	CPU#3 power failure. See Figure 5-1.	Follow 1010 "Action."
1021	Power CPU#4	CPU#4 power failure. See Figure 5-1.	Follow 1010 "Action."
1040	Power Error 1	Power unit #1 (bottom) failure. See Figure 5-2.	Ask your customer service representative for replacement of the failed power unit.
1041	Power Error 2	Power unit #2 (middle) failure. See Figure 5-2.	Follow 1040 "Action."
1042	Power Error 3	Power unit #3 (top) failure. See Figure 5-2.	Follow 1040 "Action."

Table 5-2. Operational Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
1028	Power L2 #1	CPU L2 cache power failure. See Figure 5-1.	Check CPU VRM installation. If the same error reoccurs, contact your customer service representative.
1029	Power L2 #2	CPU L2 cache power failure. See Figure 5-1.	Check CPU VRM installation. If the same error reoccurs, contact your customer service representative.
10F0	Pow Major B	Power major alarm	Contact your customer service representative.
105F	SCSI Open	The front door is open.	This is a Warning, not an error.
105E	HPC Open	The PCI slot door on the top cover is open.	This is a warning, not an error
DUMP		The DUMP switch is pressed.	This is not an error.
Sleep:x		The system is running in the power save mode. ("x" indicates the power save mode level (1 through 4).)	This is not an error. Pressing the SLEEP switch restores the original state. Level setup and definitions depend on the OS.
SMI Timeout		The system is stalled due to a hardware failure.	A critical error occurred. Contact your customer service representative.
SMBus Err xxyy		SMBus device error. (xx: channel, yy: status)	Contact your customer service representative.
ISA Error		ISA I/O check error	Check ISA board installation. If the same error reoccurs, contact your customer service representative.
1017	Thermal Hi	PCI (unknown location) high temperature error	Shut down the server to check if fans and other components are covered with dust. When a low temperature error occurred, raise the room temperature to warm up the server for operations. If there appears to be no cause of a malfunction, contact your customer service representative.
1061	Thermal Hi	Front panel high temperature error	Follow 1017 "Action."
1062	Thermal Hi	HDD cage #1 (botom) high temperature error	Follow 1017 "Action."
1063	Thermal Hi	Baseboard high temperature error	Follow 1017 "Action."

1064	Thermal Hi	HDD cage #2 (middle) high temperature error	Follow 1017 "Action."
1065	Thermal Hi	HDD cage #2 (top) high temperature error	Follow 1017 "Action."
1068	Thermal Hi	CPU#1 high temperature error	Follow 1017 "Action."
1069	Thermal Hi	CPU#2 high temperature error	Follow 1017 "Action."
106A	Thermal Hi	CPU#3 high temperature error	Follow 1017 "Action."
106B	Thermal Hi	CPU#4 high temperature error	Shut down the server to check if fans and other components are covered with dust. When a low temperature error occurred, raise the room temperature to warm up the server for operations. If there appears to be no cause of a malfunction, contact your customer service representative.
1017	Thermal Lo	PCI (unknown location) low temperature error	Follow 106B "Action."
1061	Thermal Lo	Front panel low temperature error	Follow 106B "Action."
1062	Thermal Lo	HDD cage #1 (bottom) low temperature error	Follow 106B "Action."
1063	Thermal Lo	Baseboard low temperature error	Shut down the server to check if fans and other components are covered with dust. When a low temperature error occurred, raise the room temperature to warm up the server for operations. If there appears to be no cause of a malfunction, contact your customer service representative.
1064	Thermal Lo	HDD cage #2 (middle) low temperature error	Follow 1063 "Action."
1065	Thermal Lo	HDD cage #2 (top) low temperature error	Follow 1063 "Action."
1068	Thermal Lo	CPU#1 low temperature error	Follow 1063 "Action."
1069	Thermal Lo	CPU#2 low temperature error	Follow 1063 "Action."
106A	Thermal Lo	CPU#3 low temperature error	Follow 1063 "Action."
106B	Thermal Lo	CPU#4 low temperature error	Follow 1063 "Action."

1017	Thermal Wrn	PCI (unknown location) temperature warning	Follow 1063 "Action."
1061	Thermal Wrn	Front panel temperature warning	Follow 1063 "Action."
1063	Thermal Wrn	Baseboard temperature warning	Follow 1063 "Action."
1068	Thermal Wrn	CPU#1 temperature warning	Follow 1063 "Action."
1069	Thermal Wrn	CPU#2 temperature warning	Follow 1063 "Action."
106A	Thermal Wrn	CPU#3 temperature warning	Follow 1063 "Action."
106B	Thermal Wrn	CPU#4 temperature warning	Follow 1063 "Action."
0C00	WDT Timeout	Watch-dog timer time-out	Contact your customer service representative.

Error Code Hardware Reference

The following hardware illustrations show the probable locations of hardware failures as defined by specific error codes listed in Tables 5-1 and 5-2.

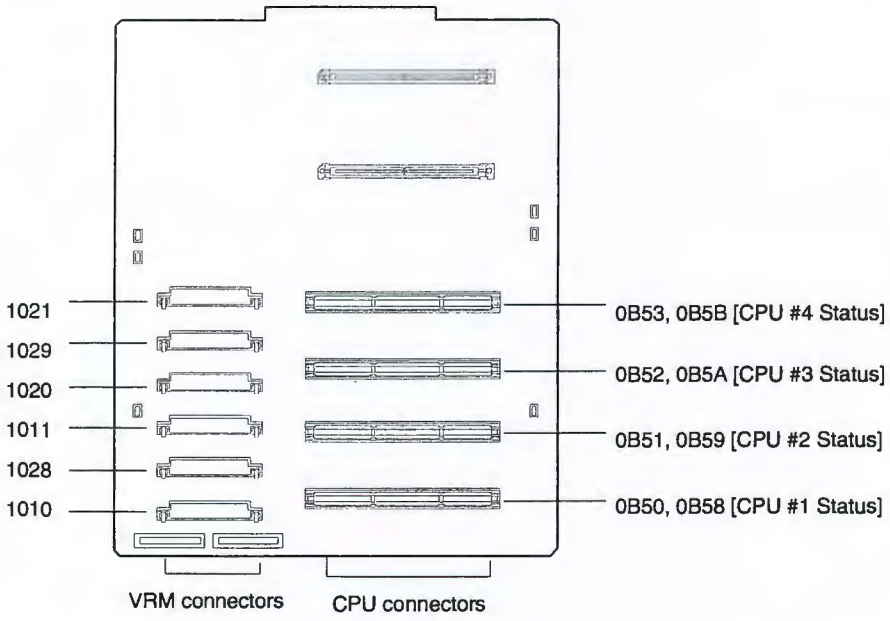


Figure 5-1. CPU/VRM Error Code Locations

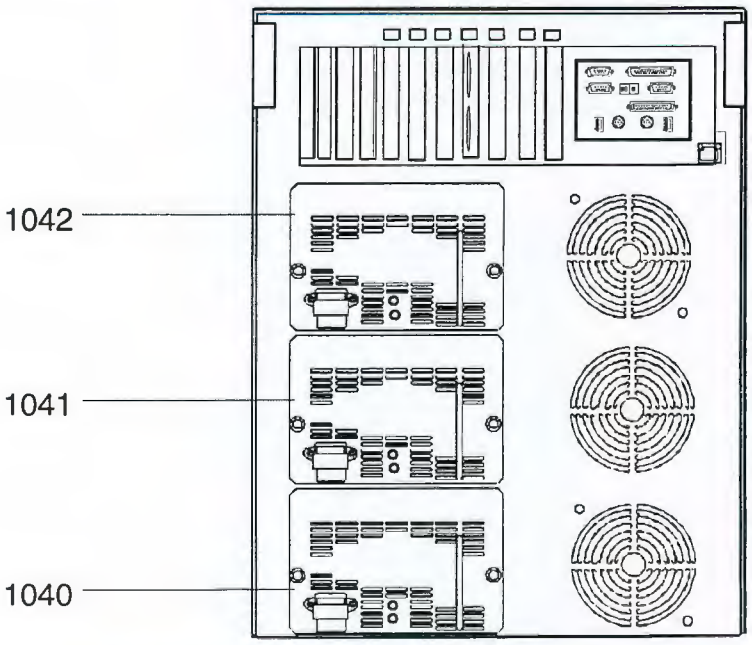
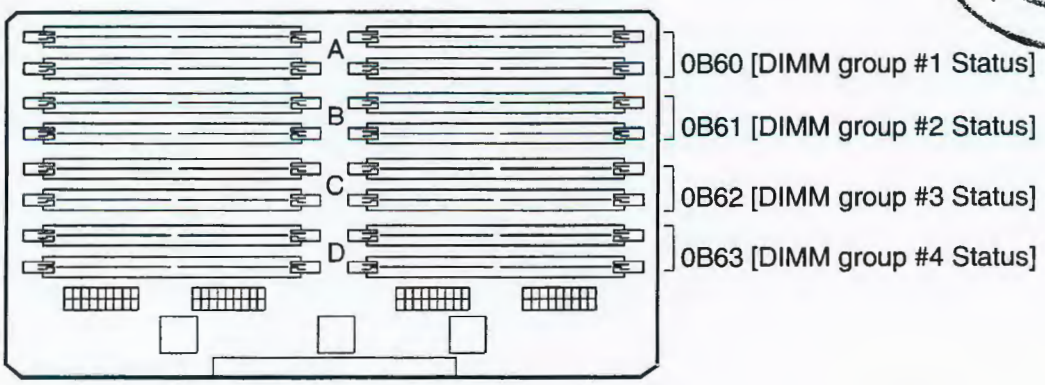
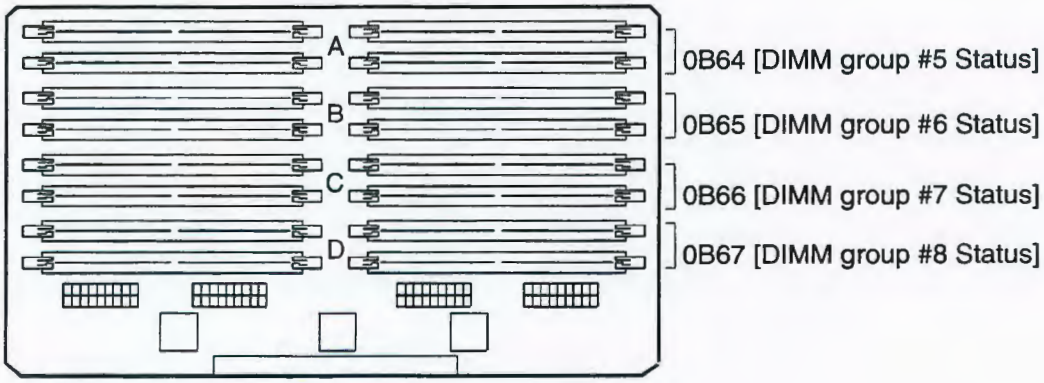


Figure 5-2. Power Supply Error Code Locations



Error Indications by Memory Bank

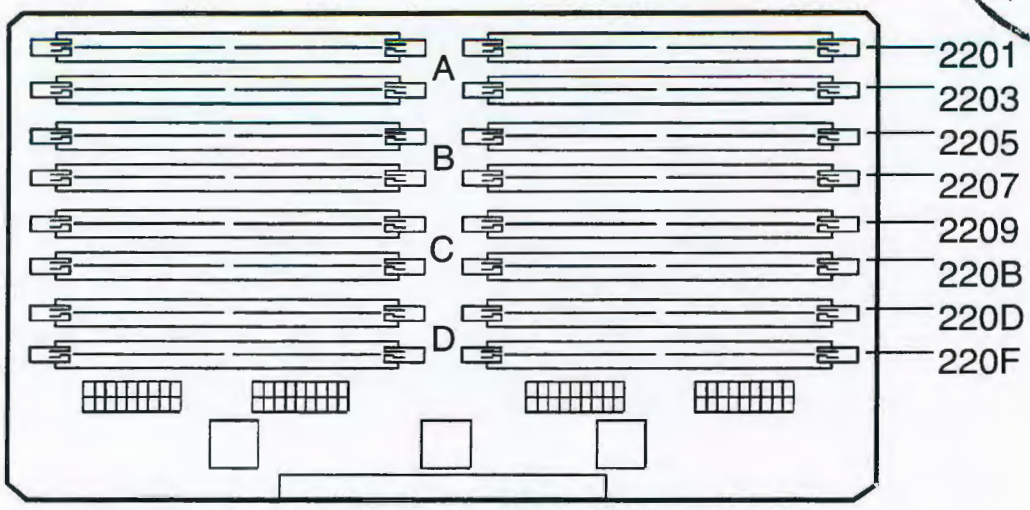
Memory Board 1



Error Indications by Memory Bank

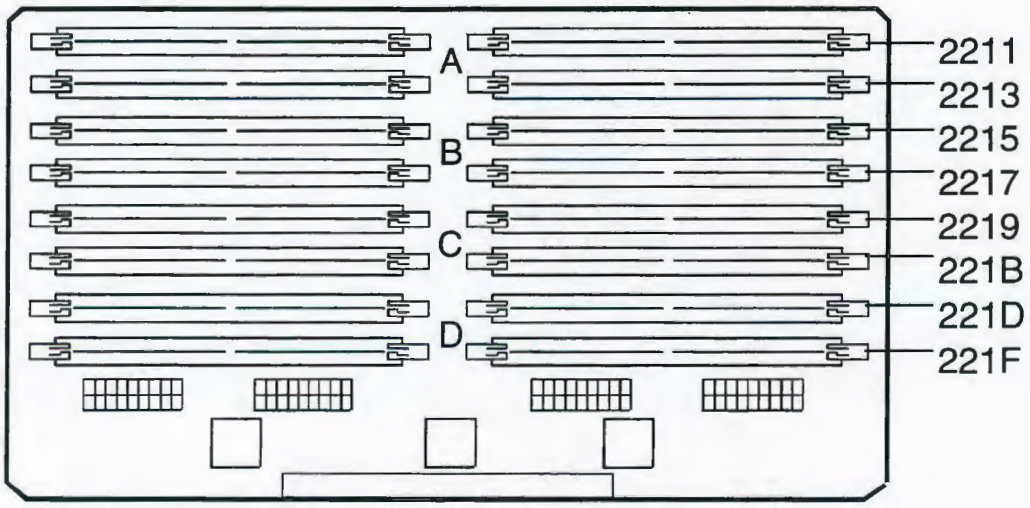
Memory Board 2

Figure 5-3. Memory Error Code Bank Locations



Error Indications by DIMM Pair

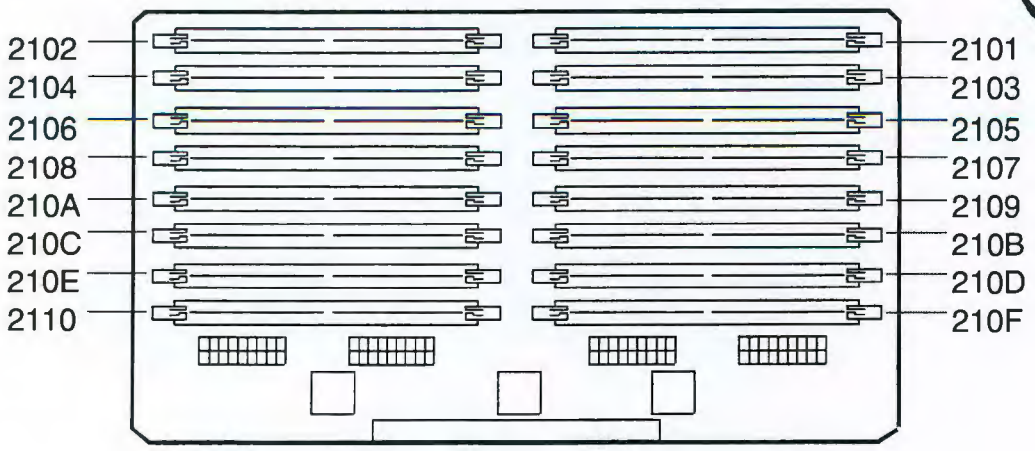
Memory Board 1



Error Indications by DIMM Pair

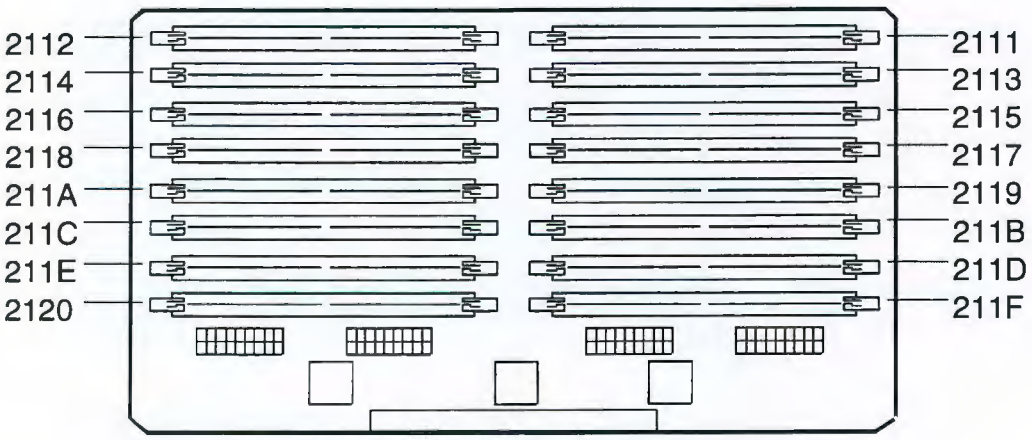
Memory Board 2

Figure 5-4. Memory Error Code DIMM Bank Locations



Error Indications by DIMM Slot

Memory Board 1



Error Indications by DIMM Slot

Memory Board 2

Figure 5-5. Memory Error Code DIMM Locations

Status LEDs

The following paragraphs list and describe the various system and disk status LED indicators and provides a user response for the various status conditions. Once your server is up and running, you can monitor server operation through the system status LED panel indicators and the SCSI device status LED panel indicators. See Table 5-3 and Table 5-4 for a list and description of the LED indicators and Table 5-5 for a list of the system status abnormal conditions.

If any problems persist, contact your service representative for assistance.

Table 5-3. System Status LED Indicators

LED	Status	Description	Response
Power	Off	Power OFF	None required (normal)
	Off	Power ON	Check: power cord outlet circuit breaker power switch is ON AC Link Mode (BIOS Setup) covers securely mounted
	Green	Power ON	None required (normal)
	Amber	System power supply failure	Replace failed power supply module.
Status	Off	Power OFF	None required (normal)
	Green	No alarms	None required (normal)
	Amber	Abnormal condition (see Table 5-5).	Check condition.
Disk	Off	Not accessing disk drives	None required (normal)
	Amber	Internal disk drive failure	Check disk drive status LEDs
	Green	Accessing disk drives	None required (normal)

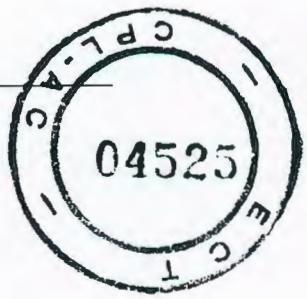


Table 5-4. Disk Drive Status LED Panel Indicators

LED	Status	Description	Response
Disk Drive Present	Off	Disk drive not present	None required (normal)
	Green	Disk drive present	None required (normal)
Disk Drive Activity	Off	Not accessing disk drive	None required (normal)
	On	Accessing disk drive	None required (normal
Disk Drive Status	Off	No alarms	None required (normal)
	Amber	Disk drive failure	Replace disk drive.

Table 5-5. System Status Abnormal Conditions

LED (Amber)	Conditions
System Status	Chassis intrusion (front cover) Unit fan alarm Memory multi-bit error (SERR) Temperature Voltage CPU thermal trip CPU, memory or option board error or failure Power supply failure

A

System Cabling

- Before You Begin
- Static Precautions
- RAID Configuration

This appendix contains information and procedures on cabling configurations used in your system. The configurations include the RAID controller.

Before You Begin

⚠ WARNING

The DC push button on/off switch on the front panel does not turn off system AC power. Also, +5vdc is present on the system board whenever the AC power cord is connected between the system and an AC outlet. Before performing any procedures, first power off the DC push button switch located on the front panel. Make sure your system is powered off and the AC power cord is unplugged from the system. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

Static Precautions

An electrostatic discharge (ESD) can damage disk drives, option boards, and other components. You can provide ESD protection by wearing an antistatic wrist strap attached to chassis ground when handling system components.

Electronic devices can be easily damaged by static electricity. To prevent damage, keep them in their protective packaging when they are not installed in your system.

RAID Configuration

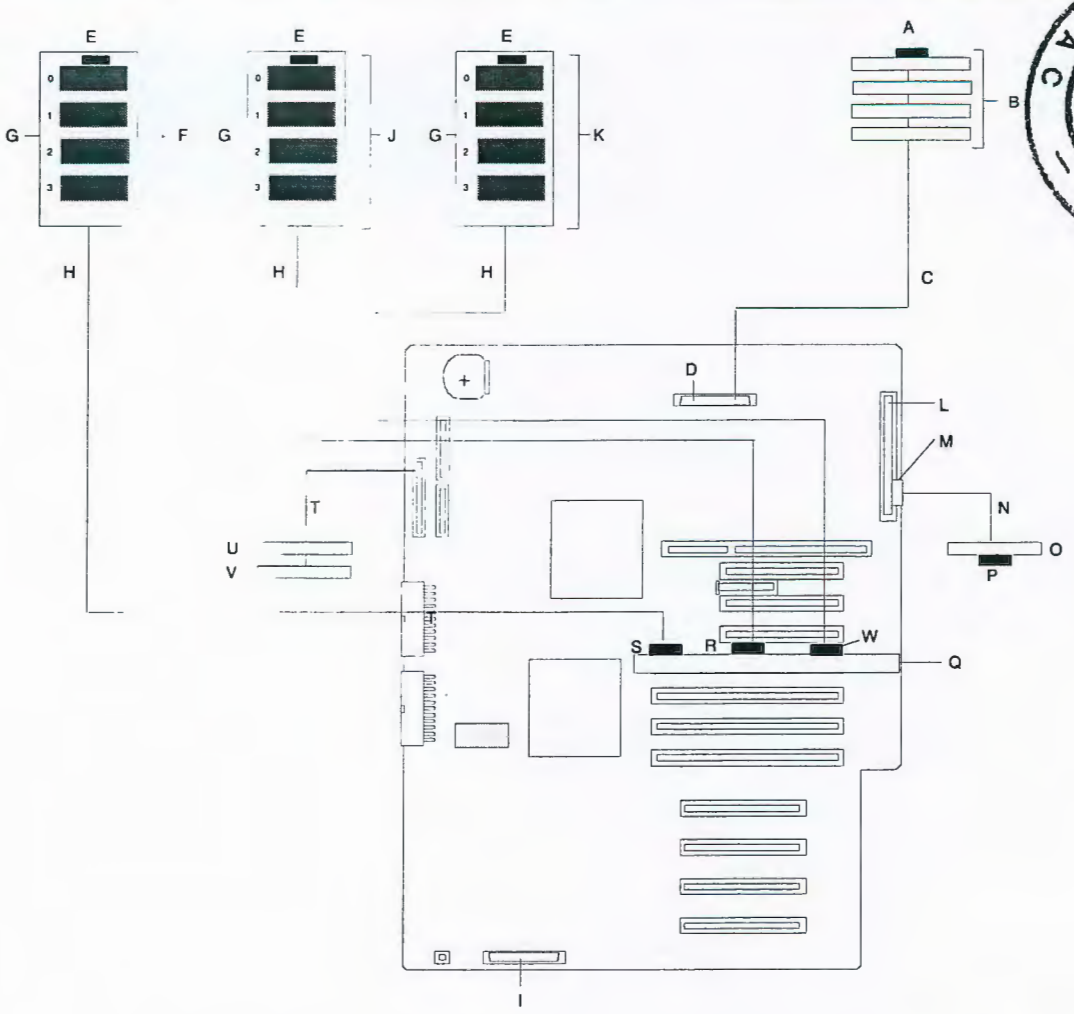
One of the standard features of your system is the three channel SecuRAID 530 (Mylex 1100) controller board, which gives your system the added security of fault tolerance. Your system has RAID pre-cabled at the factory. The RAID controller is installed in PCI slot #31 and is used to control the hard disk drives in the hot-swap hard drive cages. Channel 1 of the dual Ultra2 wide SCSI-3 controller on the system I/O board is used to control up to four peripherals (CD-ROM and tape drives) in the removable media drive bays. A 3 1/2-inch diskette drive is installed in all systems and interfaces separately to the system I/O board. Figure A-1 is a diagram of the SCSI cabling.

The narrow SCSI interface cable is connected to the SCSI connector on the system I/O board (Figure A-1, D). This cable connects to the rear of the SCSI removable media peripherals (if present). The last drive on the daisy chain cable must have its internal SCSI terminators installed (Figure A-1, A).

The Ultra2 wide SCSI-3 interface cables are connected to the RAID board (Figure A-1, Q). Termination for the hard disk drives is provided on the SCSI distribution panel (Figure A-1, E).

The onboard narrow SCSI controller also includes a connector located at the rear of the system for connecting external SCSI devices (Figure A-1, M). Three important rules must be followed if you connect external narrow SCSI devices:

- A maximum of seven narrow SCSI devices may be connected to the onboard SCSI controller. For example if three SCSI devices in the system cabinet are connected to the SCSI bus, only four external narrow SCSI devices can be connected.
- The maximum cable length for all narrow devices connected to the controller is 1 meter (39 inches).
- The last external narrow SCSI device must be terminated. Active termination is recommended.



A.	Device internal SCSI termination resister	**B.**	Narrow SCSI devices in upper peripheral bays
C.	Narrow SCSI interface cable	**D.**	SCSI channel 1 connector
E.	SCSI back plane terminator	**F.**	Ultra2 wide SCSI-3 disks in lower cage
G.	Distribution back plane	**H.**	Wide SCSI interface cable
I.	SCSI channel 2 connector (not used)	**J.**	Ultra2 wide SCSI-3 disks in middle cage
K.	Ultra2 wide SCSI-3 disks in upper cage	**L.**	I/O riser board
M.	Narrow SCSI connector (50 pin)	**N.**	External narrow SCSI cable
O.	External narrow SCSI device	**P.**	SCSI terminator
Q.	RAID controller in PCI slot #31	**R.**	Channel 1 cable connector
S.	Channel 2 cable connector	**T.**	Diskette interface cable
U.	2nd 3 1/2-inch device (optional)	**V.**	3 1/2-inch diskette drive
W	Channel 0 cable connector		

Figure A-1. RAID Cable Configuration

B

Memory Configurations

- Memory DIMM Configurations

Memory DIMM Configurations

The memory board contains sixteen 168-pin DIMM sockets for a total of up to 4 GB of system memory, using 256MB DIMMs. See Figure B-1. DIMM sockets on the board are organized as four 144-bit wide (128-bit wide data path with 16 parity bits) banks. ECC generation/checking is provided for each bank. DIMM sockets accept 168-pin single- or double-sided DIMMs. A bank must be populated using identical DIMMs. DIMMs may vary in size from one bank to the other, but all DIMMs must be the same speed. Timing requires 50ns fast page devices.

A memory DIMM upgrade kit consists of 4 identical (of the same size and type) DIMMs defined as:

4 x 32MB DIMMS = 128MB

4 x 64MB DIMMs = 256MB

4 x 128MB DIMMs = 512MB

4 x 256MB DIMMs = 1GB.

The first bank of DIMMs should be installed in sockets P02, P03, P04 and P05. When you install additional DIMMs, you must start with bank 2 and continue to bank 4. When you remove DIMMs, you must start with the highest populated bank of DIMMs. Table B-1 lists the distribution of DIMMs for system memory configurations that maximize socket availability, other combinations are possible.

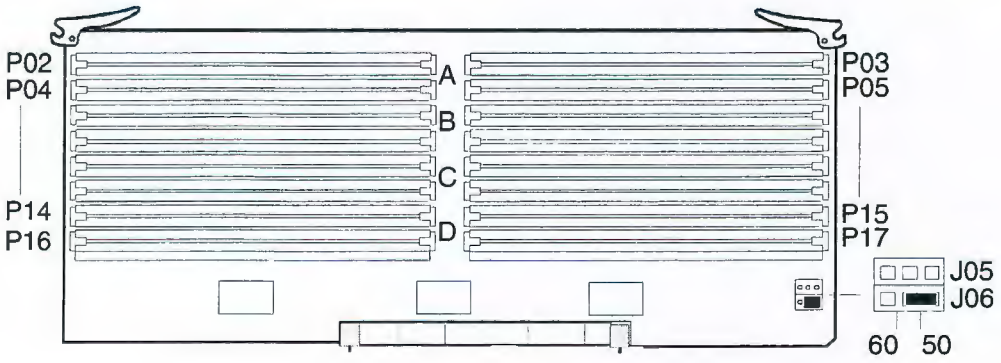


Figure B-1. CPU Base Board DIMM Sockets

Table B-1. Memory Configurations

Total Memory	Bank #A	Bank #B	Bank #C	Bank #D
128MB	4 x 32MB			
256MB	4 x 64MB			
384MB	4 x 64MB	4 x 32MB		
512MB	4 x 128MB			
640MB	4 x 128MB	4 x 32MB		
768MB	4 x 128MB	4 x 64MB		
896MB	4 x 128MB	4 x 64MB	4 x 32MB	
1024MB	4 x 256MB			
1152MB	4 x 256MB	4 x 32MB		
1280MB	4 x 256MB	4 x 64MB		
1408MB	4 x 256MB	4 x 64MB	4 x 32MB	
1536MB	4 x 256MB	4 x 128MB		
1664MB	4 x 256MB	4 x 128MB	4 x 32MB	
1792MB	4 x 256MB	4 x 128MB	4 x 64MB	
1920MB	4 x 256MB	4 x 128MB	4 x 64MB	4 x 32MB
2048MB	4 x 256MB	4 x 256MB		
2176MB	4 x 256MB	4 x 256MB	4 x 32MB	
2304MB	4 x 256MB	4 x 256MB	4 x 64MB	
2432MB	4 x 256MB	4 x 256MB	4 x 64MB	4 x 32MB
2560MB	4 x 256MB	4 x 256MB	4 x 128MB	
2688MB	4 x 256MB	4 x 256MB	4 x 128MB	4 x 32MB
2816MB	4 x 256MB	4 x 256MB	4 x 128MB	4 x 64MB
3200MB	4 x 256MB	4 x 256MB	4 x 256MB	
3328MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 32MB
3456MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 64MB
3584MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 128MB
4096MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 256MB

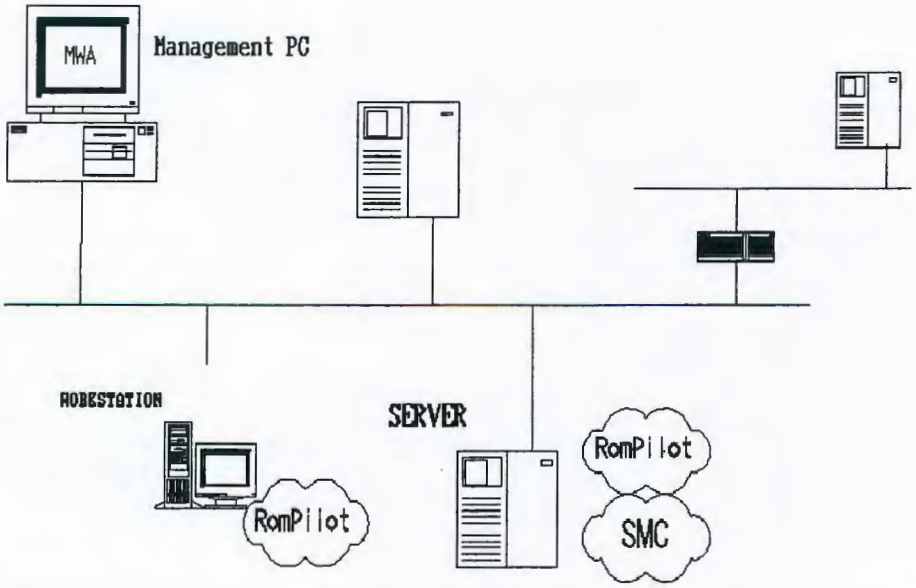
C

Management Workstation Application

- Overview
- MWA System Requirements
- Installing MWA
- MWA Main Window
- Using MWA
- Dialog Boxes
- Troubleshooting

Overview

Management Workstation Application (MWA) is an application used for remote server management in a network environment. The managed server may be remotely accessed from a management PC (the computer in which ESMPRO™ operates). MWA is a pre-boot management application in that the managed server is accessed prior to loading the server operating system.



The following server operations are available from a management PC running MWA software:

- **Remote console control -** This function enables you to see the screen of a server from the console of the management PC and to key in data to the server from the keyboard of the management PC
- **Remote drive access -** This function enables a server to access a floppy disk drive on the management PC. A server can also be booted from the floppy disk on the management PC.
- **SOS recovery** - If an SOS message is received from a server, MWA receives the fault information and sends the necessary instructions to the server for recovery.
- **Alert to ESMPRO™** - If MWA receives an alert message from a server, it sends this message to ESMPRO™ AlertManager.
- **Power cycling** - This function enables powering the server OFF and ON.
- **Reset control** - This function enables reset of the server.
- **Event Log retrieval** - All event log data recorded in the server is retrieved by the management PC.

Remote Console

Remote console enables the user to view the screen of a server or key in data to the server from the keyboard of the management PC as if operating the keyboard of the server. When a server is connected to MWA, the remote console function allows the server screen to display in the server window.

Remote Drive

Remote drive allows a server to access the diskette drive on the management PC or an FD image file as if it were the drive on the server.

> **Note:** An FD image file is copied and saved from a floppy disk. This file can be used instead of a floppy disk as a remote drive for a server.

A server can also be booted from a floppy disk on the management PC. When the remote drive function is in use, [RD] is displayed at the title bar of the server window. In this case diskette drive A on a server is allocated as a remote drive. Therefore, the floppy disk drive of the server itself cannot be used while the remote drive function is in use.

MWA System Requirements

This section outlines the management PC requirements necessary for using MWA.

Operating Systems:

- Windows 95 / Windows 98 / Windows NT 4.0 or later
- More than 3MB of free RAM
- More than 5MB of disk space
- ESMPRO Version 3.22 or later.
- TCP/IP Network.

Managed Server:

- Servers managed by MWA must support the RomPilot extended BIOS.

Installing MWA

To use MWA several procedures must be performed to configure the managed server and the management PC. For ease of installation these procedures should be performed in the order presented in the following sections. Installation procedures include procedures to be performed at the server and at the management PC.

Server Procedures

- Create a server system generation diskette (SG) containing essential server networking information.
- Run the BIOS Setup Utility making the changes to BIOS necessary for server acceptance of MWA support.

Management PC Procedures

- Install MWA software on the management PC.
- Configure and register SG information within MWA at the management PC.

Creating a Server System Generation Diskette (SG)

For the management PC to connect with a server, server system generation (SG) information must be configured and registered on MWA software running on the management PC.

In this procedure you will create a diskette containing your server's SG information. In the following section, you will register the SG information with MWA.

1. Prepare a floppy disk, formatted with MS-DOS.
2. Insert the EXPRESSBUILDER CD in the server's CD-ROM drive, and boot the server from the CD. The EXPRESSBUILDER menu displays.
3. Select: **Custom Setup**.
4. Select: **System Management**.
5. Select: **Network Setup**. The Network setup program starts.
6. Insert the floppy disk prepared in step 1 into the server's diskette drive, and press the **ESC** key.

7. Set the SG information as follows. (The items with * marks must be entered.)

   — Computer Name*
   Enter the server name.

   — IP Address*
   Enter the IP address of the server.

   — Subnet Mask*
   Enter the subnet mask of the server.

   — Default Gateway*
   Enter the IP address of the default gateway on the network.

   — Management PC (1)(3)'s IP*
   Enter the IP address of the management PC with MWA installed. (1)(3) shows priority.

   — Pass-phrase*
   Enter the pass-phrase that is used for communication between server - RomPilot and management PC - MWA.

   — Community Name (SMC supported servers)
   Enter a key for authentication used between server SMC and management PC - MWA (community name for SNMP trap). Default value is public.

   — Magic Number (SMC supported servers)
   Enter code key that is used between server - SMC and management PC - MWA.

   — Recovery Mode (SMC supported servers)
   Select automatic or manual.
   If automatic is selected, SMC automatically executes recovery processing when a fault occurs. It will be accepted as an instruction from MWA.

   — SOS Alert (SMC supported servers)
   Select SOS Alert enabled or disabled.
   If disabled is selected, SMC will not send an SOS message to MWA when a fault occurs.

8. Select: **Save Setting**. SG information is saved on the floppy disk. You will need this floppy disk (called the SG information FD) to register the server on the management PC MWA.

> ***Note:*** For details on Network setup, see EXPRESSBUILDER online help.

Configuring Server BIOS Setup

To use MWA, you must configure the server's BIOS with three specific settings enabled. These settings take place in Advanced Menu and the Hardware Menu of the BIOS Setup. (Refer to Chapter 3, "Configuring Your System," for BIOS Setup information.) The following table shows the settings that must be enabled to use MWA.

Menu Parameter Name	Required Setting for MWA
ADVANCED MENU	
Advanced Press **Enter** for menu.	
ROMPilot Support	Enabled
Peripheral Configuration Press **Enter** for menu.	
LAN controller	Enabled
SYSTEM HARDWARE MENU	
Wake On LAN	Enabled

Installing MWA on the Management PC

To Install MWA on the management PC perform the following procedure.

1. Start Windows95 / Windows 98 / or Windows NT on the management PC.
2. Insert the EXPRESSBUILDER CD into the PC CD-ROM drive.
3. Using Explorer, execute "setup.exe" in MWA folder of the CD-ROM. MWA installer will start.
4. Follow MWA installer instructions.

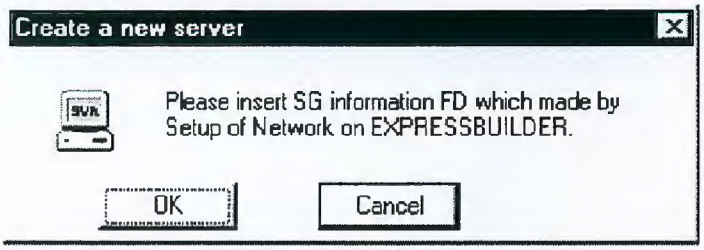
> ***Note:*** MWA will be registered in the Startup folder after installation, and started automatically when an OS start (Log in) is initiated.

Registering SG Information on MWA

In order for MWA to connect with a server, the server system generation information (SG) must be set and registered on MWA.

In this procedure SG information is registered on MWA from the server System Generation diskette (SG) created in the section *Creating a Server System Generation diskette (SG).*

1. Run MWA on the management PC and select the New SG command from File menu. The *Create a New Server* dialog box displays.



2. Insert the SG Information floppy disk into the management PC diskette drive.
3. Select OK. Server SG information is registered on MWA.

MWA Main Window

The MWA main window provides a graphical user interface (GUI) to access server control operations and to launch the management plug-ins. At the top of the GUI is the menu and tool bar. These provide the options to initiate plug-ins and other support features. A status bar at the bottom displays connection information like server name, line status, and mode.

Toolbar

The tool bar buttons of MWA main window combine server control and management plug-in options available from the Connect and Action menus as follows.

Open - The Open command opens a server window for a specified server.

Connect - The Connect command connects a current server.

Disconnect - The Disconnect command disconnects a current server.

Pause POST - The "Pause POST" command will pause to the server in the middle of POST if selected when the current server is executing POST.

To resume POST, select the Go to End of POST command, the Go (MWA mode) command, or the Go (No MWA mode) command.

Go to End of POST - The "Go to End of POST" command will pause the server at the end of POST if selected when the current server is executing POST.

To resume booting, select MWA mode command or the No MWA mode command.

MWA mode - When MWA mode command is selected when POST is paused, the server resumes POST and executes booting in MWA mode.

No MWA mode - If the No MWA mode command is selected when POST is paused, the server resumes POST and executes booting in No MWA mode.

Main Menu

MWA Main menu has the following menus.

- **File**

  — **New SG...**registers server system generation (SG) information. This command requires the SG information floppy disk described in *Registering SG Information on MWA*. When this command is selected, the Create a new server dialog box displays. Insert the floppy disk and click the OK button. If the IP address in a new server SG information exists in an old server SG information, the old information is updated. Once the registration has been completed, the server SG information is saved as (IP address).rp file. MWA can be connected only to servers registered using the New SG command.

  — **Open...**opens a server window for a specified server. The Open a Server dialog box lists SG-registered servers on MWA. Select a server to operate.

  — **Close...**closes the active server window and disconnects the server.

  — **Delete...**deletes the SG information for the selected server.

  — **Write back SG...**saves server SG information on a floppy disk. The SG information can be set again using the floppy disk. When this command is selected, the Write back a server dialog box displays. Insert a formatted floppy disk and select the OK button. Then, select a server from the server list. SG information for only one server can be saved on a floppy disk because the server SG information for all files are saved under the same name.

  — **Properties...**displays or set properties for the current server. If no servers are in operation, the Select a Server dialog box opens. Select a server to change its properties. In the Server Properties dialog box, view or set necessary information.

  — **Defaults...**allows you to view and set basic properties for all servers in the Default Server Properties dialog box. If [Use Default Settings] is checked in the Server Properties dialog box, server properties are set to the values specified in the Default Server Properties dialog box.

  — **Configure...**changes MWA configuration in the Configure dialog box. Timer counts for no response detected. After connecting to a server, MWA sometimes cannot receive any response from the server because the server is busy. If the server responds within specified timer count, MWA does not close communication. Increase the timer count if you expect the server to be busy for a long time. The default is 300 seconds.

— **Server Monitor...**enables or disables the monitor for servers. The server monitor continually monitors server status using PING or RPC even when MWA is not connected to the servers. The status of the current server is displayed in the status bar. When the server monitor is enabled, a check mark appears next to the menu item.

— **Exit...**terminates MWA and closes the connections to all servers.

- **View**

— **Toolbar...**displays or hides the toolbar. The toolbar includes buttons for some of the most common commands in MWA, such as the Open command. When the toolbar is displayed, a check mark appears next to the menu item.

— **Status Bar...**displays or hides the status bar. The status bar describes the action to be executed by the selected menu item or depressed toolbar button, and information on the current server. When the status bar is displayed, a check mark appears next to the menu item.

— **Summary...**opens or closes the Server Summary dialog box. The Server Summary dialog box displays the IP addresses, server names, and current statuses of all the SG-registered servers on MWA. When the Server Summary dialog box is open, a check mark appears next to the menu item.

— **History Log...**opens or closes the History Log dialog box. The History Log dialog box displays server communications, operator commands, and other events in chronological order. When the Delete button is selected, the Delete Logged Messages dialog box displays. The operator can delete all or part of the log. When the History Log dialog box is open, a check mark appears next to the menu item.

- **Reset/Reboot**

— **Cold Reset...**executes a cold reset on a current server.

— **Warm Reset...**command executes a warm reset on a current server. Some types of servers have been set such that a cold reset is executed by the Warm Reset command. For details, refer to the users guide for the managed machine.

— **Wake-up...**activates a server whose power is off. The Wake-Up command is executed normally under the following conditions. MWA knows the server MAC address as the server has been connected to MWA more than once. OS was terminated normally the last time server was active.

— **Pause at Next Connect...**specifies whether to pause POST when a current server is connected the next time. When pause is set, a check mark appears next to the menu item. Note that this setting is valid only when the server is connected the next time and not for later connections.

- **Data**

— **CMOS...**displays the CMOS data of a current server in the Data dialog box. The data can be read only when the server is paused at the end of POST.

— **ESCD...**displays the ESCD data of a current server in the Data dialog box.

— **DMI...**displays the DMI data of a current server in the Data dialog box. The data can be read only when the server is paused at the end of POST.

— **PCI...**When the Read button is selected in the PCI Information dialog box, the PCI information of a current server is displayed. The information includes a bus number, a device number and a function number of each device name and so on.

- **Window**

— **Cascade...**command arranges the opened windows in an overlapping fashion.

— **Tile...**arranges the opened windows in an non-overlapping fashion.

— **Arrange Icons...**arranges icons for minimized windows at the bottom of the main window. If there is an open window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this window.

— **Server Window Names 1,2...**MWA displays a list of currently opened server windows at the bottom of the Window menu. A check mark appears in front of the current server window name. Select a server window to activate.

Pop-Up Menus

Clicking the right mouse button in a server window displays a Pop-up menu. From this menu, you can execute main commands on the current server.

— **Connect command...**connects the current server to the management PC. Once the server has been connected, [Connected] is displayed in the title bar and the server screen displays in the server window.

— **Disconnect command...**closes the connection to a current server. Once the server has been disconnected, [Not Connected] is displayed in the title bar.

— **Change Remote Drive command...**temporarily changes the remote drive of a current server. This command can be executed only when a remote drive is in use. Set the necessary information in the Temporary Change to Remote Drive dialog box. This command does not update the server properties. The setting becomes invalid when the server is disconnected.

— **Pause POST command...**pauses the server in the middle of POST when the current server is executing POST. To resume POST, select the Go to End of POST command, then select Go (MWA mode) command, or the Go (No MWA mode) command.

— **Go to End of POST command...**pauses the server at the end of POST when the current server is executing POST. To resume booting, select the Go (MWA mode) command or the Go (No MWA mode) command.

— **Go (MWA mode) command...**When the Go (MWA mode) command is selected when POST is paused, the server resumes POST and executes booting in MWA mode.

— **Go (No MWA mode) command...**If the Go (No MWA mode) command is selected when POST is paused, the server resumes POST and executes booting in No MWA mode.

— **Restore Final Screen command...**displays the remote console screen as it appeared immediately before the server was disconnected. This command becomes valid after the server is disconnected.

— **Clear Screen command...**clears the remote console display. This command becomes valid after the server is disconnected.

— **Server Summary Pop-up menu...**Position the cursor on a server record in the Server Summary dialog box and click the right button to display the Server Summary Pop-up menu. From this menu, can execute main commands on the server.

Using MWA

Opening a Server Window

To remotely access a managed server from the management PC using MWA, you must open a server management window for the server. You can then issue commands to the server and make various settings though this window.

There are two ways to open a server window:

- **Using a command** - Select **Open** from the File menu. The **Select a Server** dialog box displays. Select the server you want to remotely access.
- **Automatic connection** - If a server is set for automatic connection, MWA opens a server window and connects to the server when a notification is received from the server. Refer to *Connection and Disconnection* in the next section.

Connecting and Disconnecting the Server

MWA is a pre-boot management application. MWA can be connected to a server only from the time the server is powered on or reset until the operating system is booted in the server. Once a server is connected, the remote control function displays the server screen in the server window at the management PC. Most MWA functions can be executed only when a server is connected.

Connect to a server as follows:

- **Connect command** - Select Connect from the Pop-up menu in the server window.
- **Setting automatic connection** - Select Properties from the Pop-up menu in the server window. The Server Properties dialog box displays. Check [Activate] for RESET or POST Error alert on the Alert page. After this setting is made, MWA will automatically connect to the server each time a specified alert is reported from the server.

Disconnect a server from the management PC using one of the following commands:

- **Disconnect command** - Select Disconnect from the Pop-up menu in the server window.
- **Close command** - Close from the File menu closes the active server window and closes the connection to the server.
- **Exit command** - Exit from the File menu terminates MWA and closes the connections to all servers.
- **Server reset or reboot** - When a server is reset, its connection to MWA is closed. If automatic connection is set for the server, the server is connected again.

Using a Remote Drive

When a remote drive is in use, [RD] displays in the title bar of the server window. To connect to a remote drive, perform the following steps:

1. Select Properties from the Pop-up menu in the server window to open the Server Properties dialog box. Select the Remote Drive page.
2. At the Remote Drive page, select the remote drive to use. Select [Floppy A:] or [FD Image File]. If [FD Image File] is selected, enter the file name of the FD image. The FD image file should be created in advance.

> ***Note:*** If [Read Only] is checked, an FD image file can be used in some servers.

To change the remote drive FD image file:

1. Select the Change Remote Drive command from the Pop-up menu in the server window. The Temporary Change to Remote Drive dialog box opens.
2. Select [Floppy A:] or [FD Image File]. If [FD Image File] is selected, enter a file name.

> ***Note:*** If [Read Only] is checked, an FD image file can be used in some servers.
>
> ***Note:*** The Server must be reset after a remote drive is used in the server.

Setting and Clearing Server Pause

MWA can pause server processing during or at the end of the server Power On Self Test (POST.)

Set a server pause as follows:

- **Pause command -** During server POST, select Pause POST from the Pop-up menu in the server window. The server pauses immediately. When the Go to End of POST command is executed, the server pauses again after completing the POST.
- **Pause at Next Connect command** - To set pause at the next server connection, select the Pause at Next Connect command from the Pop-up menu in the server window. When pause is set, a check mark appears next to the menu item.
- **Pause at POST error command** - Select Properties from the Pop-up menu in the server window to open the Server Properties dialog box. Check [Activate] for POST error alert on the Alert page. When MWA receives this alert message from the server, MWA will connect to the server and the server POST will be paused

Clear a server pause to resume processing as follows:

- **Go command** - To resume server processing, select the Go (MWA mode) command or the Go (No MWA mode) command from the Pop-up menu in the server window.

A server pause is also cleared in the following ways:

- Time-out reset
- If there is no communication between MWA and a disconnected server for five minutes or longer, the server is automatically reset.

Recovering from an SOS

If a fault is detected, a server that includes a system management controller (SMC), SMC transmits an SOS message to the management PC. When this SOS message is received, MWA opens an SOS Receive dialog box to display the SMC event log and other information.

The server recovery method depends on the recovery mode of each server.

- **Automatic recovery mode** - If an SOS message is received from a server, MWA displays the server information in an SOS Receive dialog box but does not accept a server recovery instruction from the operator. The server automatically executes recovery processing, such as reset.
- **Manual recovery mode** - If an SOS message is received from a server, MWA displays the server information in an SOS Receive dialog box and waits for a server recovery instruction from the user. Make an appropriate instruction in the dialog box.

> ***Note:*** If SOS Alert is disabled in [Setup of Network] in the server, the server does not send SOS message to MWA.

Alerting ESMPRO™

If MWA receives an alert message from a server, it sends this message to ESMPRO™ AlertManager. Alert types from MWA to ESMPRO are as follows.

- Alerts from the server RomPilot
  - — System Reset
  - — *POST stalled (Reset by POST stalled)
  - — *SMI stalled (Reset by SMI stalled)
  - — *Boot failed (Reset by boot failed)
  - — POST end (Booting)
  - — POST error
  - — Security breach attempted
- Alert from the server System Management Controller (SMC)
  - — Sensor limit alarm
  - — CPU missing
  - — POST stalled
  - — SMI handler alarm
  - — SMI handler stall

* Not supported by some server models.

Dialog Boxes

Select a Server Dialog Box

The Select a server dialog box displays a list of SG-registered servers on MWA.

Server Properties Dialog Box

From the Server Properties dialog box you can view and set properties for the current server. The contents of the server properties are as follows:

- **ID page...**provides server identification information, such as a server name, an IP address, a MAC address, and a UUID.
- **Alert page...**Sets MWA operation for each type of alert which comes from a server.
- **[Sound] is checked...**MWA beeps when an alert is received from a server. The server window of the server becomes active.

- **[Activate] is checked...**When an alert is received from a server, the window of the server becomes active. If [Activate] is checked for RESET or POST Error alert, MWA attempts to connect to the server. If [Use Default Settings] is checked, this property is set to the values set by the Defaults command.
- **Remote Drive page...**A remote drive can be set for a server.
- **[None] is check...**A remote drive is disabled. Server's local drive can be used.
- **[Floppy A:] is checked...**A floppy disk drive on the management PC becomes a remote drive for the server.
- **[FD Image File:] is checked...**A specified FD image file in the management PC becomes a remote drive for the server. If an image file is set as a remote drive, click the Create/Copy Image File button to display the Create/Copy Image File dialog box. From there you can create an image file or copy one to a floppy disk. If [Read Only] is checked, one FD image file can be used by more than one server. If [Use Default Settings] is checked, this property is set to the value set by the Defaults command.

Default Server Properties Dialog Box

From the Default Server Properties dialog box you can view and set basic properties of all servers. If [Use Default Settings] in the Server Properties dialog box is checked, the server property is set to the values set by the Defaults command.

- **Alert page...**Set MWA operation for each type of alert from a server.
- **[Sound] check...**MWA beeps when an alert is received from a server. The server window of the server becomes active.
- **[Activate] check...**When an alert is received from a server, the window of the server becomes active. If [Activate] is checked for RESET or POST Error alert, MWA attempts to connect to the server.
- **Remote Drive page...**A remote drive can be set for servers.
- **[None] check...**A remote drive is disabled. Server's local drive can be used.
- **[Floppy A:] check...**A floppy disk drive on the management PC becomes a remote drive for the server.
- **[FD Image File:] check...**A specified FD image file in the management PC becomes a remote drive for the server. If a FD image file is set as a remote drive, click the Create/Copy FD Image File button to display the Create/Copy FD Image File dialog box where you can create an FD image file or copy one to a floppy disk. If [Read Only] is checked, one FD image file can be used on multi servers.

Create/Copy FD Image File Dialog Box

The Create/Copy FD Image File dialog box is used to create a FD image file as a remote drive or to copy the contents of a FD image file onto a floppy disk. Select an operation to execute.

Server Summary Dialog Box

The Server Summary dialog box lists IP addresses, server names, and current status of all the SG-registered servers on MWA. This dialog box also allows the following operations:

- **Activating a server window...**Double-click on a server record to open and activate the server window for the server.
- **Executing a command on the server...**Click the right-mouse button on a server record to display the Server Summary Pop-up menu. From this menu, you can execute main commands, such as Open, Connect, and Properties on the server.

Delete Logged Messages Dialog Box

The Delete Logged Messages Dialog Box sets conditions for deleting logged messages from the history log.

- **Delete history timed at xx/xx/xx xx:xx:xx and earlier...**If a logged message is selected in the History Log dialog box, a condition for deletion can be set for messages of the same date and time and earlier. The condition becomes invalid after deletion.

  If [Server xxx:xxx:xxx:xxx only] is checked, only the messages of the specified server are deleted.

  If [General (Non-server) messages only] is checked, the messages not dependent on the server, such as Started MWA, are deleted.

  If [All messages] is checked, all the messages at the specified date and time and earlier are deleted.

- **Automatically Delete messages...**These conditions of deletion are stored and remain valid.

  If [Keep only messages less than xx days old] is checked, messages within the specified number of days from the current day are kept and other messages are deleted automatically.

  If [Keep only the xx most recent messages] is checked, the specified number of recent messages are kept and other messages are deleted automatically.

  This Automatic Deleting process is executed when the OK button is selected in the dialog box, MWA is started, and MWA is exited.

Data Dialog Box

The Data dialog box displays the CMOS, ESCD, or DMI data of a server. This dialog box also allows the following operations.

- Compare Current Data... - The previously acquired data of the current server is compared with the present data of the server, the previously acquired data of another server, or file data.

  To compare with the data of another server, select a server in the Select a server dialog box. If an error is detected by this comparison, the Data Differences dialog box displays the compared data.

- Read Data from Server... - The present data of the current server is acquired and displayed. The Save As button is used to save the acquired data in a file.

Temporary Change to Remote Drive Dialog Box

The Temporary Change to Remote Drive dialog box changes a remote drive for a server temporarily.

If [Floppy A:] is checked, a floppy disk drive on MWA-active management PC becomes a remote drive for the server.

If [FD Image File:] is checked, a specified FD image file in the management PC becomes a remote drive for the server.

If [Read Only] is checked, one FD image file can be used by more than one server. Since no FD image file can be created or copied in this dialog box, create a file using the Defaults command or the Properties command in advance.

SOS Receive Dialog Box

If a fault is detected, a server that includes the system management controller (SMC) transmits an SOS message to the management PC. When this SOS message is received, MWA opens the SOS Receive dialog box to display the server information. If the server is in Manual Recovery Mode, MWA requests the operator for the server recovery method. When MWA communicates an inquiry to the server, [Connecting] is displayed in the title bar. You can do nothing in the dialog box while the message is displayed. Wait until the message is cleared.

It is only when the OS cannot run normally due to a fault in the server that you can control the server from this dialog box. If the server is already recovered, the server cannot be operated from MWA.

Contents and functions of the dialog box are as follows:

- **Server...**The dialog box displays the name and the IP address of the server that issued the SOS message, as well as the firmware version of the SMC on the server and the recovery mode of the server. If the recovery mode is Automatic, the server is automatically reset for recovery after this dialog box displays. The server cannot be controlled from MWA.
- **Message...**The dialog box displays the SOS message received from a server on the first line. The display box also displays the SMC event log of the server sequentially from the latest data up to when the SOS occurred.
- **Server last status...**The dialog box displays the LCD contents immediately before the SOS message transmission, the POST code of the last boot processing, and the current power status (DC).
- **Server control...**The operator can send recovery instructions to a server. The buttons are explained below. If a button operation causes an error, take the appropriate action on the server that sent the SOS message.
  - — Power cycle...Use this button to turn the server off and on again. The dialog box closes after the normal execution of server control is confirmed.
  - — Reset...Use this button to reset a server. The dialog box closes after the normal execution of server control is confirmed.
  - — Power on... Use this button to turn a server on. The dialog box closes after the normal execution of server control is confirmed.
  - — Power off... Use this button to turn a server off.
  - — SMI dump... The dump switch of a server is turned on. This function is valid only for a server whose power is on. Some types of servers may not support this function. If this function is not supported, the operation ends in an error.

— Get log all... All the SMC event log data recorded in a server is acquired sequentially from the oldest one and displayed by activating the Windows standard editor WordPad. Since it takes time to make an inquiry to the server, [Connecting] is displayed in the title bar. The operator can do nothing in the dialog box while the message is displayed.

Troubleshooting

This section briefly explains problems and mistakes that may occur during MWA operations.

Problem: The Select a server dialog box does not display server information.

Probable Cause: Server SG information is not registered or the information has been lost. Register the server SG information again.

Problem: MWA cannot be operated after the reset command was executed.

Probable Cause: When some reset commands are issued, MWA waits for a response and cannot perform other operations. Wait for a while.

Problem: The Read button cannot be selected in the Data dialog box.

Probable Cause: Data read from a server is restricted as follows:

The server is connected.

CMOS data and DMI data can be read at the end of POST. Stop server processing at the end of POST by selecting the Pause POST command and the Go to End of POST command from the Pop-up menu in the server window.

Problem: A remote drive cannot be used.

Probable Cause: See *Using a Remote Drive*.

Problem: Booting from a remote drive failed.

Probable Cause: Check the following:

The remote drive is set correctly.

The remote drive is a floppy disk (or a FD image file) from which MS-DOS can be booted.

The priority of the boot device of the server is a floppy disk.

Problem: The server window does not display a server screen.

Probable Cause: A graphic server screen may not be displayed correctly in the server window. The window display becomes normal when the server returns to an MS-DOS screen.

Problem: Characters are corrupted when the server window displays a server screen.

Probable Cause: If MS-DOS is booted in a language other than English, MWA cannot display the messages for this language in the server correctly. Boot MS-DOS in English mode.

Probable Cause: If the server is displaying a graphic screen, MWA may not be able to display the screen correctly.

Problem: When an MS-DOS program is activated in English mode, the server displays corrupted characters.

Probable Cause: If MS-DOS in the server is in English mode, MWA remote console correctly displays messages from the MS-DOS programs in the server. However, the server cannot display messages for other language correctly.

Problem: OS cannot be booted from the server disk.

Probable Cause: When the remote drive is set on MWA, the server is booted from the remote drive. Cancel the remote drive setting and reset the server.

Problem: The floppy disk drive on the server cannot be used.

Probable Cause: When the remote drive is set on MWA, drive A: on the server is assigned remote drive on the management PC. Cancel the remote drive setting and reset the server.

Problem: MWA cannot connect to the server.

Probable Cause: Check each item in Step 7 of *Creating a Server System Generation Diskette*.

D

Hardware Event Log

- Introduction
- Viewing the Hardware Event Log
- Component Locations

Introduction

Sensors are located throughout your system to monitor temperature, fans, voltages and alarms. The sensors report any abnormalities of these functions in the Hardware Event Log. This appendix helps you locate the hardware component in your system that the sensor indicated to the Hardware Event Log as causing an error.

The Hardware Event Log is readable using the Off-line Maintenance Utility. The Off-line Maintenance Utility can be loaded into a maintenance partition on your hard drive using the EXPRESSBUILDER CR-ROM included with your system. Once loaded, you access the Off-line Maintenance Utility by pressing F4 during system bootup. The contents of the Hardware Event Log can also be viewed using ESMPRO in a Windows NT Operating System environment.

Table D-1 lists channel numbers that are recorded in the Hardware Event Log. The sensor that initiated the channel number entry is shown as well as the figure number of the illustration in this appendix that shows the location of the suspected faulty hardware component. Refer to the figure number noted in the Failure Location column to view the component that caused the error.

Viewing the Hardware Event Log

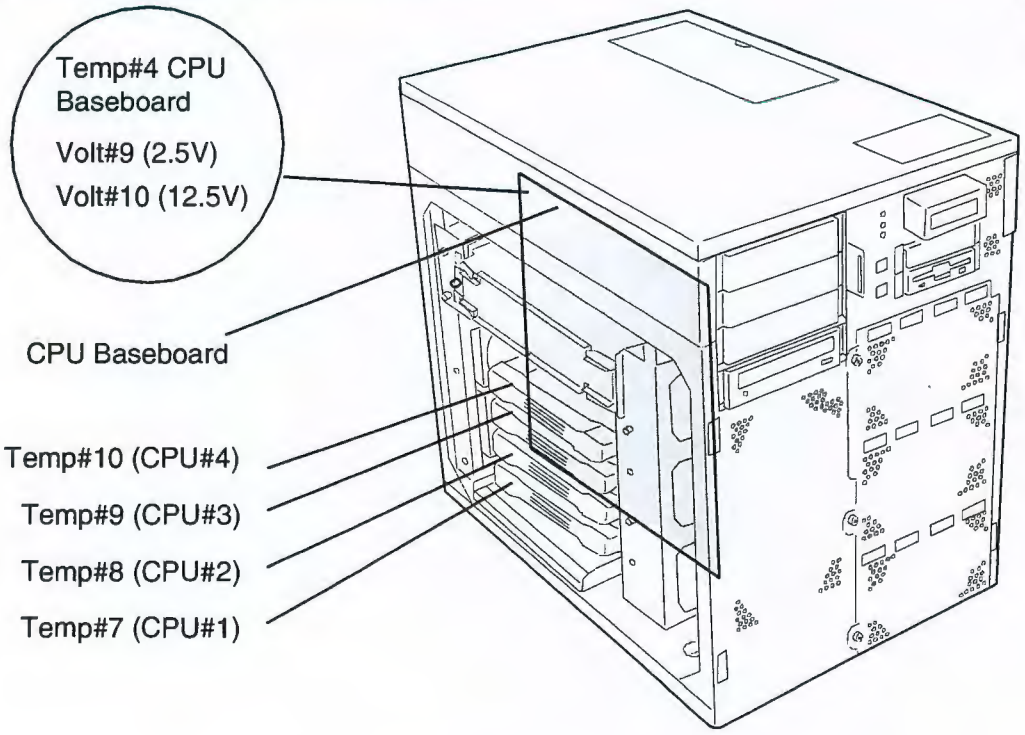
Use the following procedure to view the Hardware Event Log using the Off-line Maintenance Utility:

1. Press F4 (Maintenance Utility) during system bootup. The Off-line Maintenance Utility menu displays.
2. Select *H/W Event Log Viewer.*
   Press **ENTER**. The H/W Event Log Viewer window displays.
3. Select *Display H/W Event Log.*
   Press **ENTER**. The Display H/W Event Log <Select Event Type> window displays.
4. Select *All Event Type* or *System Error Limit Exceeded.*
   Press **ENTER**. The Display H/W Event Log <In Outline> window displays.
5. Select *System Error Limit Exceeded* of each entry listed.
   Press **ENTER**.
6. Note the channel number of the error and using Table D-1, cross-reference the channel number to the system component that caused the error. Channel numbers are listed numerically in Table D-1

Table D-1 Hardware Event Log Channel Numbers

Channel Number	Sensor	Failure Location
10h	Volt#1 (CPU#1)	See Figure D-1
11h	Volt#2 (CPU #2)	See Figure D-1
12h	Volt#3 (3.3V)	See Figure D-2
13h	Volt#4 (5V)	See Figure D-2
14h	Volt#5 (12V)	See Figure D-2
17h	Temp#2 (PCI)	See Figure D-2
20h	Volt#6 (CPU #3)	See Figure D-1
21h	Volt#7 (CPU #4)	See Figure D-1
23h	Volt#8 (5V standby)	See Figure D-2
25h	Volt#9 (2.5V)	See Figure D-1
26h	Volt#10 (1.5V)	See Figure D-1
28h	Volt#11 (CPUL2 voltage#1)	See Figure D-1
29h	Volt#12 (CPUL2 voltage#2)	See Figure D-1
40h	Power Module 1 Alarm	See Figure D-3
41h	Power Module 2 Alarm	See Figure D-3
42h	Power Module 3 Alarm	See Figure D-3
52h	Fan#5 (Memory upper rear)	See Figure D-4
53h	Fan#6 (Memory upper front)	See Figure D-4
54h	Fan#1 (CPU lower rear)	See Figure D-4
55h	Fan#2 (CPU lower front)	See Figure D-4
56h	Fan#3 (CPU middle rear)	See Figure D-4
57h	Fan#4 (CPU middle front)	See Figure D-4
58h	Fan#7 (Option cards)	See Figure D-5
5Dh	Cabinet Covers (Sides, Top)	See Figure D-6
5Eh	PCI Cover	See Figure D-6
5Fh	Front Disk Bay Cover	See Figure D-6
61h	Temp#1 (Front Panel)	See Figure D-2
62h	Temp#3 (LVD #1)	See Figure D-3
63h	Temp#4 (CPU Baseboard)	See Figure D-1
64h	Temp#5 (LVD #2)	See Figure D-3
65h	Temp#6 (LVD #3)	See Figure D-3
68h	Temp#7 (CPU #1)	See Figure D-1
69h	Temp#8 (CPU #2)	See Figure D-1
6Ah	Temp#9 (CPU #3)	See Figure D-1
6Bh	Temp#10 (CPU #4)	See Figure D-1

Component Locations



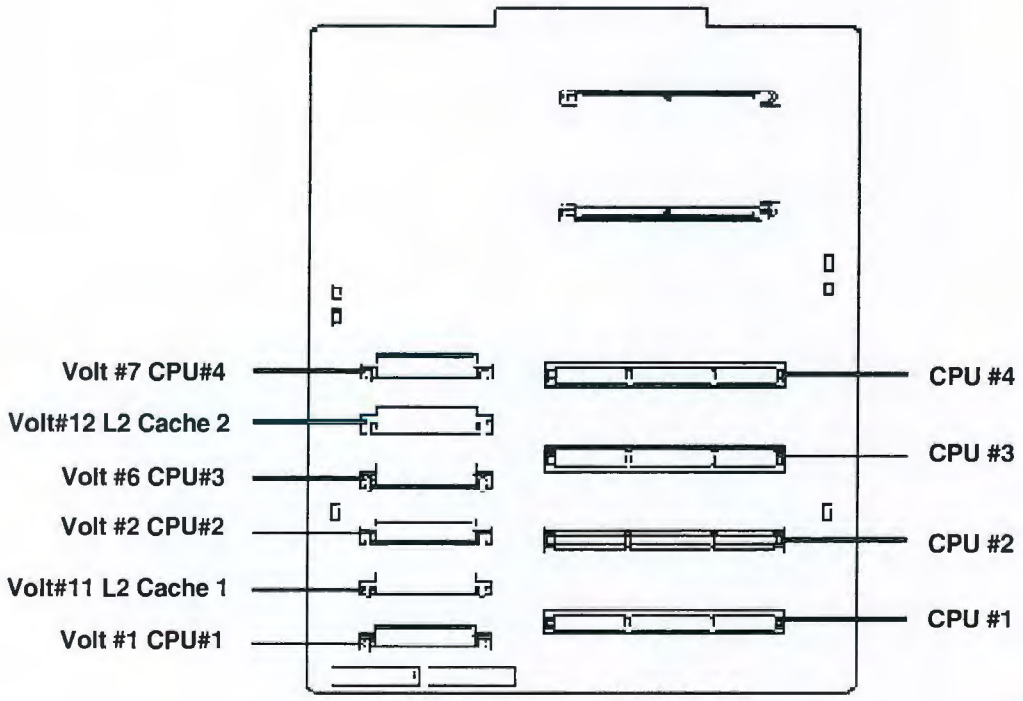


Figure D-1 Component Locations View A

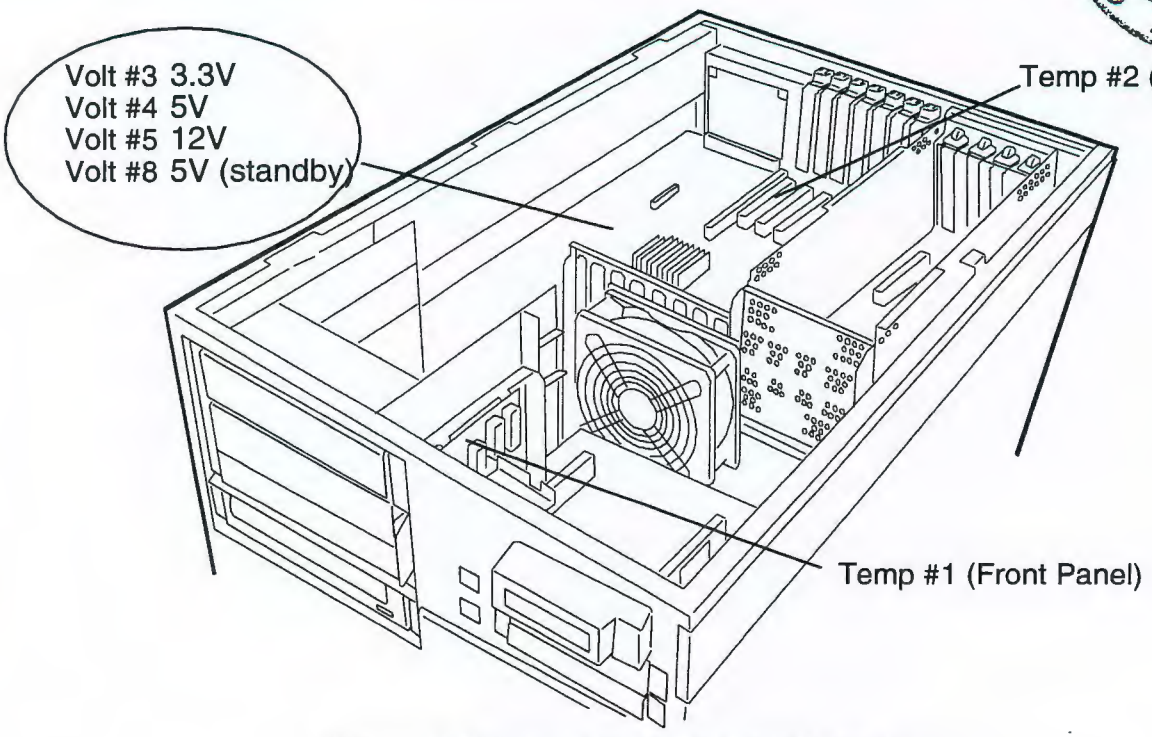


Figure D-2 Component Locations View B

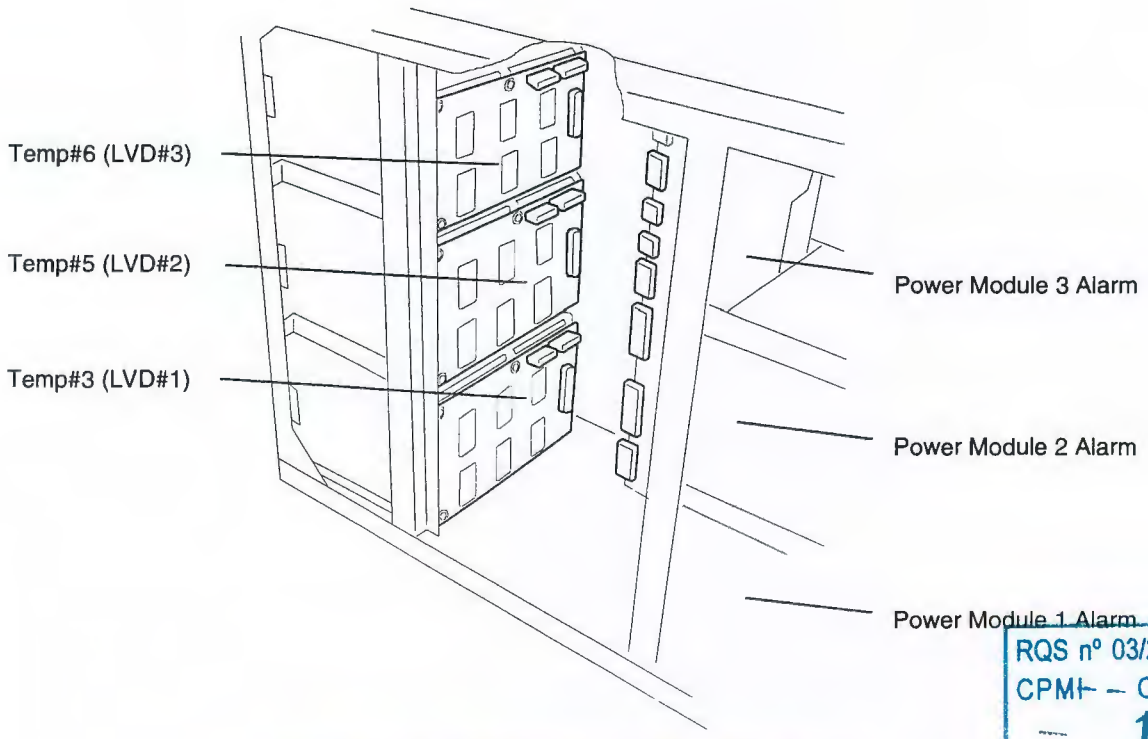


Figure D-3. Component Locations View C

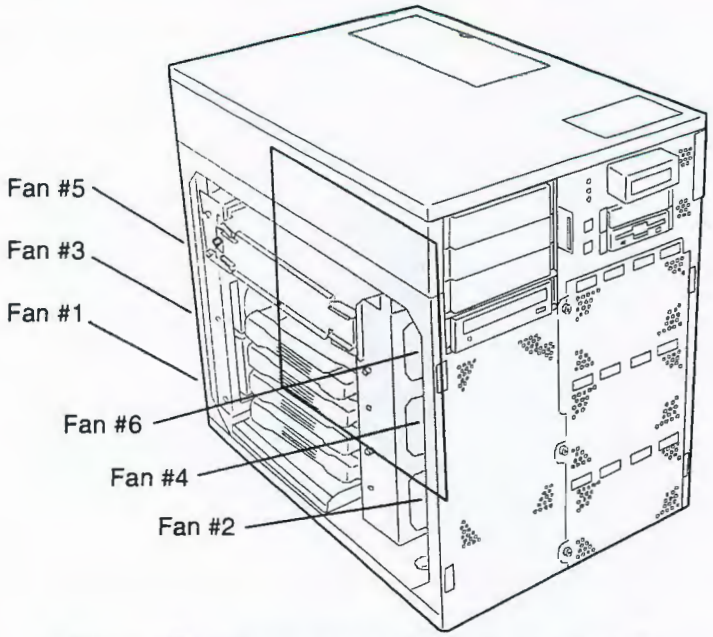


Figure D-4. Component Locations View D

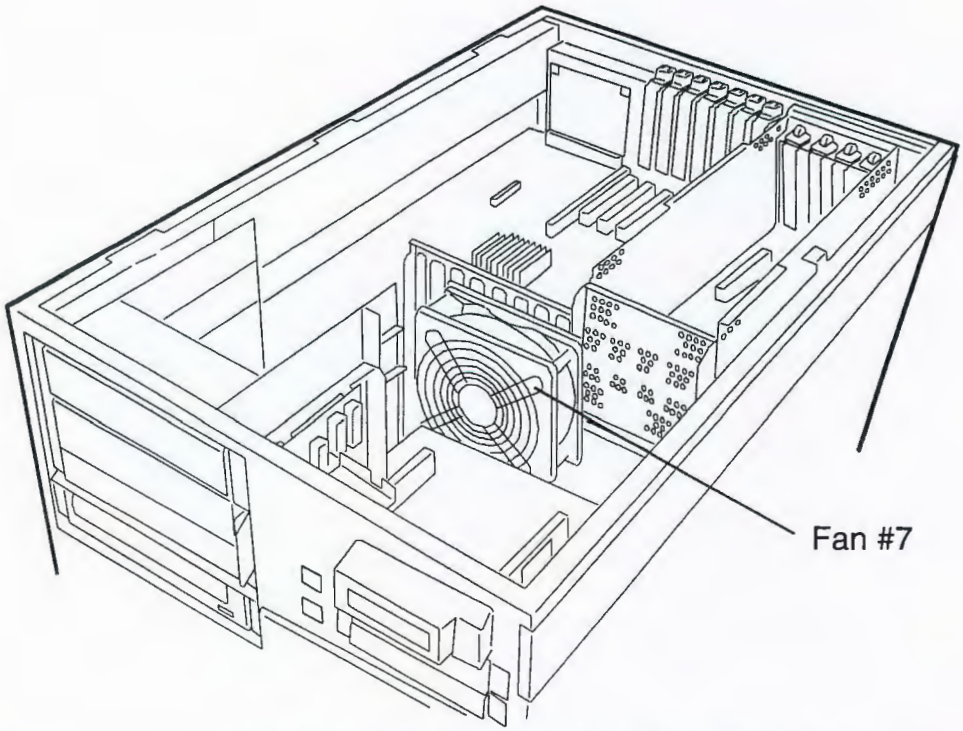


Figure D-5. Component Locations View E

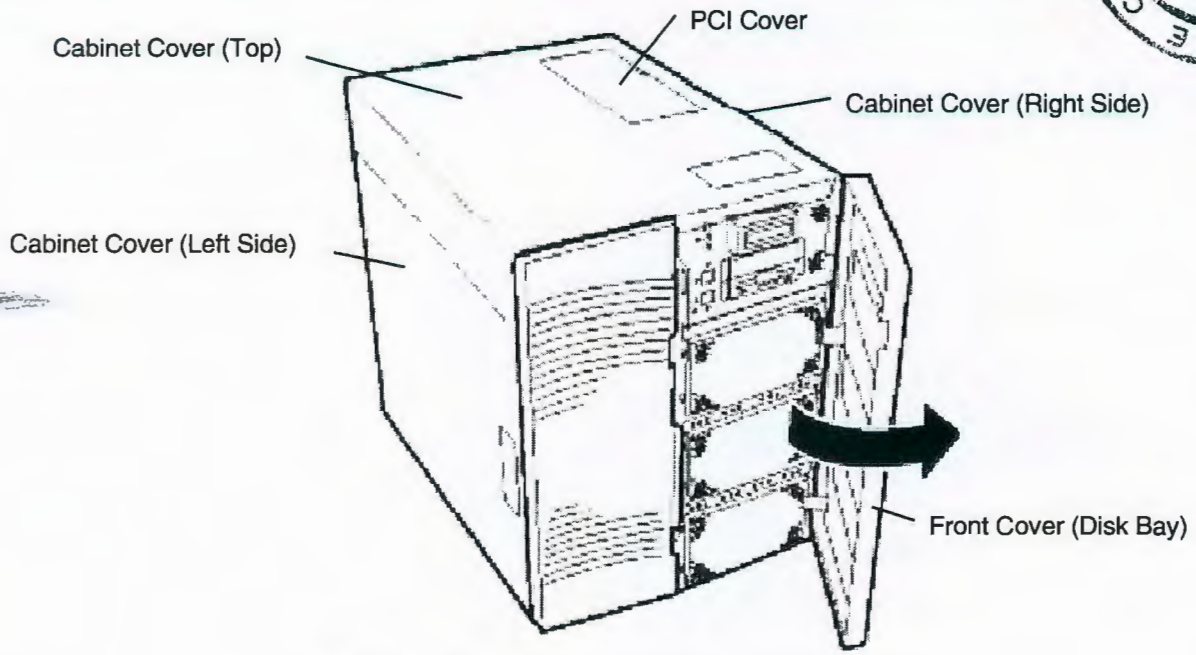


Figure D-6. Component Locations View F

Glossary

A

AC
(Alternating Current) The type of current available in wall outlets. All computers must convert alternating current to direct current to operate. See also DC.

Address
A label, name, or number that identifies a location in computer memory.

ASCII
(American Standard Code for Information Interchange) A standard number assigned to each of the alphanumeric characters and keyboard control code keys to enable the transfer of information between different types of computers and peripherals.

B

backplane slot
A connector on the backplane board in desktop computers and expansion boxes that allows you to install circuit cards.

backup
A copy of data for safe-keeping. The data is copied from computer memory or disk to a floppy disk, magnetic tape, or other media.

backup battery
The battery in your computer that maintains the real-time clock and the configuration information when the computer's power is removed.

base memory
An area of memory between 0 and 640 kilobytes.

baud rate
The speed with which data is transmitted during serial communication. The computer's operating system and software program must be configured for the same baud rate as the communication device, such as a serial printer. See also bps.

BIOS
(Basic Input/Output System) A program stored in flash EPROM or ROM that controls the keyboard, disk drives, video monitor, and other devices. See also flash EPROM, EPROM, and ROM.

bit
Derived from BInary digiT, a bit is the smallest unit of information a computer handles. See also byte.

boot
The process of loading the operating system into memory.

bps
(bits per second) The number of bits transferred in one second during serial communication, such as modem transmission.

byte
A group of eight bits.

C

cache memory
A very fast, limited portion of RAM set aside for temporary storage of data for direct access by the microprocessor.

CD-ROM drive
(Compact Disk ROM drive) A type of mass storage device that reads information from a compact disk.

Centronics port
An industry standard parallel port. See also parallel port.

CGA
(Color Graphics Adapter) A type of video display system that provides low-resolution text and graphics on TTL monochrome and color monitors.

CMOS
(Complimentary Metal-Oxide Semiconductor) A type of low-power integrated circuit used in computers. See also TTL.

COM1 or COM2
The name you can assign a serial port to set or change its address. See also serial port.

command
An instruction that directs the computer to perform a particular operation.

configuration
The way in which a computer is set up to operate. Some configurable options include CPU speed, serial port designation, and memory allocation.

coprocessor
See math coprocessor.

CPU
(Central Processing Unit) See microprocessor.

CRT
(Cathode-Ray Tube) The type of video display used in monitors for desktop computers.

D

DC
(Direct Current) The type of current available in the rechargeable battery packs used in portable computers. See also AC.

default
The factory setting your computer uses unless you instruct it otherwise. For example, when powering up, the computer will boot from the default drive.

density
The capacity of information (bytes) that can be packed onto a storage device, such as a floppy disk.

device driver
A software program that a computer must use to recognize and operate certain hardware, such as a mouse or a video monitor.

disk drive
A device that stores data on a hard or floppy disk. A floppy disk drive requires a floppy disk to be inserted; a hard disk drive has a permanently encased hard disk.

DOS
(Disk Operating System) See operating system.

DRAM
(Dynamic RAM) See RAM.

E

ECC
(Error Checking and Correction) A method of detecting and correcting errors.

EEPROM
(Electrically Erasable Programmable Read-Only Memory) A type of memory device that stores password and configuration information.

EGA
(Enhanced Graphics Adapter) A type of video display system that provides medium-resolution text and graphics on TTL monochrome, color, and enhanced color monitors.

EMS
(Expanded Memory Specification) A method of accessing memory beyond the 640K limit of DOS by exchanging data in and out of main memory at high speeds. Some software requires EMS to operate.

EPROM
(Erasable Programmable Read-Only Memory) A type of memory device that is usually used to store system BIOS code. This code can be erased with ultraviolet light, but is not lost when the computer is powered off. See also flash EPROM and ROM.

expanded memory
See EMS.

expansion slot
See backplane slot.

extended memory
The protected memory above 1M that is directly accessible by the microprocessor through certain utilities and operating systems. This memory is used in computers with 80286, 80386, and 80486 microprocessors.

F

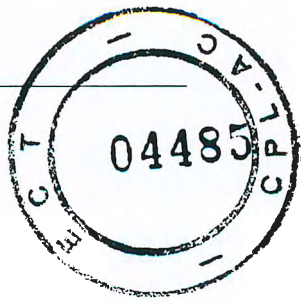
flash EPROM
A type of memory device that is usually used to store system BIOS code. This code can be replaced with updated code from a floppy disk, but is not lost when the computer is powered off. See also EPROM and ROM.

floppy disk drive
See disk drive.

format
The process used to organize a hard or floppy disk into sectors so it can accept data. Formatting destroys all previous data on the disk.

G

(Gigabyte)
1,073,741,824 bytes. See also byte.



H

hard disk drive
See disk drive.

hardware
The physical parts of your computer, including the keyboard, monitor, disk drives, cables, and circuit cards.

I

IC
(Integrated Circuit) An electronic device that contains miniaturized circuitry.

(ISA Configuration Utility)
The program that you use to change the configuration of some ISA desktop computers. This program also contains information about the hardware in the computer.

interface
A connection between the computer and a peripheral device that enables them to exchange data. See also parallel port and serial port.

ISA
(Industry Standard Architecture) An industry standard for computers and circuit cards that transfer 16 bits of data at a time.

J

jumper
A small electrical connector used for configuration on some computer hardware.

K

(Kilobyte)
1,024 bytes. See also byte.

L

LAN
(Local Area Network) A group of computers linked together within a limited area to exchange information.

LCD
(Liquid Crystal Display) The type of video display used in portable computers.

LED
(Light-Emitting Diode) A small electronic device that glows when current flows through it.

LPT1 or LPT2
The name you can assign a parallel port to specify its address. See also parallel port.

LVD
Super-fast Ultra2 SCSI Low Voltage Differential (LVD) Parallel SCSI Interface. A new SCSI interface that provides greater I/O bandwidth, device connectivity, data reliability, and longer cable lengths for Ultra2 SCSI hard disk drives.

M

(Megabyte)
1,048,576 bytes. See also byte.

math coprocessor
An IC that works with the microprocessor to speed up mathematical calculations.

memory
The circuitry in your computer that stores data and programs. See also EMS, extended memory, RAM, and ROM.

microprocessor
The integrated circuit that processes data and controls the basic functions of the computer.

modem
A device used to exchange information with other computers over telephone or data lines.

module
A circuit board that plugs into a dedicated connector on the system board in your computer.

mouse
A small input device that you guide on a flat surface to control the cursor movement and operation of the computer when using certain software programs.

N

NVRAM
(Nonvolatile RAM) A type of RAM that retains its contents even after the computer is powered off. This memory stores EISA configuration information. See also RAM and SRAM.

O

operating system
A set of programs that provides the interface between other software programs and the computer.

P

parallel port
The connector on the back of your computer that allows the transfer of data between the computer and a parallel device, such as a parallel printer.

partition
The process of dividing the storage space on a hard disk into separate areas so that the operating system treats them as separate disk drives.

password
A security feature that prevents an unauthorized user from operating your computer. See also EEPROM.

PCI
Peripheral Component Interconnect. PCI is a high-performance peripherals I/O bus supporting data transfers of up to 132MB per second.

Pentium
A type of microprocessor, with a built-in math coprocessor, cache memory, and memory and bus controllers, that processes and communicates 32 bits of data at a time. This microprocessor also contains power management capabilities.

peripheral
A device connected to and controlled by the computer, such as an external disk drive or a printer.

pixel
The smallest element that is visible on a video display. The resolution of a video display system is measured in pixels.

PnP
(Plug-n-Play) Plug-and-play is the ability to plug a device into a computer and have the computer recognize that the device is there. The user doesn't have to tell the computer.

POST
Power-On-Self-Test.

R

RAM
(Random-Access Memory) A temporary storage area for data and programs. This type of memory must be periodically refreshed to maintain valid data, and is lost when the computer is powered off. See also NVRAM and SRAM.

real-time clock
The IC in your computer that maintains the time and date.

RCU
(Resource Configuration Utility) The program that you use to change the configuration of your system. This program also contains information about the hardware in your system.

ROM
(Read-Only Memory) A type of memory device that usually is used to store system BIOS code. This code cannot be altered and is not lost when the computer is powered off. See also BIOS, EPROM, and flash EPROM.

RS-232C port
An industry standard serial port. See also serial port.

S

save
To store information on a floppy disk, hard disk, magnetic tape, or some other permanent storage device.

SCSI
(Small Computer System Interface) An industry standard interface that provides high-speed access to tape drives, hard disk drives, and other peripheral devices.

SEL
(System Event Log) A record of system management events. The information stored includes the name of the event, the date and time the event occurred and data pertinent to the event. Event data may include POST error codes that reflect hardware errors or software conflicts within the system.

serial communication
Information sent sequentially, one bit at a time.

serial port
The connector on the back of your computer that allows the transfer of data between the computer and a serial device, such as a mouse, a modem, or a serial printer.

Setup program
The program that you use to change the configuration of some ISA desktop and notebook computers. This program also contains information about the hardware in the computer.

software
Programs with specific functions, such as word processing, data base management, communications, and operating system.

SRAM
(Static RAM) A temporary storage area for data and programs. This type of memory does not need to be refreshed, but it is lost when the computer is powered off. See also NVRAM and RAM.

SVGA
(Super VGA) A type of video display system that provides very high-resolution text and graphics on analog color monitors.

system board
The main circuit board in your computer. It contains most of the connectors and ports.

T

tape drive
A type of storage device using magnetic tape.

TTL
(Transistor-Transistor Logic) A type of integrated circuit used in computers. See also CMOS.

V

VGA
(Video Graphics Array) A type of video display system that provides high-resolution text and graphics on analog color monitors.

Equipment Log

Use this equipment log form to record pertinent information about your system. You will need some of this information to run the System Setup Utility. Be sure to update the equipment log when you add options.

Record the model and serial numbers of the system components, dates of component removal or replacement, and the name of the vendor from whom the component was purchased. Be sure to record the same information for any components added to the system, such as hard disk drives, add-in boards, or printers.

Record the model and serial numbers of the unit and system baseboard. The model and serial numbers of the system unit are recorded on a label attached to the rear of the unit. The serial number of the system board is located along the left side of the board, near the PCI expansion slot covers.

The location of serial numbers on add-in boards, hard disk drives, and external equipment, such as video displays or printers, varies from one manufacturer to another. Literature accompanying these products should illustrate or describe the location of model and serial numbers.

Component	Manufacturer Name and Model	Serial Number (if available)	Date Installed
Server			
CPU 1			
CPU 2			
CPU 3			
CPU 4			
Memory Board #1			
Memory Board #2			
DIMMs			
DIMMs			
DIMMs			
DIMMs			
DIMMs			
DIMMs			
Modem			
Diskette Drive A			
Diskette Drive B			
Tape Drive 1			
Tape Drive 2			
CD-ROM Drive 1			
CD-ROM Drive 2			
Hard Disk Drive 1			
Hard Disk Drive 2			
Hard Disk Drive 3			
Hard Disk Drive 4			
Hard Disk Drive 5			
Hard Disk Drive 6			
Hard Disk Drive 7			
Hard Disk Drive 8			
Hard Disk Drive 9			
Hard Disk Drive 10			
Hard Disk Drive 11			

Component	Manufacturer Name and Model	Serial Number (if available)	Date Installed
Hard Disk Drive 12			
RAID Controller			
Network Controller 1			
Network Controller 2			
Monitor			
Keyboard			
Mouse			
External Peripherals			

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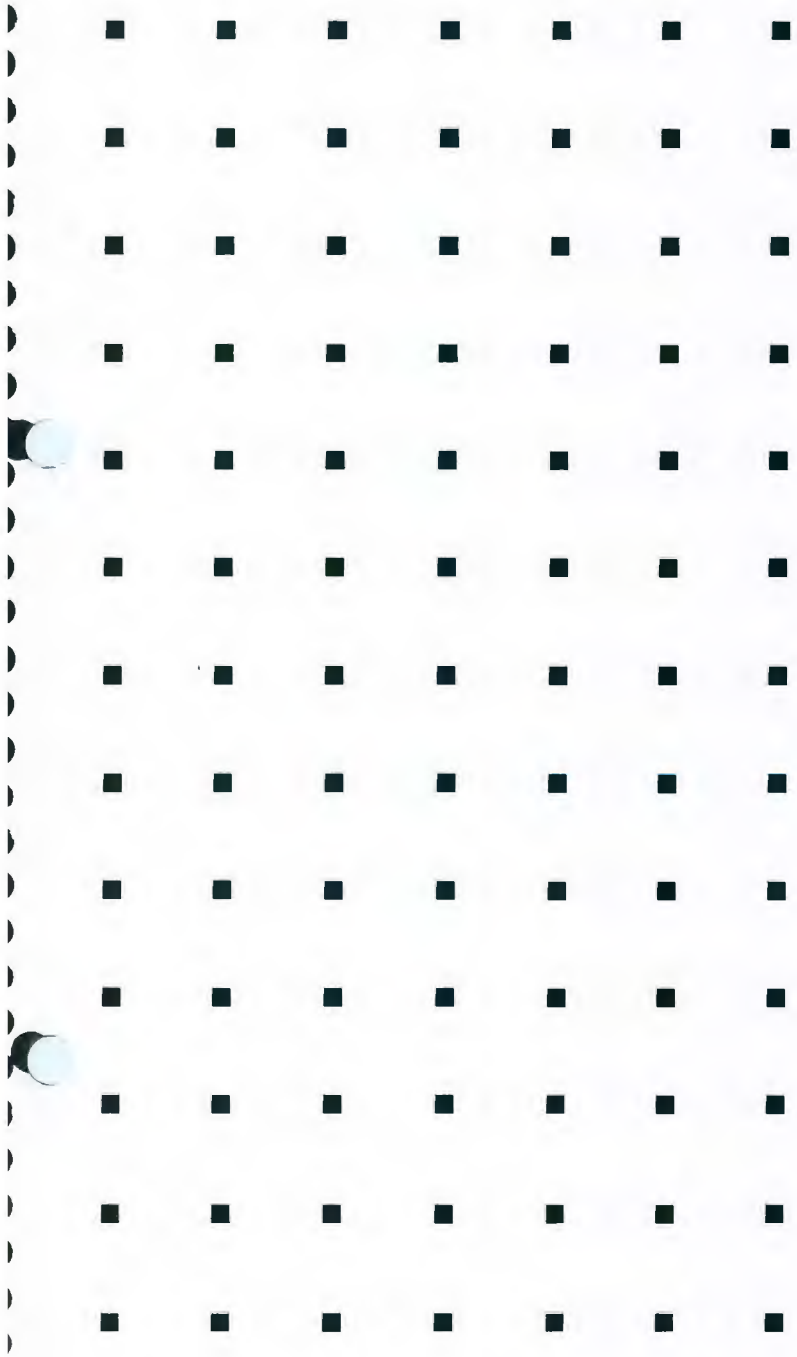

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ACCESSORIES GUIDE

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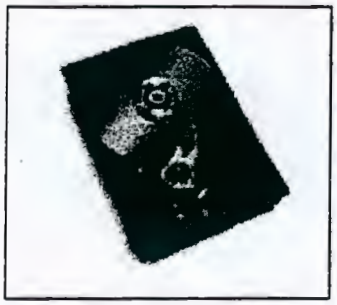

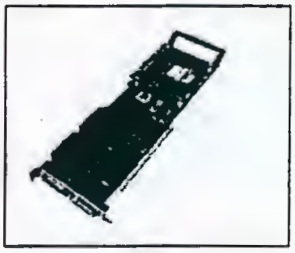

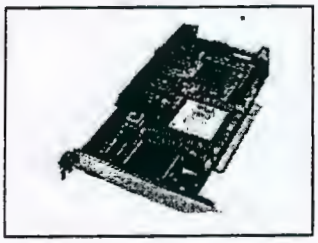

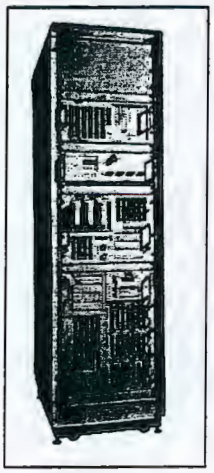

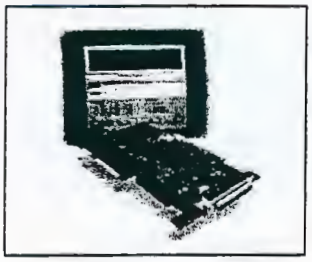

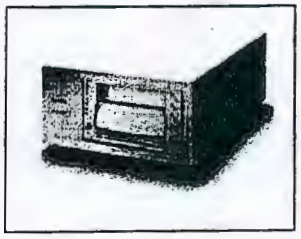

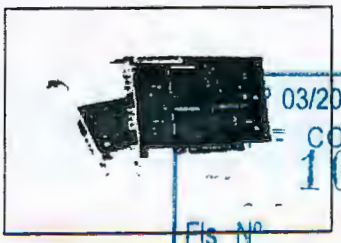

Created by Mark Carr

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TECHNOLOGY REFERENCE

MEMORY TECHNOLOGY

WHAT IS SDRAM?

- *Synchronous DRAM - a fast high-bandwidth memory designed to work best with systems employing high-performance chipsets and processors*
- *Can Synchronise itself with the system clock that controls the CPU, eliminating time delays + improving processor efficiency.*
- *Bandwidths of up 100Mhz — twice the bandwidth of EDO-SDRAM is a result of a major shift from EDO and Fast Page Mode DRAMs.*

WHAT IS EDO?

- *Extended Data Out is a memory technology that can provide approximately a 5-30% boost in the memory subsystem speed versus Fast-Page Mode.*
- *EDO provides increased performance by loading data at the same time it is searching for new information.*
- *EDO reduces the bottlenecking in data transfers between high-speed processors that need to get data quickly*

WHAT IS ECC?

- *Error checking and correcting memory automatically checks and corrects single-bit errors without bringing the system.*
- *The system will halt when 2-, 3-, 4-bit errors are detected.*
- *ECC memory requires more overhead than parity memory for storing data and causes approximately 3% performance degradation in the memory subsystem, but the resulting error detection and correction can make the trade-off well worth it.*

WHAT IS PC133 memory?

- *PC133 provides a one to one speed match with a FSB that is running at 133MHz. It is the bridge between PC100 SDRAM and future DDR SDRAM.*
- *PC133 improves overall memory timings and it also transfers data 33% faster between the memory and the microprocessor,*
- *The evolution of this new technology gives extra memory performance for the end user*

HARD DISK DRIVE TECHNOLOGY

WHAT IS ULTRA SCSI?

- *Also known as Fast-20, Ultra SCSI supports up to 20MBps burst transfers across 8-bit paths and up to 40MBps burst transfers across Wide 16-bit paths.*

- *As it is pin- and cable-compatible with SCSI-2 Fast and Fast/Wide, there's no need to change the physical connection, although you are restricted to shorter cables for external attachments.*

WHAT IS ULTRA 2 SCSI?

- *Ultra 2 SCSI technology is a doubling of the bus data rates of Ultra SCSI.*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *While Ultra 2 drives are implemented allowing operations on Ultra SCSI data buses, the new performance levels only exist in buses that are Ultra 2 exclusive.*

WHAT IS ULTRA-160/M SCSI?

- *Ultra-160/m SCSI technology provides data transfer rates of up to 160MB/s, thus doubling the bus rates of Ultra2 SCSI*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *Gives improved scalability and accommodation of faster devices, thus becoming an important building block in creating the worlds' fastest servers.*

Table showing current SCSI categories:

STA TERMS	Bus Speed Mbytes/Sec Max	Bus Width, bits	Max. Bus Lengths, Meters			Max. Device Support
			Single ended	LVD	HVD	
SCSI-1	5	8	6	(2)	25	8
Fast SCSI	10	8	3	(2)	23	8
Ultra SCSI	20	8	1.5	(2)	25	8
Ultra Wide SCSI	40	16	-	(2)	25	16
Ultra2 Wide SCSI	80	16	(1)	12	25	16
Ultra3 SCSI or Ultra-160/m (4)	160	16	(1)	12	(3)	16

(1) Single ended is not defined for speeds beyond Ultra
(2) LVD was not defined in the original SCSI standards for this speed. If all devices on the bus support LVD, then 12-meters operation is possible at this speed. However, if any device on the bus is singled-ended only, then the entire bus switches to single-ended mode and the distances in the single-ended column apply.
(3) HVD (Differential) is not defined for speeds beyond Ultra2
(4) After Ultra2 all speeds are wide only

UNINTERUPTIBLE POWER SUPPLIES

What is Uninteruptible Power Supplies?

- *A piece of hardware that help to protect your server from power outages.*
- *We strongly recommend for all Express5800 servers to be accompanied by a UPS (Uninterruptible Power Supply) which will protect data from any power problems and outages. We offer models in both tower based and 3U rack-mount form factors*
- *Our different UPS models provide a back up power supply to allow the server to overcome power problems. In the event of a complete power failure, the back up time allows the user to shut down the machine without losing important data.*
- *The table below shows the UPS options available. Firstly, calculate the total VA power of the configuration to be connected to the UPS by adding the power of all items of the configuration. Then, select the UPS corresponding to the calculated VA power and the required autonomy (in minutes) supplied by the UPS.*
- *It is recommended that you allow some UPS power margin for future configuration expansion.*

Table 1: Typical and Maximum VA power of Express5800 servers

Model	Typical VA (a)	Max VA (b)	Typical VA (a)	Max VA (b)	Max VA
TM1100	286	407	**HX4600**	1007	1438
LC1400	364	520	**HV8600**	1510	2157
LS2400	315	451	**ST8000**	365	520
MC2400	364	520	**ST1400**	365	520
120Ld	238	340	**4-Port concentrator**	36	52
120Mc2	268	383	**8-Port concentrator**	36	52
120Mc3	285	407	**Monitor 15"**	104	138
MH4500	719	1027	**Monitor 17"**	171	224
HX4500	755	1079	**Monitor 19"**	189	243

Table 2 : UPS autonomy (in minutes)

VA	SU700	SU1000	SU1400 SU1400RM	SU2200 SU2200RM	SU3000 SU3000RM
300	**20**	**36**	**60**	**130**	**116**
350	**17**	**28**	**49**	**112**	**101**
400	**14**	**24**	**41**	**98**	**89**
450	**11**	**20**	**36**	**86**	**79**
500	**9**	**18**	**32**	**76**	**70**
550	**7**	**15**	**28**	**68**	**63**
600	**6**	**13**	**25**	**61**	**57**
700	**5**	**11**	**21**	**50**	**46**
800	-	**9**	**17**	**41**	**39**
900	-	**7**	**14**	**35**	**34**
1000	-	**6**	**11**	**31**	**30**
1200	-	-	**9**	**24**	**24**
1400	-	-	**7**	**19**	**18**
1600	-	-	-	**16**	**16**
1800	-	-	-	**13**	**13**
2000	-	-	-	**10**	**10**
2200	-	-	-	**9**	**9**
2500	-	-	-	-	**8**
3000	-	-	-	-	**7**

What is a Smart Slot Interface and a UPS Share Box?

- *These two options provide added data protection for Multiple servers that are using a single UPS. If you are managing multiple servers, we propose that you use a Smart Slot Interface or a UPS share box ...*

TAPE DRIVE TECHNOLOGY

What is DAT?

- *Digital Audio tape (DAT) was originally designed specifically for digital audio recording applications.*
- *When it was realised that 4mm tape could store large amounts of digital data, produce fast data transfer rates and deliver reliability, hence DAT was introduced as a tape backup medium.*

What is DLT?

- *Digital Linear Tape (DLT) - latest development in tape backup technology.*
- *Uses symmetric phase recording technology that alternates head angles to help eliminate cross-track interference.*

MEMORY

- 64MB, 128MB, 256MB 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 133MHz FSB SDRAM Memory
- 128MB, 256MB, 512MB, 1GB ECC DIMM Memory
- 256MB, 512MB, 1GB ECC DIMM Memory

64MB, 128MB, 256MB 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AME-0511-00-00	AME-0511-IN-00	64MB (1x64) 100MHz FSB SDRAM Memory
AME-0512-00-00	AME-0512-IN-00	128MB (1x128)100 MHz FSB SDRAM Memory
AME-0513-00-00	AME-0513-IN-00	256MB (1x256) 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AME-0511-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0512-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0513-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB ECC 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-4064-00-00	AMS-4064-IN-00	64MB (1x64) ECC 100MHz FSB SDRAM Memory
AMS-4128-00-00	AMS-4128-IN-00	128MB (1x128) ECC 100MHz FSB SDRAM Memory
AMS-4256-00-00	AMS-4256-IN-00	256MB (1x256) ECC 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-4064-xx-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4128-xx-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4256-xx-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB, 512MB ECC 133MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-5064-00-00	AMS-5064-IN-00	64MB (1x64) ECC 133MHz FSB SDRAM Memory
AMS-5128-00-00	AMS-5128-IN-00	128MB (1x128) ECC 133MHz FSB SDRAM Memory
AMS-5256-00-00	AMS-5256-IN-00	256MB (1x256) ECC 133MHz FSB SDRAM Memory
AMS-5512-00-00	AMS-5512-IN-00	512MB (1x512) ECC 133MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-5064-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5128-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5256-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5512-00-00	64M bit x 72 Synchronous Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-6256-00-00	AMD-6256-IN-00	256MB ECC (4x64) 60ns DIMM Memory Upgrade kit
AMD-6512-00-00	AMD-6512-IN-00	512MB ECC (4x128) 60ns DIMM Memory Upgrade kit
AMD-6010-00-00	AMD-6010-IN-00	1GB ECC (4x256) 60ns DIMM Memory Upgrade Kit
Same characteristics for the AMD-7256-00-00, AMD-6512-00-00 and AMD-6010-00-00.		

TECHNICAL SPECIFICATIONS

AMD-6256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-6512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-6010-00-00	32Mx72bits Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-8256-00-00	AMD-8256-IN-00	256MB ECC (4x64) 50ns DIMM Memory Upgrade kit
AMD-8512-00-00	AMD-8512-IN-00	512MB ECC (4x128) 50ns DIMM Memory Upgrade kit
AMD-8010-00-00	AMD-8010-IN-00	1GB ECC (4x256) 50ns DIMM Memory Upgrade Kit

TECHNICAL SPECIFICATIONS	
AMD-8256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-8512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-8010-00-00	32Mx72bits Dynamic RAM high density memory module

HARD DISK DRIVES

- The 5,400rpm EIDE 10.2GB, 15GB HDD
- The 7,200rpm EIDE 12.9GB, 20.4GB HDD
- The 7,200rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 7,200rpm Ultra2 80-pin SCSI 9.1GB, 18.2GB, 36.4GB HDD
- The 7,200rpm Ultra2 68-pin SCSI 9.1GB, 18.2GB HDD
- The 10,000rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 10,000rpm Ultra2 80-pin SCSI 9.1GB, 18.2, 36.4GB HDD

HARD DISK DRIVES

PRICE PERFORMANCE

10.2GB,15GB (1")
5,400rpm
AST : 9/9.5ms
ITR : up to 158Mbit/s
ETR : 33MB/sand
66MB/s
Cache: 128KB to 512KB

12.9GB, 20.4GB (1")
7200rpm
AST : 9ms
ITR : up to 158Mbit/s
ETR : 33MB/s
Cache: 128KB to 512KB

9.1GB, 18.2GB (1")
7,200rpm
68-pin
AST : 6.9 to 8.2ms
ITR : up to 192Mbit/s
ETR : 80MB/s
Cache: 512KB

9.1GB, 18.2GB (1") 36.4GB
(1.6") 7,200rpm 80-pin
AST : 6.9 to 7.6ms
ITR : up to 190Mbit/s
ETR : 80MB/s
Cache: 512KB to 1MB

9.1GB, 18.2GB
(1"),36.4GB (1.6")
10,000rpm
AST : 5.4 to 6.7ms
ITR : up to 231Mbit/s
ETR : 80MB/s
Cache: up to 4MB

9.1GB, 18.2GB
(1"),36.4GB (1.6")
7,2000rpm
AST : 6.9 to 7.5ms
ITR : up to 231Mbit/s
ETR : 160MB/s
Cache: up to 2MB

9.1GB, 18.2G
(1"),36.4GB (1.
10,000rpm
AST : 5.4 to 6.
ITR : up to 231
ETR : 160MB
Cache: up to 2M
with Fibre Cha

AST : Average Seek Time
ITR : Internal Transfer Rate
ETR : External Transfer Rate

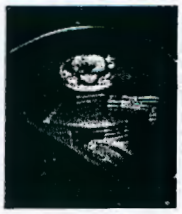
EIDE | **U2W SCSI** | **U-160/m SCSI**

EIDE vs SCSI

	EIDE	SCSI
ENVIRONMENT		
	Offers low cost and performance equal to SCSI in Entry level servers and Mobile environments.	Delivers excellent performance for network computers with Intel-Based processors. Data-intensive applications and large numbers of users in LAN Environments.
PERFORMANCE		
	In one to one HDD performance comparison EIDE performs equally well.	A SCSI interface offers the performance edge, especially when coupled with Windows NT.
PRICE		
	Generally least expensive. The controller is standard on the system board Chipset.	Drives are a little more expensive for the same capacity and rotational speed as EIDE. May also require a SCSI adapter.
EXPANDABILITY		
	Can support high hard drive capacity, as well as CD-ROM and tape devices up to 4 devices in all.	Holds more than 9GB. Offers high capacity and performance for multiple hard disks, a wide variety of devices and long cable connectors for more convenient attachment of external devices. Backwards compatible.
EASE OF INSTALLATION		
	Although most PCs ship with an EIDE interface, ensure that your system's EIDE interface and BIOS support all the new drive's Functionality.	You may need to install a SCSI adapter

The 5,400rpm EIDE 10.2GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0110-00-10	ADH-0110-IN-00	10.2GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0100-xx-00
Formatted Capacity	
ADH-0100-xx-00	10.2 GB
Interface	ATA-4/Ultra DMA

DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
ADH-0100-##-00	3
Tracks per Surface (Cylinders)	11,530
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320

PERFORMANCE SPECIFICATIONS	
Buffer Size	256 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.56ms
Rotation Speed (±0.1%)	5,400 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 18.6 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 7.5 sec typical

[1] - *Controller overhead not included.*

RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.77 (146.6)
Width inches (mm)	4.02 (102.1)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating ^{0} C	5 to 55
Non-operating ^{0} C	-40 to 71
Operating/Non-operating Relative ^{0} C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb (^{0} C)	27

POWER REQUIREMENTS

MODE	12V ± 5%	5V ± 5%	Power
Spin-up (peak)	1600mA	200mA	20.2W
Seek	650mA	340mA	9.6W
Read/Write	250mA	350mA	4.8W
Idle	250mA	280mA	4.4W
Standby	8mA	160mA	0.9W

The 5,400rpm EIDE, 15GB Hard Disk Drive

- 3.5" high performance hard drives
- Fast average seek time 9.5ms

Fast data transfer rate (up to 66MB/sec)

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0150-00-10	ADH-0150-IN-10	15GB (1") Fast ATA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0150-00-10
Interfaces	Ultra ATA
Formatted Capacity	15.367
DISK DRIVE ORGANISATION	
Heads	3
Disks	2
PERFORMANCE SPECIFICATIONS	
Buffer Size (KB)	512
Buffer type	SDRAM
Typical Seek Times* (ms)	
Average	9.5
Track-to-Track	1
Rotational Speed (rpm)	5,400
Average Rotational Latency (ms)	5.55
Start time (0-drive ready)	7.3sec typical
Integrated Controller	ATA-5/UDMA
Data Zones per surface	16
Bytes per sector/Block	512
DATA TRANSFER RATES	
To/From Interface	Up to 66.7MB/sec
To/From Media VL20 Series	Up to 36.9MB/sec
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles (min)	50,000
Component Design Life (min)	5 years
Non-recoverable Data Errors(per bits read)	<10 per 10^{14}
Annual return rate	<1%
PHYSICAL DIMENSIONS	
Width (Inches /mm)	4.00/102.0
Length-(Inches /mm)	5.78/146.7
Height-(Inches /mm)	1.02/25.9
Weight-(pounds/kg)	1.30/0.59
ENVIRONMENTAL LIMITS	
Operating Temperature(^{0}C)	5-55
Non Operating (^{0}C)	-40 to 71
Operating/Non-operating Humidity %(non-condensing)	5-95
Maximum Wet Bulb (^{0}C)	30

POWER REQUIREMENTS			
MODE	**12V ± 10%**	**5V ± 5%**	**Power**
Spin-up (peak)	2100mA	275mA	
Seek	740mA	420mA	11.0W
Read/Write	295mA	440mA	5.7W
Idle	230mA	380mA	4.7W
Standby	20mA	220mA	1.3W

The 7,200rpm EIDE 12.9GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- 66/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0130-00-11	ADH-0130-IN-11	12.9GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0130-00-11
Formatted Capacity	12.9 GB
Interface	ATA-4/Ultra DMA/66

DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
Recording Surfaces	4
Tracks per Surface (Cylinders)	16,383
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320

PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.55ms
Rotation Speed (±0.1%)	7200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 22.0 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical

[1] - *Controller overhead not included.*

RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 10 per 10^{15} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	4.00 (101.6)
Length inches (mm)	5.75 ()146.1)
Width inches (mm)	1.00 (25.4)
Weight lbs. (kg)	1.26 (0.5)

ENVIRONMENTAL LIMITS

Temperature	
Operating^0 C	5 to 55
Non-operating^0 C	-40 to 65
Operating/Non-operating Relative^0 C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb^0 C	27

POWER REQUIREMENTS

Nominal Voltage	**+5/ +12**
Voltage Margin (%)	+5/ +12
Typical Power Draw (W)	
Idle	6.2
Operating	8.8
Peak Current (mA on +5/ +12V)	700/1,830

The 7,200rpm EIDE 20.4GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- Up to 33MB/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0200-00-10	ADH-0200-IN-10	20.4GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0200-00-10
Formatted Capacity	20.4GB
Interface	ATA-4/Ultra DMA
DISK DRIVE ORGANISATION	
Data Surfaces/Heads	8
Tracks per Surface (Cylinders)	14,850
Track Density	14,522 tpi
Areal Density	3,800Mb per in^2
Recording Density	204-255 Kbit/inch
Flux Density	217-271 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	240-403
PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	1 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	4.18ms
Rotation Speed (±0.1%)	7,200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 31.2 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.78 (146.7)
Width inches (mm)	4.00 (102.0)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating^0 C	5 to 55
Non-operating^0 C	-40 to 71
Operating/Non-operating Relative^0 C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb^0 C	27

POWER REQUIREMENTS

MODE	12V ± 8%	5V ± 10%	Power
Spin-up (peak)	2400mA	200mA	29.8W
Seek	860mA	340mA	12.1W
Read/Write	460mA	325mA	<8W
Idle	475mA	250mA	<7W
Standby	8mA	160mA	<1W

The 7,200rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Advanced SCSI interface support data transfer rates of up to 160MB/s
- 7,200rpm, 6.19ms average seek time, 21MB/sec maximum sustained
- throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-7945-00-00	CDH-7945-IN-00	9GB Ultra-160/m SCSI,1"
CDH-7845-00-00	CDH-7845-IN-00	18GB Ultra-160/m SCSI,1"
CDH-7645-00-00	CDH-7645-IN-00	36GB Ultra-160/m SCSI,1.6"

KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-7945-00-00	CDH-7845-00-00	CDH-7645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	2	4	8
Number of heads	4	8	16
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
Rotational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1011	10 per 1011	10 per 1011
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.6/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91

NVIRONMENTAL LIMITS			
Operating Temperature	5* to 55*	5* to 55*	5* to 55*
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	1.0	1.0	1.0
Sound Power (bels, Idle)	3.6	3.6	4.0
Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (|G, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC+ 5%/12V DC+ 5%/	5V DC+ 5%/12V DC+ 5%/	5V DC+ 5%/12V DC+ 5%/
Typical Power Draw (W, Idle)	6.5	7.9	10.8
Typical Current Draw (A, Operating)			
5V	0.5	0.5	0.5
12V	0.85	0.90	1.20

The 7,200rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 80MB/s
- 7,200rpm, 4.17ms average latency

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-794#-00-00	BDH-794#-IN-00	9.1GB Ultra2 SCSI,1"
BDH-784#-00-00	BDH-784#-IN-00	18.2GB Ultra2 SCSI,1"
BDF-764#-00-00	BDF-764#-00-00	36.4GB Ultra2 SCSI,1.6"

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500	8	
1		3		5		7	HX4500, HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-794#-00-00	BDH-784#-00-00	BDF-764#-00-00
Interface	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
DISK DRIVE ORGANISATION			
Number of disks	3	5	10
Number of heads	5	10	20
Areal density (maximum)	N/A Mbits/sq.inch	N/A Mbits/sq.inch	N/A Mbits/sq.inch
Recording density (maximum)	223,000 bits/inch	223,000 bits/inch	223,000 bits/inch
User cylinders	11,737	11,721	11,721
Track density (T/inch)	12,580	12,580	12,580
Sector size	512 Bytes	512 Bytes	512 Bytes
Recording Method	16/17 EPR4	16/17 EPR4	16/17 EPR4
PERFORMANCE SPECIFICATIONS			
Data buffer	1,024KB	1,024KB	1,024KB
Rotational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	80MB/s	80MB/s	80MB/s
Average seek time	6.9/7.4ms	6.9/7.4ms	7.6ms
Track-to-Track	0.8ms	0.8ms	0.9ms
Full track	15ms	15ms	16ms
RELIABILITY SPECIFICATIONS			
Non recoverable read errors	10 per 10^{15}	10 per 10^{15}	10 per 10^{15}
S.M.A.R.T	Yes	Yes	Yes
MTBF (hours)	1,000,000	1,000,000	1,000,000
PHYSICAL DIMENSIONS			
Height in/mm	1.0/25.4	1.0/25.4	1.63/41.7
Width in/mm	40.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146	5.75/146	5.75/146
Weight (max.)lb/ kg	1.5/0.68	1.5/0.68	2.1/0.93

ENVIRONMENTAL LIMITS			
Idle Accoustics (mean/max Bels)	4.1/4.4	4.1/4.4	4.2/4.5
Operating Temperature	5* to 50*	5* to 50*	5* to 50*
Nonoperating temperature	-40* to 70*	-40* to 70*	-40* to 70*
Operating Shock	15	15	15
Nonoperating shock	75	75	75
Operating vibration (5-350 Hz)	0.5	0.5	0.5
Nonoperating vibration (350 Hz)	2.0	2.0	2.0
POWER REQUIREMENTS			
Start up current (amps)	1.4	1.5	1.4
Idle power (typ.Watts)	9.8	9.8	13.4

The 7,200rpm 68-pin Ultra2 SCSI 9.1GB, 18.2GB, Hard Disk Drives

- Formatted capacities of 9.1 to 36.4 Gbytes
- 7,200-rpm, 4.17 msec average latency
- Ultra2 SCSI (LVD) and Fibre Channel Interfaces
- Advanced SCSI Architecture (ASA II)
- MR heads, embedded servo and PRML channel

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-7930-00-00	BDH-7930-IN-00	9.1GB LVD Ultra2SCSI 68-pin
BDH-7830-00-00	BDH-7830-00-00	18.2GB LVD Ultra2SCSI 68-pin

KIT CONTENTS
HDD + 4 screws

CAPACITY & INTERFACE	BDH-7930-00-00	BDH-7830-00-00
Formatted Gbytes	18.2	36.4
Interface	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)
Interface type	68-pin	68-pin
PERFORMANCE		
Internal Transfer Rate	137 to 240 Mbits/s	137 to 240 Mbits/s
Internal Formatted Transfer Rate	12.9 to 22.5 Mbytes/s	12.9 to 22.5 Mbytes/s
External Transfer Rate -Mbytes/s Ultra2 SCSI/Fibre Channel	80/100 per loop	80/100 per loop
Multisegmented Cache, Ultra2 SCSI/FC	1,024 (4,096 optional)	1,024 (4,096 optional)
Track to Track Seek, Read/Write	0.8/1.1 msec	0.8/1.1 msec
Average Seek, read/Write	6.9/7.4 msec	7.4/8.2 msec
Average Latency	4.17 msec	4.17 msec
Spindle speed	7,200	7,200
Disks/Heads	3/5	5/10
I/O	Embedded	Embedded
Sectors/ track (512bytes/sector)	304	304
Cylinders	11,737	11,721
Recording Method (PRML)	16/17 EPR4	16/17 EPR4
S.M.A.R.T Capable	Yes	Yes
Recoverable Read Errors per Bits Read	10 per 10^{12}	10 per 10^{12}
NonRecovarable Read Errors per Bits Read	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	10 per 10^{8}	10 per 10^{8}
Service Life/Limted Warranty	5/5 years	5/5 years
POWER REQUIREMENTS		
+ 12 VDC + 5% (amps) Ultra SCSI, Ultra2 SCSI	0.9/0.9	0.9/0.9
+ 5 VDC + 5% (amps) Ultra SCSI/Ultra2 SCSI	0.8 [1.2]	1.2 [1.25]
Power (Idle watts) Ultra SCSI/Ultra2 SCSI [FC]	9.75 [11.3]	13.65 [15.5]
ENVIRONMENTAL		

Idle Acoustics (mean/max bels)	4.1/4.4	4.2/4.5
Operating Temperature (^{0}C)	5 to 50	5 to 50
Nonoperating Temperature(^{0}C)	-40 to 70	-40 to 70
Shock (Gs) Operating/Nonerating	15/75	15/75
Vibration (Gs) Operating(5-350Hz)		
Nonoperating (-350 Hz)		
Shock (Gs) Operating	0.5 (5-350 Hz)	0.5 (5-350 Hz)
Nonoperating	2.0 (<350Hz)	2.0 (<350Hz)

PHYSICAL

Height (in/mm)	1.0/25.4	1.63/41.7
Width (in/mm)	4.0/101.6	4.0/101.6
Depth (in/mm)	5.75/146.0	5.75/146.0
Weight (lb/Kg)	1.5/0.68	2.1/0.93

The 10,000rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 160MB/s
- 10Krpm, 5.0ms Seek time, 26MB/sec sustained throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-1945-00-00	CDH-1945-00-00	9GB Ultra-160/m SCSI,1"
CDH-1845-00-00	CDH-1845-00-00	18GB Ultra-160/m SCSI,1"
CDF-1645-00-00	CDF-1645-00-00	36GB Ultra-160/m SCSI,1.6"

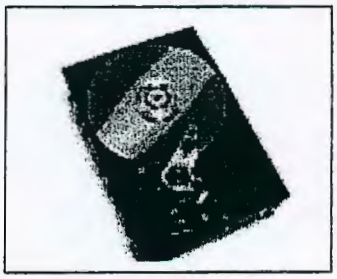
KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-1945-00-00	CDH-1845-00-00	CDF-1645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	3	6	12
Number of heads	6	12	24
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
Rotational speed	10Krpm	10Krpm	10Krpm
Latency (average)	3.0ms	3.0ms	3.0ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1012	10 per 1012	10 per 1012
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.6/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91
NVIRONMENTAL LIMITS			
Operating Temperature (@C)	5 to 50	5 to 50	5 to 50
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	0.5	0.5	0.5
Sound Power (bels, Idle)	4.0	4.0	4.2

Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (IG, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC± 5%/+12V DC± 5%/	5V DC± 5%/+12V DC± 5%/	5V DC± 5%/+12V DC± 5%/
Typical Power Draw (W, Idle)	8/10	10/12	15.5/17.5
Typical Current Draw (A, Operating)			
5V	0.50	0.50	0.55
12V	0.65	0.80	1.25

The 10,000 rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- 10,000rpm 3.5 inch disc drive
- Average seek times as fast as 5.2ms
- Unsurpassed formatted data rates of 14.5 to 21.3 Mb/S
- High-Performance Ultra2 SCSI interface



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-194#-00-00	BDH-194#-IN-00	9.1GB HDD Ultra2 SCSI, 1'
BDH-184#-00-00	BDH-184#-IN-00	18.2GB HDD Ultra SCSI, 1'
BDF-164#-00-00	BDF-164#-IN-00	36.4GB HDD Ultra SCSI, 1.6'

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500 (9GB only)	8	
1		3	ST8000	5	LC1400, MC2400, ST1400	7	HX4500/ HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-194#-xx-00	BDH-184#-xx-00	BDF-164#-xx-00
Formatted GB (512 bytes/sector)	9.1GB	18.2GB	36.4GB
Interface	Ultra2 SCSI	Ultra2 SCSI	Ultra2 SCSI
Interface type	80-pin	80-pin	80-pin
DISK DRIVE CONFIGURATION			
Disks/Heads	3 / 6	6 / 12	12 / 24
Sectors per drive (512 Bytes/Sector)	21	28	28
Cylinders	6,962	9,801	9,772
Recording Method	16/17 PR4	16/17 PR4	16/17 PR4
PERFORMANCE SPECIFICATIONS			
Internal Transfer Rate (Mbits/s)	152 to 231	193 to 308	179 to 313
Internal Formatted Transfer Rate (MB/s)	15 to 21	18 to 28	18 to 28
External Transfer Rate	80	80	80
Multi-segmented Cache (KB)	1,024	1,024	1,024
Optional Cache (KB)	4,096	4,096	4,096
Track-To-Track Seek (Read/Write/ms)	0.6 / 0.9	0.6 / 0.9	0.6 / 0.9
Average Seek, Read/Write (ms)	5 / 6	5.2 / 6	5.7 / 6.5
Maximum Seek, Read/Write (ms)	12.2 / 13.2	12.2 / 13.2	14 / 15
Average Latency (ms)	2.99	2.99	2.99
Spindle Speed (RPM)	10,025	10,025	10,016
RELIABILITY SPECIFICATIONS			
MTBF (Power-On hours)	1,000,000	1,000,000	1,000,000
S.M.A.R.T.	Yes	Yes	Yes
Recoverable Read Errors (per Bits)	1 per $10^{10^{\wedge}}$	1 per 10^{10}	1 per 10^{10}
Non-recoverable Read Errors (per Bits)	1 per 10^{15}	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	1 per 10^{8}	1 per 10^{8}	1 per 10^{7}
Service (years)	5	5	5

PHYSICAL DIMENSIONS			
Height (mm)	25.4 (1")	26.1 (1")	40.6 (1.6")
Width (mm)	101.6	101.6	101.6
Depth (mm)	146.1	147	146.1
Weight (kg)	0.54	0.59	0.91
ENVIRONMENTAL LIMITS			
Non-operating Temperature (°C)	-40 to 70	-40 to 70	-40 to 70
Operating Temperature (°C)	5 to 50	5 to 50	5 to 50
Operating Shock (Gs @ msec)	2	5	5
Operating Vibration (Gs @ 5-530 Hz)	0.5	0.5	0.5
Non-Operating Vibration (Gs @ 5-530 Hz)	2	2	2
POWER REQUIREMENTS			
+12 VDC± 5% (amps typical)	0.3	1	1.5
+5 VDC± 5% (amps typical)	0.8	1.1	0.8
Power (Idle watts)	11.1	10.4	15.6

STORAGE CONTROLLERS

PCI SCSI Controllers

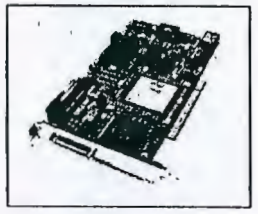
- The PCI Ultra - Wide Single-Ended Differential SCSI-3 Single Channel Controller Card
- The PCI Ultra-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI Single channel Controller Card

PCI RAID Controllers

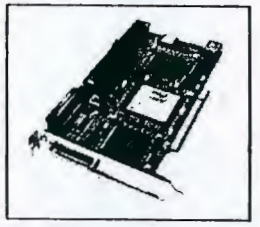
- The SecuRaid 110, PCI RAID Ultra2 SCSI Single Channel RAID Card
- The SecuRaid 210, PCI Ultra-2 SCSI Single Channel RAID card
- The PCI RAID Ultra-Wide SCSI-3 Single Channel RAID card
- The SecuRaid 530 64 bit PCI Ultra2 SCSI Tri-channel
- The Differential Ultra-Wide SCSI to SCSI RAID Kit

RAID CONTROLLERS

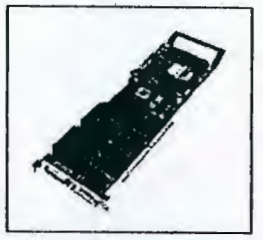
PRICE PERFORMANCE



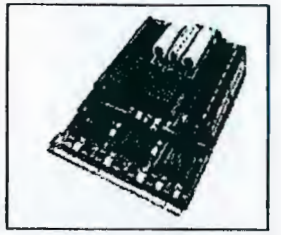
SecuRAID110
1-channel ; Ultra2 Wide SCSI
33Mhz i960 RISC processor
4MB and 16MB cache



SecuRAID210
1-channel ; Ultra2 Wide SCSI
66Mhz i960 RISC processor
8-16-32-64MB cache



SecuRAID530
3-channel ; Ultra2 Wide SCSI
233Mhz StrongArm processor
16-32-64MB cache with or without battery backup



U/W SCSI to SCSI RAID
3-channel (2 drive – 1 host)
U/W SCSI
33Mhz i960 RISC processor
16-32-128MB cache

Internal Storage (PCI based)

The PCI Ultra- Wide SCSI-3 Single Channel Controller Card

- 40 MB/s Ultra Wide SCSI data transfer rate
- Connectivity for up to 15 SCSI peripheral devices in a single PCI slot
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0585-00-00	AIF- 0585-IN-00	Ultra-Wide SCSI-3 Single-Channel
AIF-0586-00-00	AIF-0586-IN-00	Ultra-Wide Differential SCSI-3 Single Channel

KIT CONTENTS
32 Bit Single-ended/Differential SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0585-xx-00 AIF-0586-xx-00
Computer Bus	32-bit PCI Local Bus
PCI Compliance:	PCI 2.0 specification, (PCI 33MHz)
Interface Protocol	Bus master DMA
Host bus Burst data Rate	133 MB/s
Peripheral Bus	8-bit and 16-bit wide Ultra SCSI
SCSI Synchronous	40 MB/s
SCSI Asynchronous data Rate	3.3 MB/s
Device Protocol	SCSI-1, SCSI-2, SCSI-3, Wide Ultra SCSI
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	One 68-pin high density
External Connectors:	One 68-pin high-density
External Drivers :	
IF-0585-xx-00	Single-ended, active termination
AIF-0586-xx-00	Differential, active termination
Device Support	Up to wide 15 devices

OPERATING SYSTEM SUPPORT	
Regulatory Compliance:	FCC Class B, CE, IEC

PHYSICAL DIMENSIONS	
Length inches (cm)	6.87 (17.0)
Height inches (cm)	3.87 (9.5)

ENVIRONMENTAL LIMITS	
Storage Temperature ^{0}C	-55 to 85
Operating Temperature ^{0}C	0 to 55
Operating Humidity %	10 to 90, non-condensing
Power Requirements	5 V +/-5% at 2.0 amps maximum

The PCI Ultra-Wide SCSI-3 Dual channel Controller Card

- Up to 80 MB/s across two SCSI channels in a single PCI slot
- Connection for up to 30 SCSI devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0587-00-00	AIF-0587-IN-00	PCI Ultra-Wide SCSI-3 Dual Channel

KIT CONTENTS
SCSI Controller Card EZ-SCSI software

CONTROLLER SPECIFICATIONS	AIF-0587-xx-00
Computer Bus	PCI Local bus PCI 2.0 specification, (PCI 33MHz), Two fully independent PCI SCSI channels bridged to systems PCI bus
Interface Protocol	Bus master DMA
Device Protocol	16-bit Ultra SCSI
Host Bus Data Transfer Rate	Up to 133 MB/s
SCSI Synchronous Data Rate	80 MB/s (6 MB/s per channel)
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	Two 68-pin, high-density internal connector
External Connector	One 68-pin, very high density external connector
Electrical Drivers	Single-ended, active termination
Device Support	Up to 30 devices

OPERATING SYSTEM SUPPORT	
I/O Operating Environment	DOS, Windows, Windows95, Windows NT, Windows for Workgroups, OS/2, NetWare, UNIX (SCO, UnixWare)
Regulatory compliance	FCC class B, CE, IEC

PHYSICAL DIMENSIONS	
Length inches (cm)	6,875 (17.463)
Width inches (cm)	4.0 (10.16)

ENVIRONMENTAL LIMITS	
Operating Temperature: °C	-5 to 60
Storage Temperature°C	-60 to 95
Operating Humidity %	10 to 95, non-condensing
Power requirements	5V ± 5% at 2.0 amps max.

The PCI Ultra-Narrow SCSI-3 Single channel Controller Card

- Easy Plug and Play installation of up to seven Fast SCSI hard drives, CD-Re-writaeable drives, scanners, DAT and DLT media peripherals
- Fast SCSI data transfer rate of up to 10MB/sec

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0588-00-00	AIF-0588-IN-00	PCI Ultra-Narrow SCSI-3

KIT CONTENTS
SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0588-xx-00
PC Bus Type	32-PCI
Interface Transfer Method	Bus Master DMA
Total Devices supported	7 total (internal or external)
Data Transfer rate	10MB/s
Supported Protocols	SCSI-1, SCSI-2, and Fast SCSI-2
Boot support	Bootable (on board BIOS)
Internal Connector	50-pin standard (male)
External Connector	50-pin high-density SCSI-2 (female)
OPERATING SYSTEM SUPPORT	IBM-compatible PC-486, Pentium, or above Windows NT, Windows 95, Windows 3.1, MS-DOS 6.0, OS/2, SCO UNIX or UnixWare OS, PCI expansion slot SCSI peripheral
PHYSICAL DIMENSIONS	
Length inches (cm)	4.7" (11.9)
Height inches (cm)	3.0 (7.6)
Weight lbs	Approx 1.5
ENVIRONMENTAL LIMITS	
Operating temperature	-5 to 60
Non-Operating temperature	-55 to 60
Relative Humidity	10 to 90 non-condensing
	5.0v+ /-0.25 at 2.0 amps maximum

The PCI Ultra2 Wide SCSI-3 Single channel Controller Card

- Up to 80MB/s across one SCSI channel in a single PCI slot
- Connection for up to 15 SCSI-2 or SCSI-3 devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0589-00-00	AIF-0589-IN-00	PCI Ultra 2-Wide SCSI-Single Channel

KIT CONTENTS
Symbols SYM8952U

CONTROLLER SPECIFICATIONS	AIF-0589-00-00
SUPPORTED BUSES	
	32-bit, PCI Local bus 16-bit, Wide SCSI bus Single-ended SCSI asynchronous transfers, single-ended Fast/Ultra SCSI synchronous transfers, LVD Ultra2 SCSI Synchronous transfers
SCSI BUS TERMINATION	
	Active, automatic terminating, Universal LVDlink with automatic switching to single-ended Termination power: current limited, self-resetting
SCSI BUS CONNECTION	
	Up to 15 SCSI, SCSI-2 or SCSI-3 devices
BOARD CONNECTORS	
Internal	68-pin, right angle, high density, SCSI bus 4-pin for off-board SCSI Active LED
External	68-pin, high-density connector interconnect
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI asynchronous	Up to 14 MBps
SCSI synchronous single ended	
FAST	Up to 20MBps
ULTRA	Up to 40MBps
SCSI synchronous LVD	
ULTRA2	Up to 80 MBps
PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size	3.5in. x 6.0in
Form Factor	PCI 2.1 universal board
Bracket	ISA/EISA style
Operating temperature	5^0C to 55^0C
Relative humidity range	5^0 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage Temperature	-40^0C to 85^0C
Electrical	5V +/- 5% (1,5A max) 12V +/-5% (50mA max)
MTBF	<500,000 hours
PCI Maximum power dissipation	15 Watts
PRSNT1#	Open
PRSNT2#	**Ground**

The PCI Ultra2-Wide SCSI Dual channel controller Card

- Supports Fast/ Ultra SCSI bus speeds of up to 20 or 40MBps
- Connects up to 15 Fast or Ultra devices

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0590-00-00	AIF-0590-00-00	PCI - ULTRA2 SCSI Dual Channel Host Adapter

KIT CONTENTS
Symbios SYM21002

SUPPORTED BUSES	AIF-0590-00-00
	8-/16-bit Fast/Ultra SE SCSI bus (up to 15 SCSI devices 16-bit Ultra/Ultra2 SE or LVD SCSI bus (up to 15 SCSI devices) up to 80 MBps (Channel B)
SCSI BUS TERMINATION	
	Active Termination with Tolerant. (active negation) technology on both channels Channel A: Single-ended SCSI Channel B: Universal LVDlink SCSI with automatic switching to single-ended when single-ended devices are connected to SCSI bus
SCSI BUS CONNECTION	
	Up to 15 Fast SCSI Ultra SCSI peripherals on Channel A Up to 15 Fast SCSI, Ultra or Ultra2 SCSI peripherals on Channel B
BOARD CONNECTORS	
Internal	Universal, 32-bit PCI edge connector Channel A 68-pin, right angle, high density latching SCSI bus Channel A 50-pin low density Channel B 68-pin, right angle, high density latching SCSI bus
External	Channel A 50-pin High Density
Off-board LED Indicator:	Channel A and B SCSI Bus Active 4-pin header for off-board LEDs
On-board jumpers:	The standard SYM21002 is a jumper-less solution
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 14 MBps (per channel)
SCSI Synchronous single-ended	Fast-up to 40 MBps (per channel)
SCSI Synchronous LVD	Ultra-up to 40 MBps (per channel) Ultra2-up to 80MBps (per channel)

PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS

Board Size:	Approximately 4in. X 7.5in.
Form Factor:	PCI 2.1, 32-bit Universal Board
Bracket:	ISA/EISA style
Operating temperature	0^0C to 55^0
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-40^0 C to 85^0C
MTBF	>400,000 hours
Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts PRSNT1#- open PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B CE VCCI UL94V0

The PCI Ultra-Narrow SCSI Single channel controller Card

- Fastest standard systems bus available today, offering high performance Fast SCSI I/O technology
- Connects up to 7 SCSI devices
- Data transfer rate of up to 10MBps.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0591-00-00	AIF-0591-00-00	PCI - Fast SCSI host adapter

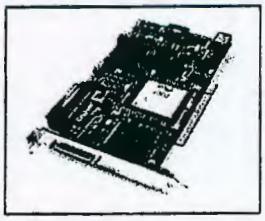
KIT CONTENTS
Symbios SYM20810

SUPPORTED BUSES	AIF-0591-00-00
	32-bit, DMA bus master, PCI local bus
	8-bit, single-ended SCSI-1, SCSI-2 (Fast SCSI)
SCSI BUS TERMINATION	
	Single-ended with active, auto termination for SCAM (SCSI Configured Automatically) support.
	Fused, self - resetting termination power
SCSI BUS CONNECTION	
	Up to 7 SCSI or SCSI-2 devices
BOARD CONNECTORS	
Internal	50-pin, low density 8-bit SCSI (SYM20810 only)
External	50-pin, high density 8-bit SCSI (SYM20810 / SYM20811)
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 7 MBps
SCSI Synchronous	Up to 5 MBps
Fast SCSI-synchronous	Up to 10 MBps
Direct(bus master) memory access for low overhead, 32-bit data burst transfers at PCI bus bus transfer rates	✓
Zero wait state PCI transfer rate	✓
Up to 64-byte PCI burst size to maximise the PCI data transfer rate	✓
PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size:	
Form Factor:	2.5" x 4.75"
Bracket:	ISA/EISA style
Operating temperature	5 to 55
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-55 to 8'c
MTBF	>400,000 hours

Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts
	PRSNT1#- open PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B CE VCCI UL94V0

The SecuRAID 110, PCI Ultra2 Wide SCSI Single channel RAID card

- Onboard Intel i960RP 33MHz RISC processor
- Single Channel PCI-to-Ultra2 SCSI LVD
- I_20 Ready
- Quick and easy configuration with (GAM) DACCF Software



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0677-00-00	AIF-0677-IN-00	PCI Ultra2 SCSI Single Channel

KIT CONTENTS
RAID card 4MB.16MB cache

CONTROLLER SPECIFICATIONS — AIF-0677-xx-00

- Intel i960RP 33MHz RISC processor
- PCI 2.1 compliant
- I_2O compliant
- ECC EDO RAM
- 4MB cache, Flash EEPROM, 512K x 8 (72 pin JEDEC SIMM)
- BIOS resident configuration Utility

Internal Connectors
- 1 68-pin High-Density

External Connector
- 1 68-pin Very High-Density

SCSI SPECIFICATIONS

- 1 Ultra2 LVD channel on controller
- SISL Features
- Up to 80MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect/reconnect
- 64 concurrent host commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- RAID Clustering
- Transparent disk drive rebuild
- Background Initialisation
- Immediate RAID Availability
- RAID Migration
- RAID expansion
- Drive travelling during Power-Off
- Automatic detection of failed drives
- Automatic and transparent re-build of replacement drive
- On-line RAID expansion
- Hot Spare drive support

- Hot Drive Swapping support
- SAF-TE enclosure management
- RAID configuration stored on disk and NVRAM

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client Server GUI Interface
- Create, manage, expand and monitor program
- Error statistics and performance
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEMS SUPPORT

- Windows 95 & Windows 98
- Windows NT 3.51, 4.0 Workstation and Server
- NetWare 3.x, 4.x, 5.x & SMP
- SCO UnixWare 2.1
- SCO UNIX OSR 5.x
- DOS 5.x, 6.x & above
- 120 supported platforms and OS environments

PHYSICAL DIMENSIONS

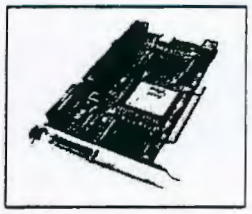
Length inches	7.225
Width inches	4.2
Max.Component inches	0.105 solder side
Height	0.570 component side
Board	Not to exceed the width of one PCI slot

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to + 55
Non-operating Temperature ^{0}C	-20 to +70
Operating Humidity %	10 to 90 relative humidity (non-condensing)
Non-Operating Humidity %	10 to 90 relative humidity (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

The SecuRaid 210, PCI Ultra2 Wide SCSI Single Channel RAID card

- 32bit PCI Ultra2 Single Channel RAID controllers
- Embedded Intel i960RD 66MHZ processor
- Monolithic NT driver that increases overall system throughput



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0685-00-HU	AIF-0685-IN-HU	PCI RAID Ultra2 SCSI Single Channel
AMR-0508-00-00	AMR-0508-IN-00	8MB Cache Memory Module for SecuRAID 210
AMR-0516-00-00	AMR-0516-IN-00	16MB Cache Memory Module for SecuRAID 210
AMR-0532-00-00	AMR-0532-IN-00	32MB Cache Memory Module for SecuRAID 210
AMR-0564-00-00	AMR-0564-IN-00	64MB Cache Memory Module for SecuRAID 210

KIT CONTENTS
RAID card Documentation

CONTROLLER SPECIFICATIONS — AIF-0685-xx-HU

- Intel i960RD RISC Processor / 66MHz
- PCI 2.1 Compliant
- I_2O Ready
- 8/16/32/64MB cache
- ECC EDO RAM in a 72 pin JEDEC SIMM
- RAID firmware on 1 MB Flash EEPROM
- Hardware XOR
- ECC Memory Support

SCSI SPECIFICATIONS

- Supports SCSI1, SCSI2, Ultra SCSI and Ultra2 SCSI devices
- Full support for Low Voltage Differential (LVD) devices
- SISL Features
- Up to 80 MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect / reconnect
- 64 concurrent host commands
- 256 tagged commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- Transparent disk drive rebuild
- On-Line RAID expansion (M.O.R.E.)
- Up to Eight Controllers per System (NT)
- Logical drive size of 2 Terabytes, 32 logical drives per controller
- Background initialisation; Immediate RAID Availability
- RAID migration

- Variable stripe size per controller
- Variable cache line size per controller
- Up to 8 non-disk devices per controller
- Drive travelling during power off
- SAF-TE enclosure management
- Automatic error recovery
- Write through or write back cache support / logical device
- Automatic detection of failed drives
- Automatic rebuild of hot spare drive
- Hot drive swapping support
- ECC detection/correction on cache memory
- Support for SMART capable drives
- Configuration data stored on disk and NVRAM

RAID MANAGEMENT

- Client Server GUI Interface
- Global Array Manager
- Create, manage, expand and monitor program
- Error statistics and performance information
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEM SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare 3.x, 4.x (non NWPA) & SMP
- SCO UnixWare 2.1, 7.0, UNIX OSR 5.x
- OS/2.x,3.x &SMP
- DOS 5.x, 6.x and above

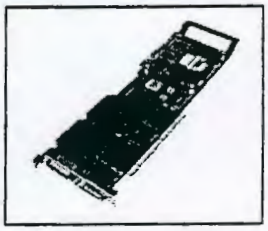
PHYSICAL DIMENSIONS

- Half Length PCI Footprint (7.225" x 4.2")

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to 55
Power Requirements	+5.0V (+- 5%), 3.5 A (max); 17.5 watts max.
MTBF Hrs	200,000

The SecuRaid 530 64 bit PCI Ultra2 Wide SCSI Tri-channel RAID card



- A 64bit PCI Ultra2 SCSI RAID Controller for extreme performance
- Intel's leading edge DSP a 233MHZ StrongArm micro-controller
- Offers Uncompromising fault tolerance, data availability , superior configuration and management flexibility.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0690-00-HU	AIF-0690-IN-HU	64 bit PCI Ultra2 SCSI Tri-channel
AMR-0616-00-00	AMR-0616-IN-00	16MB Cache Memory Module for SecuRAID530
AMR-0617-00-00	AMR-0617-IN-00	16MB Cache Memory Module+ Battery Backup Unit for SecuRAID53
AMR-0632-00-00	AMR-0632-IN-00	32MB Cache Memory Module for SecuRAID530
AMR-0633-00-00	AMR-0633-IN-00	32MB Cache Memory Module + Battery Backup Unit for SecuRAID5
AMR-0664-00-00	AMR-0664-00-00	64MB Cache Memory Module for SecuRAID530
AMR-0665-00-00	AMR-0665-00-00	64MB Cache Memory Module + Battery Backup Unit for SecuRAID5

KIT CONTENTS
RAID card Disks Documentation

CONTROLLER SPECIFICATIONS — AIF-0690-xx-HU

- Intel DSP 233MHz RISC micro-controller
- 64Bit PCI Hot plug support
- 8MB to 64MB
- 1_2O Hardware ready
- SDRAM in a 72 pin JEDEC SIMM
- RAID Hardware on 4MB FLASH EEPROM
- Hardware XOR
- ECC Memory Support

SCSI SPECIFICATIONS

- 3 Ultra2 SCSI channels
- Full support for Low Voltage Differential (LVD) devices
- Up to 80Mb/s Burst data rate
- Automatic SCSI bus termination
- Disconnect/reconnect
- Support of embedded SCSI controllers through a specific I/O Slot (SSIL feature)
- 256 tagged commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID Levels 0,1,0+1, 5 and JBOD
- Transparent disk drive rebuild
- Up to 16 controllers per system (NT)
- Onboard BIOS: Embedded in the firmware

- On-line RAID expansion (M.O.R.E)
- Automatic Detection of failed drives
- Automatic and transparent re-build of replacement drives
- Automatic error recovery
- SAF-TE enclosure management
- Write through or write back cache support/ logical device
- Hot Drive Swapping support
- RAID configuration stored on disk and NVRAM
- Memory write and Invalidate command

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client GUI Interface (GAM client)
- Create manage, expand system drives, error statistics and performance information
- BCU BIOS config utility with RAID manager (DACCF)

OPERATING SYSTEMS SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare3.x, 4.x & SMP
- SCO UnixWare 2.1
- SCO UnixWare 2.1
- DOS 5.x, 6.x & above
- Sun Solaris
- I_2O supported platform and OS environments

PHYSICAL DIMENSIONS

Length inches	12,280
Width inches	4,750
Max Component inches	0.105 solder side of board
Height inches	0.570 component side of board

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to +55
Non-Temperature ^{0}C	-20 to +70
Operating Relative Humidity %	10 to 90 (non-condensing)
Non-Operating Relative Humidity %	10 to 90 (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

SERVER OPTIONS

Server Management

- The ISA Server Management Board

Network & Communication

- The 32bit PCI 10/100Mbps Ethernet (Intel Pro100+ Server)Adapter
- The 32bit Dual Port 10/100Mbps Ethernet (Intel Pro100+Dual Port Server) Adapter
- The 32 bit PCI 10 / 100Mbps Ethernet Adapter (3COM)
- The External Fax Modem 56Kbps
- The 32 bit PCI Gigabit Ethernet (Alteon ACenic)Adapter

CD-ROM Drives

- The 40x Internal SCSI CD-ROM drive
- The 40x Internal IDE CD-ROM drive

Tape Backup Options

- The 4GB IDE Internal Tape Drive
- The DDS2 4/8GB, DDS3 12/24GB, Autoloader 48/96GB SCSI DAT Tape Backup
- The DDS4 20/40GB SCSI DAT Tape Backup
- The 20/40GB SCSI DLT External/Internal Tape Drive
- The 35/70GB SCSI DLT External/Internal Tape Drive

ISA Server Management Board

- Supported in ESMPRO Management Suite 1.5 and above
- Optional External modem
- Security (user name, password, call back feature)

CUSTOMER INTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0702-00-00	AIF-0702-IN-00	ISA Server Management Board

KIT CONTENTS
ISA Server Management Board
AC Power Module
Cables x 2
Installation Documents

! Requires an external modem

FUNCTIONS	AIF-0702-000
BUSI/F	ISA
Processor	H8/3003
NVRAM	128K
Serial port	Dual A sync Serial port
Battery	Internal
AC adapter	External
Modem	External
RTC	Internal
Reset I/F	Requires same cable as NEC's SMB
Power control	Requires same cable as NEC's SMB
Sensor	Temperature, Voltage, Optic chassis open
Interrupt	1
WDT	Internal
MONITORING	✓
Post monitoring	✓
BOOT monitoring	✓
Watch dog Timer+	✓
Shutdown (Shut down at trouble, User shut down)	✓
Temperature, Voltage, Chassis open	✓
OS Hang (Stall panic)	✓
LOG	
HW Error Log (ex. Troubles detected by monitoring)	✓
NT Event Log (System, Application, Security)	✓
OS Event Log area	✓
ALERT	
Information capturing (POST code)	✓
WAN (Atomic Alert)	✓
Pager	✓

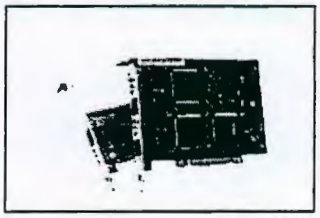
REMOTE MAINTENANCE	
Shutdown	✓
Remote Power Control (Reset, Power OFF, ON)	✓
Remote SMB configuration	✓

OTHER	
FW update	N/A
Set Threshold	✓
Security (user name, ID, Password)	✓

SOFTWARE ENVIRONMENT	
ESMPRO	✓
EV2701	✓
Windows NT,	✓
Netware	✓

The 32bit PCI 10/100Mbps Ethernet (Intel Pro 100+ Server) Adapter

- Scalable performance (up to 800Mbps) reduces server bottlenecks
- Redundant connections maximise server uptime
- Remote Server Management increases IT staff efficiency



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0519-00-00	ALN-0519-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter
1 NT disk
1 Netware disk
1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0519-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Connectors	Single: RJ-45
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	6K cache
Interrupt levels	INTA
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558
NETWORK-MANAGEMENT	
WfM baseline v2.0 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
Intel Pro/	✓
SNMP-manageable	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓

Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓

ENVIRONMENTAL LIMITS

Operating temperature ^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT

.67 Watts @ +5VDC

The 32bit PCI 10/100Mbps Ethernet (Intel Ethernet Pro 100+Dual Port Server) Adapter

- Two 10/100Mbps ports on one card
- Aggregate bandwidth up to 800Mbps
- PCI Hotplug lets you swap out an adapter with the server
- High-link availability through Adapter Fault Tolerance

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0619-00-00	ALN-0619-IN-00	

CONTROLLER SPECIFICATIONS	ALN-0619-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	Dual: PILA8472
Connectors	Dual: RJ-45
ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	12K cache
Interrupt levels	INTA and INTB
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558
NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
SNMP-manageable	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓
Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓
OS/2	✓
DOS	✓

ENVIRONMENTAL LIMITS

Operating temperature^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT

6.5 Watts @+5VDC

The 32bit PCI 10/100Mbps Ethernet Adapter (3COM)

- DMI 2.0 support which enables PC asset Management and diagnostics via standard DMI browsers
- Integrated Managed PC Boot Agent (MBA) allows for after hour updates, installations and repairs.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0922-00-00	ALN-0922-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter 1 NT disk 1 Netware disk 1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0918-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	3C905B-TX
Connectors	Single: RJ-45 (female)
ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5 packs
Switchless board configuration	
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	
Data rate(s) supported per port	10 & 100Mbps
On-board memory	4K cache
Interrupt levels	
IEEE support	802.3
Data path width	32-bit
Hardware certifications	
Data transfer mode	
Controller or processor	
NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	✓
DMI 2.0 support	
Board and network diagnostics	Optional
SNMP	✓
RMON	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓

Windows* 95,98	✓
Novell NetWare* 3.x and 4.x server drivers	✓
SCO UnixWare*	✓
OS/2 ODI	✓
DOS Windows 3.x	✓
Windows for Workgroups	✓
SCO Open Server 5	✓
LAN Manager	✓

ENVIRONMENTAL LIMITS

Operating temperature ^{0}C	0-70
Operating humidity %	10-90%

The NICs described in the table above can support the latest 3 sophisticated technologies:

- ✓ **Adapter Fault Tolerance**
- ✓ **Asymmetric Port Aggregation (aka "Adaptive Load Balancing")**
- ✓ **Symmetric Port Aggregation (aka "Fast EtherChannel")**

For more information visit our website at www.neccsd-europe.com and look in our Technology section.

The 32bit PCI 1Gigabit Ethernet Adapter (Alteon ACEnic)

- Full-duplex Gigabit Ethernet Interface
- Replaces multiple 100Mbps interfaces in congested servers
- Adaptive interrupt frequency
- Completely interoperable with existing Ethernet equipment

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0400-00-00	ALN-0400-IN-00	32-bit PCI Gigabit Ethernet Adapter

KIT CONTENTS
Server Adapter 1 NT disk 1 Netware disk 1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0400-00-00
Bus interface	PCI bus master, 32/64-bit, 33/66 MHz Adaptive DMA
Connections	SC Fiber connector for 62.5/125 micron fiber or 50/125 micron fiber

ADAPTER PRODUCT FEATURES	
Adaptive Interrupt Technology	✓
Separate Read & Write DMA	✓
Aggregate bandwidth	2Gbps
Full-duplex capable	✓
Data rate(s) supported per port	1Gbps
IEEE support	802.1Q
Data path width	32-bit
Maximum IP addresses per adapter	64
Embedded 32-bit RISC processor	✓

OPERATING SYSTEM SUPPORT	
Windows NT 4.0	✓
Novell NetWare 4.10 & 4.11	✓
Solaris 2.5.1, 2.6 & 2.7	✓

ENVIRONMENTAL LIMITS	
Operating temperature °C	0-50
Operating humidity %	5-85% (non-condensing)

OPERATING DISTANCES	
62.5 MICRON MM fiber	2-260 meters
50 mi	2-550 meters

The External Fax/Modem 56 Kbps

- Up to 56 Kbps Internet Connectivity
- K56flex upgradeable to ITU/TIA standard
- Enhanced ADPCM/PCM voice operation with concurrent DTMF detection

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESRIPTION
ACC-0056-**-00		External Modem 33.6KBps

**country code BB=British, FF=French, DD=German, TT=Italian, EE=Spanish, JJ=Dutch, SS=Swedish, AA=Danish, NN=Norwegian, YB=Belgian/English, CF=Swiss/French.

KIT CONTENTS
Modem adapter
Cable for power socket

MODEM FEATURES	DCC-115-AO
Modem Speed	56 Kbps Internet connectivity
Chipset Resolution	Rockwell RCVDL56ACFW/SP modem chip Downloadable MCU & Data Pump firmware from Host
DATA Modem	56 Kbps Internet connectivity (K56flex upgradeable to ITU/TIA standard) V.34bis (33.6) V.34 (28.8 Kbps) V.32 bis (14.4 Kbps) V.32, V.23, V.22, V.22 A/B, V.21 Bell 212A, Bell 103
Data Compression	V.42 bis, MNP 5
Error Correction	V.42LAPM, MNP 2-4
Fax Modulations	V.17, V.29, V.27ter
Fax Control/Protocol	Class 1, V.21 Channel 2 and Group 3 fax mode
OPERATING SYSTEM SUPPORT	
	Windows 3.1x Widows 95 Windows NT3.5x TAPI compliant
MODEM COMPONENTS	
Indicator lights	AA (auto Answering lights up when the modem is configured to answer the ring automatically TR (Data Terminal Ready) lights up when the computer raises the Data Terminal Ready (DTR) line, indicating it is ready to begin communications. CS (Clear to send) lights up when the data transfer path is clear for data transmission. OH (Off Hook) lights up when modem is connected to another modem and off hook CD (Data Carrier Detect) lights when modem detects a carrier signal the telephone line. SC (Send Data) lights up when the modem transmits data to the computer RD (Receive Data) lights up when data is receive by the modem.
CONNECTORS AND SWITCHES	
	1 x ON/OFF rocker switch 1 POWER socket for supplied cable 1 x 9-pins SERIAL PORT connector RJ11 Telephone socket for telephone line/handset 3.5mm jack for Mono Mic-Input

The 40x Internal SCSI, CD-ROM

- Up to 6,000KB/s Sustained Transfer Rate
- SCSI Interface
- 80ms Average Random Access
- 256KB Buffer

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADO-5703-00-00	ADO-5703-IN-00	40x internal SCSI CD-ROM

KIT CONTENTS
CD-ROM + Screws
Users Guide

CAPACITY AND INTERFACE	ADO-5703-xx-00
Interface	Internal SCSI-2 (ID 0 to 7)
FORMAT SPECIFICATIONS	
Average Random Access (32X)	80 ms
Compatible CD Roms Standards:	Red-Book, Yellow-Book, CD-ROM XA, CD-I Bridge (Photo-CD, Video CD), CD-I, CD-I Ready, CD-G and Multisession (Photo-CD, CD-Extra, CD-RW, CD-R), CD-TEXT
PERFORMANCE SPECIFICATIONS	
Sustained Mode 40X	2,595KB/s (20MB/s Sync.)
Burst (SCSI)	6,000 KB/s (20MB/s Sync)
Buffer Cache Size	256KB
RELIABILITY SPECIFICATIONS	
ERROR RATES	
UNRECOVERABLE-Mode 1	< 1 in 10^{15}
UNRECOVERABLE-Mode 2	< 1 in 10^{12}
Seek	< 1 in 10^{6}
MTBF	1000,000 POH @ 20% Duty Cycle
ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 50
Storage Temperature ^{0}C	-10 to 60
Operating Humidity %	8 to 80 non-condensing
Wet Bulb	27 ^{0}C max
POWER REQUIREMENTS	
Avg. DC +12v, +5v (± 5%)	6.9W
Standby DC +12v, +5v (± 5%)	0.5W

The 40x Internal IDE CD ROM

- 6 MB/sec maximum data transfer rate
- 100 ms average access time
- 256 KB buffer memory
- MPC-III compliant
- E-IDE/ATAPI interface

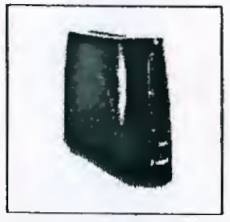
CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADR-0400-00-10	ADR-0400-IN-10	40x Internal IDE CD-ROM

KIT CONTENTS
CD-ROM + Screws Users Guide

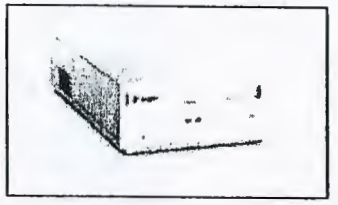
CAPACITY AND INTERFACE	ADR-0400-00-10
Interface	E-IDE/ATAPI
FORMAT SPECIFICATIONS	
Supported Formats	ISO 9660, High Sierra Group, Photo CD multisession, CD-ROM XA Mode 2 Form 1 & 2, CD-ROM mode 1& 2, CD-i FMV*, Video CD*, CD-DA, Enhanced-CD, MPC-III compliant, CD-RW, CD-R
PERFORMANCE SPECIFICATIONS	
Transfer Rate	Maximum data transfer rate 6 MB/sec
Average Access Time	100 ms(typical)
Rotation Method	CAV (constant angular velocity)
Buffer	256 KB
RELIABILITY SPECIFICATIONS	
MTBF	: 60,000 hours 10% duty cycle
PHYSICAL DIMENSIONS	
Width inches (mm)	5.87,5.87, 5.87(149)
Depth inches (mm)	7.95, 7.87, 7 (202) (200) (178)
Height inches (mm)	1.65, 1.65, 1.65 (42)
Weight kg (lbs)	1.0kg (2.2)
ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 40
Storage Temperature^{0}C	-10 to 60
Relative Humidity %	20% to 85%RH
POWER REQUIREMENTS	
Voltage Tolerance-5V DC	± 5%
Voltage Tolerance-12V DC	± 5%
Ripple+Noise Tolerance-peak to peak-5V DC	< 90 mVpp
Ripple+Noise Tolerance-peak to peak-12V DC	< 90 mVpp
Hold Track (max.)-5V DC	1200mA
Hold Track (max.)-12V DC	500mA
Seeking current (peak)-5V DC	1200mA
Seeking current (peak)-12V DC	700mA

BACKUP TAPES

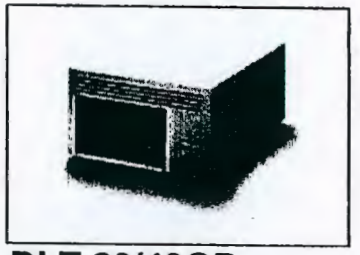
PRICE PERFORMANCE



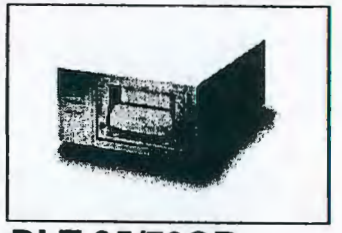
Travan 4/8GB
STR : 300/600KB/s
Interface : IDE ATAPI (4MB/s)



DDS-2 4/8GB,
DDS-3 12/24GB
DDS-4 20/40GB
DDS-3 Autoloader 48/96GB
STR DDS2-Autoloader:
1,100/2,200KB/s
STR DDS3: 550/1,100KB/s



DLT 20/40GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast
(10MB/s)



DLT 35/70GB
DLT 40/80GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast/Wide
(20MB/s)

STR : Sustained Transfer Rate

DAT

DLT

The 4GB IDE Internal Tape Drive

- Up to 2,000- Kbyte per second native transfer rate
- Read-after-write , four head design
- High-performance 1-Mbyte buffer
- Compatible with most popular operating systems

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0800-00-00	ADT-0800-IN-00	4GB ATAPI Tape Drive

KIT CONTENTS
Internal Tape Drive
Cleaning Kit
4 screws
Tape Band
Users Guide

CAPACITY AND INTERFACE	ADT-0800-xx-00
Capacity	
Native	4.0
Interface	
Physical	IDE/ATAPI

TAPE FORMAT SPECIFICATIONS	
Compatibility	
Read only Media Compatibility	QIC-3020 QIC-3010 QIC-80
Read/Write Media Compatibility	3M Travan TR-4 Seagate8000TR4 Seagate 4000QT Sony QW-3080XLF

PERFORMANCE SPECIFICATIONS	
Performance	
Transfer Rate (Kbytes/sec)	600/450/300**
Tape Speed Read/Write (ips)	92/69/46
Search/Rewind (ips)	100
Backup Rate, Sustained (Native Mbytes/min, max)	30

RELIABILITY SPECIFICATIONS	
Read While write	No
MTBF (20% duty cycle)	330,000

PHYSICAL DIMENSIONS
1-inch high; configurable as 3.5-inch x 1.0-Inch or 5.25-inch x half-height (1.7inch)

ENVIRONMENTAL LIMITS	
Operating Temperature	
Internal ^{0}C	5 to 45
External ^{0}C	5 to 35

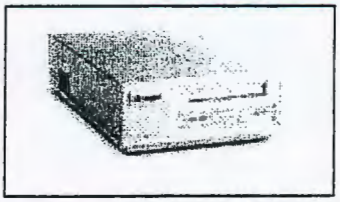
Non-Operating Temperature ^{0}C	-40 to 65
Relative Humidity %	20 to 80 non-condensing
Wet Bulb Temperature	26^{0}C

POWER REQUIREMENTS	+5V ± 5%		+12V ± 5%
Operating Internal			
Idle/Stepping (amps)	0.63/1.0		0.25/1.8
Idle Watts		0.15	
Normal Watts		15	
Max Watts		17.0	

**Based on fast sense capability

The DDS2 4/8GB, DDS3 12/24GB,DDS3 Autoloader 48/96GB SCSI DAT Tape Backup

- Native transfer rates up to 1,100 Kbytes per second
- Read-after-write, four head design
- High-performance 2-MB buffer
- Compatible with most popular operating systems



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0409-00-00	ADT-0409-IN-00	4/8GB DDS-2 DAT
ADT-2400-00-00	ADT-2400-IN-00	12/24GB DDS-3 DAT
ADT-4896-00-00	ADT-4896-IN-00	48/96GB DDS-3 DAT Autoloader

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-0409-xx-00	ADT-2400-xx-00	ADT-4896-xx-00
Compressed (GB)2			
90 Metre Tape	4.0	4.0	16.0
120 Metre Tape	8.0	8.0	32.0
125 Metre Tape	NA	24.0	96.0
Native			
90 Metre Tape	2.0	2.0	8.0
120 Meter tape	4.0	4.0	16.0
125 Metre tape	NA	120	48.0
Internal Connector			
TAPE FORMAT SPECIFICATIONS			
Recording Method	DDS-DC, DDS Helical Scan (R-DAT) ANAI/ECMA	DDS-DC,DDC Helical Scan (R-DAT) ANAI/ECMA	DDS-2, DDS-3 DDS-C, DDS Helical Scan (R-DAT) ANSI/ECMA
PERFORMANCE SPECIFICATIONS			
Transfer rate			
Native/Compressed(Kbytes/sec)	550/1,100	1,1000/2,200	1,100/2,200
Tape Speed (in/sec, mm/sec)	0.47/11.9	0.47/11.9	0.47/11.9
Head to Tape Speed (in/s, mm/s)	270/6,858	270/6,858	270/6,858
Search/Rewind speed (x normal speed)	200	200	200
Average access Time			
90 Metre Tape (sec.)	30	30	30
120 Metre tape (sec.)	40	40	40
125 Metre Tape (sec.)	NA	40	40
Buffer (Mbytes)	Flash	Flash	Flash
EEPROM	DDS-2	DDS-2	DDS-2/DDS-3
RELIABILITY SPECIFICATIONS			
MTBF (20% duty cycle)			

Internal (hours)	265,000	265,000	135,000
External (hours)	150,000	150,000	80,000
Error Rate (bits)	<1 per 10^15	<1 per 10^15	<1 per 10^15
Limited Warranty(years)	2	2	2
MTTR	<30 minutes	<30 minutes	<30minutes

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)			

ENVIRONMENTAL LIMITS

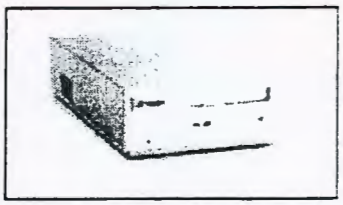
Operating Temperature			
Internal (hours)	5 to 45	5 to 45	5 to 45
External (hours)	5 to 35	5 to 35	5 to45
Non-operating Temperature Relative °C	-40% to 65	-40 to 65	-40 to 65
Humidity (%non-condensing)	20°C to 80	20 to 80	20 to 80
Wet Bulb Temperature (°C)	26	26	26

POWER REQUIREMENTS

Internal +5V+12V	0.44/0.28	0.48/0.3	1.5/0.8
Watts (typ)	5.5	5.5	17.0
External (VAC universal)	100 to240	100 to 240	100 to240

The DDS4 20/40GB SCSI DAT Tape Backup

- Compressed data-transfert rates up to 5.5 Mbytes per second and 20Gbytes per hours
- Highest reliability with an MTBF of over 400,000 hours
- Read-after-write, four-head design
- High-performance 8-Mbyte buffer
- Compatible with most popular operating systems



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2000-00-00	ADT-2000-IN-00	20/40GB DDS-4 DAT

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-2000-xx-00
Compressed (Gbytes)	
90 Meter Tape	4.0
120 Meter Tape	8.0
125 Meter Tape	24.0
150 Meter Tape	40.0
Native	
90 Metre Tape	2.0
120 Meter tape	4.0
125 Metre tape	12.0
125 Metre tape	20.0
Interface	Ultra2 SCSI

PERFORMANCE SPECIFICATIONS	
Transfer rate	
Native/Compressed(Mbytes/sec)	2.75/5.5
Tape Speed (in/sec, mm/sec)	0.81/20.4
Cylinder speed (RPM)	10,000
Search/Rewind speed (x original DDS-1 speed)	400
Average access Time	
90 Metre Tape (sec.)	9.5
120 Metre tape (sec.)	12.6
125 Metre Tape (sec.)	13.2
150 Metre Tape (sec.)	15.8
Buffer (Mbytes)	8
Recording Method	DDS-4, DDS-3, DDS-2, DDS-DC,DDS, Helical Scan, ANSI/ECMA

RELIABILITY SPECIFICATIONS	
MTBF (20% duty cycle)	
Internal (hours)	>400,000
External (hours)	>200,000
Error Rate (bits)	<1 per 10^{15}
Limited Warranty(years)	3

MTTR	<0.5

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)	✓

ENVIRONMENTAL LIMITS

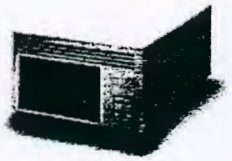
Operating Temperature	
Internal (°C)	5 to 45
External (°C)	5 to 45
Non-operating Temperature Relative ^{0}C	-40 to 65
Humidity (%non-condensing)	20 to 80
Wet Bulb Temperature (°C)	0 to 90

POWER REQUIREMENTS

Internal +5V +/- 5%	0.7/1.5
Internal +12V +/- 10%	0.05/0.25
Watts (typ)	10.5
Auto-ranging Input Voltage (external)	100 to 240

The 20/40GB SCSI DLT External/Internal Tape Drive

- 5MB/sec native transfer rate
- 20 GB native capacity
- 64-bit Cyclical Redundancy Check (CRC)
- SCSI-2 Bus and internal data path.



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2040-00-00		20/40GB SCSI DLT External Tape Drive
ADT-4000-00-00	ADT-4000-IN-00	20/40GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes cable
Blank Cartridge
Cleaning Kit
Documentation

CAPACITY AND INTERFACE	ADT-2040-xx-00 ADT-4000-xx-00
Formatted Capacity	
Native (GB)	20
Compressed (GB)	40*
Average File Access (sec)	68
Interface	SCSI-2 Fast Single-End
Internal Connector	50-Pin

TAPE FORMAT SPECIFICATION	
Recording Format	128 track serial serpentine
Recording Density	82 kbits per inch
Track Density (tpi)	256
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20GB native capacity
DLT Cleaning Tape	20 uses
Read/Write Compatible With All Previous DLT Formats	
Archive Storage	More than 30 years with less than 5% loss in demagnetisation (at 20oC and 40% non-condensing humidity)
Durability	Average 1,000,000 head passes in Typical office/computer environment

Actual transfer rate and capacity will vary depending on data.

PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	1.5
Compressed	3.01
Burst Transfer Rate (MB/sec) Synchronous	10

RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	10,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 x 1017 bits read
Undetected Error Rate	1 x 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including Media
Non-operating Temperature ^{0}C	-40 to 151
Non-Condensing Humidity	10% to 95%
Condensing Humidity %	20to 80

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	25 watts

The 35/70GB SCSI DLT External/Internal Tape Drive

- 5 MB per second native transfer rate
- 35 GB native capacity
- Recording head life of more than 30,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLTtape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-3570-00-00		35/70GB SCSI DLT External Tape Drive
ADT-7000-00-00	ADT-7000-IN-00	35/70GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-3570-xx-00 ADT-7000-xx-00
Formatted Capacity	
Native (GB)	35
Compressed (GB)	70*
Interface	SCSI-2 Fast /Wide Single-ended
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	86 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10 GB native capacities
DLTtape IIIXT	15 GB native capacity
DLTtape IV	20 and 35 GB native capacities
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	5
Compressed	10*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	30,000 hours

Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 1017 bits read
Undetected Error Rate	1 X 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	37 Watts

Read/Write compatible with all previous DLT formats

**Actual transfer rate and capacity will vary depending on data*

***Excluding bezel*

The 40/80GB SCSI DLT External/Internal Tape Drive

- 6 MB per second native transfer rate
- 40 GB native capacity
- Recording head life of more than 50,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLT tape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-4080-00-00		40/80GB SCSI DLT External Tape Drive
ADT-8000-00-00	ADT-8000-IN-00	40/80GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-4080-xx-00 ADT-8000-xx-00
Formatted Capacity	
Native (GB)	40
Compressed (GB)	80*
Interface	SCSI-2 Fast /Wide (SE/LVD or HVD)
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	98 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
MEDIA/FORMAT COMPATIBILITY	
DLTtape III	10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20, 35 and 40GB native capacities
Read/write compatible with all previous	DLT formats
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	6
Compressed	12*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	250,000 hours @ 100% duty cycle
Head Life	50,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 10^{17} bits read
Undetected Error Rate	1 X 10^{27} bits read

PHYSICAL DIMENSIONS	External	Internal**
Width - inches (mm)	6.88 (174.8)	5.7 (144.8)
Length - inches (mm)	12.8 (325.1)	9.0 (228.6)
Height - inches (mm)	6.48 (164.6)	3.25 (82.5)
Weight–pounds (kg)	14 (6.35)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	28 Watts

Read/Write compatible with all previous DLT formats
**Actual transfer rate and capacity will vary depending on data*
***Excluding bezel*

UNINTERRUPTIBLE POWER SUPPLIES

UPS Tower Format

- Smart UPS 230V/ 700VA,
- Smart UPS 230V/1000VA
- Smart UPS 230V/1400VA
- Smart UPS 230V/3000VA

UPS Rack Format (only for AZA-xx-xx rack frames)

- 3U Rackmountable 230V/1400VA UPS
- 3U Rackmountable 230V/2200VA UPS
- 3U Rackmountable 230V/3000VA UPS

UPS Accessories

- Smart Slot Interface Expander
- UPS Share Box
- Signal cable for Interface Expander and Share Box
- Link Power Cord for UPS or PDU

Uninterruptible Power Supplies

- UPS Tower based format
- Increased data protection by supporting network grade batttery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-0700-00-00	Smart UPS 700VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1000-00-00	Smart UPS 1000VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1400-00-00	Smart UPS 1400 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3100-00-00	Smart UPS 3000 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

	ABA-0700-00-00	ABA-1000-00-00	ABA-1400-00-00	ABA-3100-00-00
OUTPUT				
Output Power Cap..VA/ watts	700 / 450	1000 / 670	1400 / 950	3000 / 2250
Output Voltage	230 V	230 V	230 V	230V
Output connections	(4) IEC-320-C13	(4) IEC-320-C13	(4) IEC--320-C13	(8)IEC-320-C13
Waveform Type	Sinewave	Sinewave	Sinewave	Sineware
Transfer Time (ms)	2 (4 ms max)	2 (4 max)	2 (4 ms max)	2 (4 ms max)
Nominal input voltage	230V	230V	230V	230V
Input frequency (auto sensing)	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz
Input connection	IEC- 320-C14	IEC- 320-C14	IEC- 320-C14	IEC- 320-C20
BATTERIES				
Typical backup time (at half load)	18.2 min	20.1 min	24.0 min	18.1 min
Battery type	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte leakproof	Lead-Acid + suspended electrolyte leakproof
Recharge time (hrs)	4.0	4.4	5.14	4.5
Replacement battery catridge	RBC5	RBC6	RBC7	RBC11
COMMUNICATIONS AND MANAGEMENT				
Interface port	RS-232 port	RS-232 port	RS-232 port	RS-232 port
Management Software	PowerChute Smart-UPS bundle	PowerChute UPS bundle	PowerChute Smart-UPS bundle	PowerChute Smart-UPS bundle
Control panel (LED status display withload and battery bar-graphs and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓	
Audible alarm	✓	✓	✓	
Emergency Power Off (EPO)	Optional	Optional	Optional	Optional
SURGE PROTECTION AND FILTERING				
Surge Energy rating (joules)	320	320	320	320
Filtering				

Full time multi pole noise filtering;	✓	✓	✓	
% IEEE surge let-through	0.7	0.3	0.3	0.3
0 clamping response time	✓ 0	✓ 0	✓ 0	✓ 0
meets UL 1440	✓	✓	✓	✓

PHYSICAL DIMENSIONS

Height (inches / cm)	6.2 / 15.7	8.5 / 2.6	8.5 / 21.6	17 / 43.2
Width (inches / cm)	5.4 / 13.7	6.7 / 17.0	6.7 / 17.0	7.7 / 19.6
Depth (inches / cm)	14.1 / 35.8	17.3 / 43.9	17.3 / 43.9	21.5 / 54.6
Weight (lbs / kg)	29.0 / 13.2	41.5 / 18.8	58 / 26.3	123 / 55.8

ENVIRONMENTAL

Operating temperature ºC / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions ºC / F	-15-45 / 32-120	-15-45	-15-45	-15-45
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	41 dBA	41 dBA	45 dBA	53 dBA
On line thermal dissipation	85 BTU / hr	100 BTU / hr	135 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Uninterruptible Power Supplies

- Rack based format
- Increased data protection by supporting network grade battery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-1401-00-00	3U Smart UPS (SU1400RM),1400VA4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-2201-00-00	3U Smart UPS (SU2200RM), 2200VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3001-00-00	3U Smart UPS (SU3000RM), 3000VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

TECHNICAL SPECIFICATIONS	ABA-1401-00-00	ABA-2201-00-00	ABA-3001-00-00
Output Power Capacity VA/ watts	1400 / 950	2200 / 1600	3000 / 2250
Output Voltage	230V	230V	230V
Output connections	(4) IEC-320-C13	(8)-IEC-320-C13 (1)-IEC-320-C19	8)-IEC-320-C13 (1)-IEC-320-C19
Waveform Type	Sinewave	Sinewave	Sinewave
Transfer Time (ms)	2 (4 max)	2 (4 max)	2 (4 max)
Nominal input voltage	230V	230V	230V
Input frequency	50 / 60 Hz +/- 5 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)
Input connection	IEC-320-C14	IEC-320-C20	IEC-320-C20
BATTERIES			
Typical backup time (at half load)	16.9 min	23.2 min	12.4 min
Battery type	Lead-Acid, suspended electrolyte; leakproof	Lead-Acid suspended electrolyte; leakproof	LeadAcid,suspended electrolyte; leakproof
Recharge time (hrs)	4.2	4.5	4.5
Replacement battery catridge	RBC8	RBC12	RBC12
COMMUNICATIONS AND MANAGEMENT			
Interface port	RS-232	RS-232	RS-232
Management Software	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle
Control panel (LED status display withload and battery bar-grapns and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓
Audible alarm	✓	✓	✓
Emergency Power Off (EPO)	optional	optional	Optional
SURGE PROTECTION AND FILTERING			
Surge Energy rating (joules)	320	320	320
Filtering			
Full time multi pole noise filtering;	✓	✓	✓
% IEEE surge let-through	0.3	0.3	0.3
0 clamping response time	✓	✓	✓
meets UL 1440	✓	✓	✓

PHYSICAL DIMENSIONS			
Height (inches / cm)	5.2 / 13.2	5.2 / 13.2	5.2 / 13.2
Width (inches / cm)	19.0 / 48.3	19.0 / 48.3	19.0 / 48.3
Depth (inches / cm)	14.0 / 35.6	25 / 63.5	25.0 / 63.5
Weight (lbs / kg)	58 / 26.3	103 / 46.8	114 / 51.8
Rack height	3U	3U	3U
ENVIRONMENTAL			
Operating temperature °C / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions °C / F	-15-45 / 32-120	-15-45 / 32-120	-15-45 / 32-120
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	45dBA	47 dBA	47 dBA
On line thermal dissipation	135 BTU / hr	275 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Smart Slot Interface Expander and UPS Share Box

- Enables thorough management of servers in mixed OS environments
- Essential tools to properly managing signalling from a single UPS

CUSTOMER INSTALLABLE	DESCRIPTION
AEX-2200-00-00	Smart Slot Interface Expander to manage up to 2 additional servers
AEX-2008-00-00	UPS Share Box to manage up t o 8 servers

FEATURES AND BENEFITS	AEX-2200-00-00 AEX-2008-00-00
Central UPS Management	Use one server to manage the power environment for servers with multiple UPS
Integrates with PowerChute Software	Each server runs its own copy of PowerChute plus software, for monitoring and power management of the UPS
WARRANTY AND APPROVALS	
Product Warranty	2 year warranty
Approvals	Smart Slot Interface Expander :FCC Class B, EN50022, En50082-1 Share UPS-:FCC Class A, EN50082-1

Signal Cable for Interface Expander or Share Box

CUSTOMER INSTALLABLE	DESCRIPTION
ACN-2000-00-00	Kit of 1 Cable for Interface Expander or Share Box
ACN-2001-00-00	Kit of Link Power cord for UPS or PDU

DESCRIPTION	ACN-2000-00-00
Smart Signalling UPS Link Cable	Smart Signalling RS-232 communication cable

DESCRIPTION	ACN-2001-00-00
Power cord	Smart Signalling RS-232 communication cable

MISCELLANEOUS

- Ultra2 SCSI cable Kit for internal HDD and Media device support
- SCSI cable Kit for internal UN Media device support
- SCSI cable Kit for internal UW Media support
- SCSI cable Kit with 68-pin High density External connector
- Y-shape SCSI-3 Termination cable
- SCSI Wide (68-pin) to Narrow (50-pin) connector

Ultra2 SCSI cable Kit for internal HDD and Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0025-00-00	ACN-0025-IN-00	68-Pin internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal Cable to connect Media and HDD SCSI devices

CONNECTORS	7
TYPE	68-pin
Hard Disk	3
Media Devices	3 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	37

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0026-00-00	ACN-0026-IN-00	50-pin Narrow Internal SCSI cable

KIT CONTENTS
SCSI Cable

External 50-pin conductor ribbon for Huron Chassis

CONNECTORS	
Type	50-pin
Media Devices	4
CD-ROM	✓
DAT/DDS 2	✓
DLT	To Be Confirmed
Adaptec 2920	1
PHYSICAL DIMENSIONS	
Length inches	53

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0027-00-00	ACN-0027-IN-00	68-pin Internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
Tape Drive	1 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	10.25

SCSI cable kit with 68-pin High Density External Connector

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0028-00-00	ACN-0028-IN-00	68-pin External SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
External SCSI (HD)	1
Internal SCSI (HD)	1 (50-pin)
PHYSICAL DIMENSIONS	
Length cm	45

SCSI Wide (68-pin) narrow (50-pin) converter

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACT-0010-00-00	ACT-0010-IN-00	SCSI Internal converter 68 pin HD female pins to 50 pin female pins.

KIT CONTENTS
SCSI Converter

Mouse

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
MSS-0392-01-00	MSS-0392-02-00	2 Button Mouse

KIT CONTENTS
1x 2 Button Mouse

TECNICAL SPECIFICATIONS

- 2 Button Mouse
- Resolution 320 dpi
- Microsoft complient

The 16 Bits Sound Card

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASX-0591-00-00	ASX-0591-00-00	16 Bits ISA Sound Card

KIT CONTENTS
1 16 Bits Sound Card

TECNICAL SPECIFICATIONS

- 16 Bits CD-Quality stereo recording and playback
- 32 voices of wave table audio with Creative
- WaveSynth/WG

Keyboard

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AKB-0587-00-00	AKB-0587-00-00	104 Keys Keyboard

KIT CONTENTS
1 x 104 keys Keyboard

MONITORS

	VR 15 Affordable Viewing Comfort	HR 15 Superior Quality for Advanced Needs	VR 17 Perfect for Business Applications
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT	CRT
Screen diagonal	15"	15"	17"
Viewable diagonal	13.8"	13.7"	16"
Anti-Glare Coating	Yes	Yes	Yes
Anti-Static Coating	Yes	Yes	Yes
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.28	0.28	0,27
Video Bandwidth (MHz)	Over 85	Over 95	Over 110
Horizontal scan frequency (kHz)	30-54	30-70	30-70
Vertical refresh rate (Hz)	50-120	50-150	55-120
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			
Contrast ratio			
Top flicker-free VESA (>75Hz)	800 x 600 @ 85Hz	1024 x 768 @ 85Hz	1024 x 768 @ 85Hz
Max non-interlaced resolution	1024 x 768 @ 60Hz	1280 x 1024 @ 60Hz	1280 x 1024 @ 60Hz
Resolutions supported	640 x 480 @ 60, 75, 85Hz 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60Hz	640 x 480 @ 60, 85, 120Hz 720 x 400 @ 70Hz 800 x 600 @ 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz, 1280 x 1024 @ 60Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz 1280 x 1024 @ 60Hz
OTHER SPECIFICATIONS			
Front panel control	Digital Control	On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	Yes	Yes
TCO 95	No	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 H1		
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 NO	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	380 x 360 x 381mm	376 x 365 x 396mm	420 x 403 x 418mm
Weight	12.5 kg	11.9 kg	15.5 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	Up to 3 years on site	Up to 3 years on site	Up to 3 years on site
Reference	**NCM-1520-H1-00** **French price list only**		
Reference	**NCM-1520-N0-00** **Rest of Europe only**	**NCM-1550-H0-00**	**NCM-1720-N0-00**
Notes	**Our monitors can only be sold together with a PC.**		

CRT and LCD MONITORS

	HR 17	HR 19	LR 15
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT short length tube	Colour TFT active matrix
Screen diagonal	17"	19"	15"
Viewable diagonal	16"	18"	15"
Anti-Glare Coating	Yes	Yes	-
Anti-Static Coating	Yes	Yes	-
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.26	0,25	0.297
Video Bandwidth (MHz)	Over 200	Over 202	Over 95
Horizontal scan frequency (kHz)	30-95	30-95	31-69
Vertical refresh rate (Hz)	50-150	50-150	56 - 85
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			200cd/m^2
Contrast ratio			200:01:00
Top flicker-free VESA (>75Hz)	1280 x 1024 @ 85Hz	1280 x 1024 @ 85Hz	-
Max non-interlaced resolution	1600 x 1200 @ 75Hz	1600 x 1200 @ 75Hz	-
Resolutions supported	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 75, 85Hz, 1600 x 1200 @ 75Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 60, 75, 85Hz, 1600 x 1200 @ 60, 75Hz	640 x 350 @ 70, 85Hz 640 x 400 @ 70, 85Hz 720 x 400 @ 70Hz 640 x 480 @ 60, 72, 75, 85Hz 800 x 600 @ 56, 60, 72, 75, 85Hz 1024 x 768 @ 60, 70, 75, 85Hz
OTHER SPECIFICATIONS			
Front panel control	One Touch On Screen Display	One Touch On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	No	No
TCO 95	Yes	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO			
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	419 x 410 x 447mm	480 x 468 x 419 mm	384 x 380 x 174 mm
Weight	17.3 kg	22,0 kg	5.0 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	up to 3 years on site	up to 3 years on site	up to 3 years on site
Reference	**NCM-1750-H0-00**	**NCM-1950-H0-00**	**NCL-1500-H0-00**
Notes	**Our monitors can only be sold together with a PC.**		

RACK SOLUTIONS

- The 27U, 36U and 42U 19" Rack Mount Frame
- Rack Mount Concentrator and Options
- The 24A Power Distribution Unit

The 27U, 36U and 42U 19"Rack Mount Frame

- Available in 27U, 36U or 42U form factors
- Designed to host your chosen combination of rackmountable Express5800 servers and storage units

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AZA-2700-00-00	N/A	19" rack mount frame 27U
AZA-3600-00-00	N/A	19" rack mount frame 36U
AZA-4200-00-00	N/A	19" rack mount frame 42U

KIT CONTENTS
Front/Rear metal vented doors and front stabiliser

PHYSICAL DIMENSIONS

U	27	36	42
Width (mm)	600	600	600
Height (mm)	1400	1800	2000
Depth (mm)	1000	1000	1000
Colour	Mist White	Mist White	Mist White

Rack-Mount Concentrator and Options

- 8-port model
- Control up to 64 servers from one console
- Patented OSCAR (On-Screen Configuration and Activity
- Reporting) user Interface allows for very easy access and control.
- Programmable scanning, naming, security and broadcast functions.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AEX-8000-00-00	N/A	1U 8 Port Monitor/Keyboard/Mouse Concentrator
ACN-0009-00-00	N/A	7' BSU to Concentrator Monitor / keyboard/ Mouse cable
ACN-0010-00-00	N/A	12' BSU to to Concentrator Monitor / keyboard/ Mouse cable
ACN-0011-00-00	N/A	12' Keyboard/Mouse/Monitor extension Cable Extension

KIT CONTENTS
8 Port Concentrator /3 cable Kit

TECHNICAL SPECIFATIONS	AEX-8000-00-00
OSCAR	On-screen pop-up menu system
Windows NT	Microsoft certified
Password security	Restrict system access through the switch
Broadcast Commands	Send the same keyboard or mouse commands to multiple computers (configurable)
Programmable scanning	Set system view time and selection pattern
SnapShot	Manages communication with the CPU during power-down
Long-line operation	Separate switch and CPUs by up to 12'
On-screen diagnostics	Displays technical assistance information on-screen
Automatic System Restart	Provides unattended reboot without administrative intervention
Power Supply	Auto senses 100-240 VAC internal
Flexible applications	SVGA, VGA, XGA, and PS/2 support Serial mouse capable with ACN-00xx00-00
Video	VGA, SVGA XGA
Regulatory	FCC-A, UL, cUL, TUV/GS, CISPER-A, VCCI, CE Mark, NEMKO
Connections	
Output:	
Console Video	HD15
Console Keyboard	PS/2
Console Mouse	PS/2
Input:	
System Video	HD15
System Keyboard	PS/2
System Mouse	PS/2
PHYSICAL DIMENSIONS	
Height inches (cm)	1.75 (4.45)
Depth inches (cm)	10.8 (27.7)
Width inches (cm)	17.0 (43.2)
Wight lbs (Kg)	9.0 (4.09)
ENVIRONMENTAL LIMITS	
Temperature (^{0}C)	10-40

The 230V Rackmountable Power Distribution Unit

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASP-0001-00-00	N/A	24A Power Distribution Unit, including 10 outlets

KIT CONTENTS
Power Distribution Unit 3 connection cords 1 power cord

TECHNICAL SPECIFICATIONS

AC Input	120/240 V
AC Output	120/240V
Current	24A/16A
Max. Current	30A/20A
Circuit Breaker	30/20/20
EMI/RFI Filter	30A
Transient Protection	6500PA
Receptacle Outlets	10, 14/16
Receptacle type	NEMA/IEC
Power Cord	12/3 - 15'
Power Plug 220V	L5-30P

	EXPRESS5800 120Ld	EXPRESS5800 120Mc2
DESIGN		
Form factor	Tower or 5U Rack	Tower or 6U Rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 2 (SMP)
Type	Pentium® III 600 to 800 MHz	Pentium® III 600 to 800 MHz
Slot type	Slot 1	Slot 1
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	256KB ECC L2 on-die
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	133 MHz
ARCHITECTURE		
Chipset	ServerSet III LE	ServerSet III LE
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	64MB/ 2GB / ECC SDRAM
Memory slots	4 DIMM	4 DIMM
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	All
MEDIA AND STORAGE		
CD ROM drive	40x EIDE	40x EIDE
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives EIDE 5400 RPM		
Hard Disk Drives EIDE 7200 RPM		
Hard Disk Drives SCSI 7200 RPM	U2W: 9.1/18.2GB	U 160/m: 9.1/18.2GB
Hard Disk Drives SCSI 10 kRPM	U2W: 9.1/18.2GB	U 160/m : 9.1/18.2GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board
RAID controller	Option	Option
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	3 / 2	4 / 3
3.5" Media bays (total / free)	1 / 0	1 / 0
3.5" Non-Hot Swap HDD bays	4 x 1.6" ***OR***	-
3.5" Hot swap HDD bays	6 x 1" (choose one type)	7 x 1" or (3 x 1.6" and 4 x 1")
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	4MB/4MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	-/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	1xUW SCSI	Option
System Management	Integrated	Integrated
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	300W
Hot-Plug PSU option	-	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1	1 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	445x220x620mm	533x289x591 mm
Weight	30 kg	30 kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35° C, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1

Standard warranty	3 year on-site	3 year on-site
Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes NTSL certified
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 1400 (option)

SERVERS AT A GLANCE

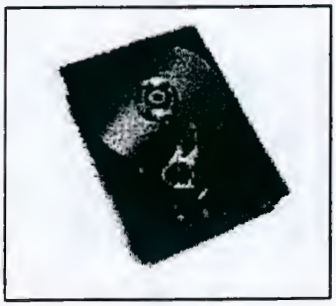
	EXPRESS5800 120Mc3	EXPRESS5800 HX4600
DESIGN		
Form factor	Tower or 7U Rack	Dual Tower or 14U rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 4 (SMP)
Type	Pentium® III Xeon 733-800MHz	Pentium® III Xeon 550MHz
Slot type	Slot 2	Slot 2
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	512KB or 1MB or 2MB ECC L2
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	100MHz
ARCHITECTURE		
Chipset	ServerSet III LE	Intel 450NX
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	256MB / 8GB / ECC RAM
Memory slots	4 DIMM	16 or 32 DIMM (with add. Memory board)
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	4 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	3 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
MEDIA AND STORAGE		
CD ROM drive	40xEIDE	40x SCSI
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives SCSI 7200 RPM	U 160/m: 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Hard Disk Drives SCSI 10 kRPM	U 160/m : 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x U2W SCSI on board 1x UN SCSI on board
RAID controller	Option	Standard (U2/W tri)
Maximum Internal Storage capacity	127.4GB (7x18.2)	436.8GB (12x36.4)
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	4 / 3	4 / 3
3.5" Media bays (total / free)	1 / 0	2 / 1
3.5" Non-Hot Swap HDD bays	-	-
3.5" Hot swap HDD bays	7 x 1" or (3 x 1.6" and 4 x 1")	8 or 12 x 1" or 1.6"
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	2MB/2MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	Yes/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	Option	1x UN SCSI
System Management	Integrated	Optional board
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	560W
Hot-Plug PSU option	Yes	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1 standard + 1 option	2 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	533x289x591 mm	620x445x678 mm
Weight	30 kg	77 Kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35°, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1
WARRANTY		

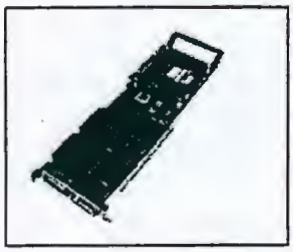
Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 2200 (option)

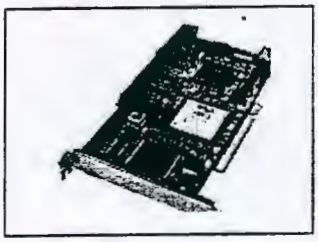
(1) 4-way : 1 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit ; 8-way : 2 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit
(2) 4-way : 1 standard + 1 option ; 8-way : 2 standard + 1 option
(3) Additional Disk Unit option and UPS option are mutually exclusive

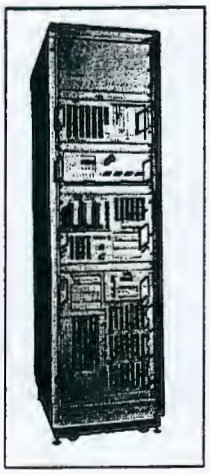
ACCESSORIES GUIDE

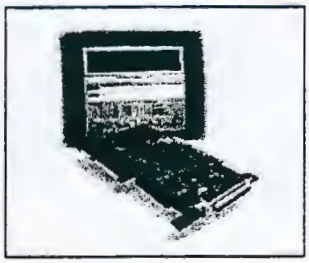
JANUARY 2000

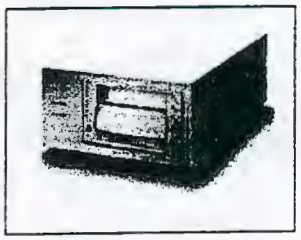


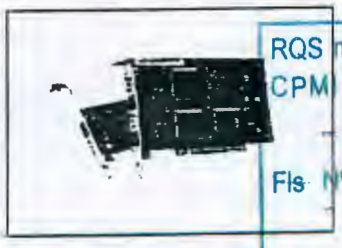












Created by Mark Carr

BULL TECNOLOGIA DA INFORMAÇÃO LTDA.

TABLE OF CONTENTS

TECHNOLOGY REFERENCE

MEMORY TECHNOLOGY

WHAT IS SDRAM?

- *Synchronous DRAM - a fast high-bandwidth memory designed to work best with systems employing high-performance chipsets and processors*
- *Can Synchronise itself with the system clock that controls the CPU, eliminating time delays + improving processor efficiency.*
- *Bandwidths of up 100Mhz — twice the bandwidth of EDO-SDRAM is a result of a major shift from EDO and Fast Page Mode DRAMs.*

WHAT IS EDO?

- *Extended Data Out is a memory technology that can provide approximately a 5-30% boost in the memory subsystem speed versus Fast-Page Mode.*
- *EDO provides increased performance by loading data at the same time it is searching for new information.*
- *EDO reduces the bottlenecking in data transfers between high-speed processors that need to get data quickly*

WHAT IS ECC?

- *Error checking and correcting memory automatically checks and corrects single-bit errors without bringing the system.*
- *The system will halt when 2-, 3-, 4-bit errors are detected.*
- *ECC memory requires more overhead than parity memory for storing data and causes approximately 3% performance degradation in the memory subsystem, but the resulting error detection and correction can make the trade-off well worth it.*

WHAT IS PC133 memory?

- *PC133 provides a one to one speed match with a FSB that is running at 133MHz. It is the bridge between PC100 SDRAM and future DDR SDRAM.*
- *PC133 improves overall memory timings and it also transfers data 33% faster between the memory and the microprocessor,*
- *The evolution of this new technology gives extra memory performance for the end user*

WHAT IS ULTRA SCSI?

- *Also known as Fast-20, Ultra SCSI supports up to 20MBps burst transfers across 8-bit paths and up to 40MBps burst transfers across Wide 16-bit paths.*
- *As it is pin- and cable-compatible with SCSI-2 Fast and Fast/Wide, there's no need to change the physical connection, although you are restricted to shorter cables for external attachments.*

WHAT IS ULTRA 2 SCSI?

- *Ultra 2 SCSI technology is a doubling of the bus data rates of Ultra SCSI.*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *While Ultra 2 drives are implemented allowing operations on Ultra SCSI data buses, the new performance levels only exist in buses that are Ultra 2 exclusive.*

WHAT IS ULTRA-160/M SCSI?

- *Ultra-160/m SCSI technology provides data transfer rates of up to 160MB/s, thus doubling the bus rates of Ultra2 SCSI*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *Gives improved scalability and accommodation of faster devices, thus becoming an important building block in creating the worlds' fastest servers.*

Table showing current SCSI categories:

STA TERMS	Bus Speed Mbytes/Sec Max	Bus Width, bits	Max. Bus Lengths, Meters			Max. Device Support
			Single ended	LVD	HVD	
SCSI-1	5	8	6	(2)	25	8
Fast SCSI	10	8	3	(2)	23	8
Ultra SCSI	20	8	1.5	(2)	25	8
Ultra Wide SCSI	40	16	-	(2)	25	16
Ultra2 Wide SCSI	80	16	(1)	12	25	16
Ultra3 SCSI or Ultra-160/m (4)	160	16	(1)	12	(3)	16

(1) Single ended is not defined for speeds beyond Ultra
(2) LVD was not defined in the original SCSI standards for this speed. If all devices on the bus support LVD, then 12-meters operation is possible at this speed. However, if any device on the bus is singled-ended only, then the entire bus switches to single-ended mode and the distances in the single-ended column apply.
(3) HVD (Differential) is not defined for speeds beyond Ultra2
(4) After Ultra2 all speeds are wide only

UNINTERUPTIBLE POWER SUPPLIES

What is Uninteruptible Power Supplies?

- *A piece of hardware that help to protect your server from power outages.*
- *We strongly recommend for all Express5800 servers to be accompanied by a UPS (Uninterruptible Power Supply) which will protect data from any power problems and outages. We offer models in both tower based and 3U rack-mount form factors*
- *Our different UPS models provide a back up power supply to allow the server to overcome power problems. In the event of a complete power failure, the back up time allows the user to shut down the machine without losing important data.*
- *The table below shows the UPS options available. Firstly, calculate the total VA power of the configuration to be connected to the UPS by adding the power of all items of the configuration. Then, select the UPS corresponding to the calculated VA power and the required autonomy (in minutes) supplied by the UPS.*
- *It is recommended that you allow some UPS power margin for future configuration expansion.*

Table 1 - Typical and Maximum VA power of Express5800 servers

Model	Typical VA (a)	Max VA (b)	Typical VA (a)	Max VA (b)	Max VA
TM1100	286	407	**HX4600**	1007	1438
LC1400	364	520	**HV8600**	1510	2157
LS2400	315	451	**ST8000**	365	520
MC2400	364	520	**ST1400**	365	520
120Ld	238	340	**4-Port concentrator**	36	52
120Mc2	268	383	**8-Port concentrator**	36	52
120Mc3	285	407	**Monitor 15"**	104	138
MH4500	719	1027	**Monitor 17"**	171	224
HX4500	755	1079	**Monitor 19"**	189	243

Table 2 - UPS autonomy (in minutes)

VA	SU700	SU1000	SU1400 SU1400RM	SU2200 SU2200RM	SU3000 SU3000RM
300	**20**	**36**	**60**	**130**	**116**
350	**17**	**28**	**49**	**112**	**101**
400	**14**	**24**	**41**	**98**	**89**
450	**11**	**20**	**36**	**86**	**79**
500	**9**	**18**	**32**	**76**	**70**
550	**7**	**15**	**28**	**68**	**63**
600	**6**	**13**	**25**	**61**	**57**
700	**5**	**11**	**21**	**50**	**46**
800	-	**9**	**17**	**41**	**39**
900	-	**7**	**14**	**35**	**34**
1000	-	**6**	**11**	**31**	**30**
1200	-	-	**9**	**24**	**24**
1400	-	-	**7**	**19**	**19**
1600	-	-	-	**16**	**16**
1800	-	-	-	**13**	**13**
2000	-	-	-	**10**	**10**
2200	-	-	-	**9**	**9**
2500	-	-	-	-	**8**
3000	-	-	-	-	**7**

What is a Smart Slot Interface and a UPS Share Box?

- *These two options provide added data protection for Multiple servers that are using a single UPS. If you are managing multiple servers, we propose that you use a Smart Slot Interface or a UPS share box ...*

TAPE DRIVE TECHNOLOGY

What is DAT?

- *Digital Audio tape (DAT) was originally designed specifically for digital audio recording applications.*
- *When it was realised that 4mm tape could store large amounts of digital data, produce fast data transfer rates and deliver reliability, hence DAT was introduced as a tape backup medium.*

What is DLT?

- *Digital Linear Tape (DLT) - latest development in tape backup technology.*
- *Uses symmetric phase recording technology that alternates head angles to help eliminate cross-track interference.*

MEMORY

- 64MB, 128MB, 256MB 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 133MHz FSB SDRAM Memory
- 128MB, 256MB, 512MB, 1GB ECC DIMM Memory
- 256MB, 512MB, 1GB ECC DIMM Memory

64MB, 128MB, 256MB 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AME-0511-00-00	AME-0511-IN-00	64MB (1x64) 100MHz FSB SDRAM Memory
AME-0512-00-00	AME-0512-IN-00	128MB (1x128)100 MHz FSB SDRAM Memory
AME-0513-00-00	AME-0513-IN-00	256MB (1x256) 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AME-0511-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0512-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0513-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB ECC 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-4064-00-00	AMS-4064-IN-00	64MB (1x64) ECC 100MHz FSB SDRAM Memory
AMS-4128-00-00	AMS-4128-IN-00	128MB (1x128) ECC 100MHz FSB SDRAM Memory
AMS-4256-00-00	AMS-4256-IN-00	256MB (1x256) ECC 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-4064-xx-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4128-xx-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4256-xx-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB, 512MB ECC 133MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-5064-00-00	AMS-5064-IN-00	64MB (1x64) ECC 133MHz FSB SDRAM Memory
AMS-5128-00-00	AMS-5128-IN-00	128MB (1x128) ECC 133MHz FSB SDRAM Memory
AMS-5256-00-00	AMS-5256-IN-00	256MB (1x256) ECC 133MHz FSB SDRAM Memory
AMS-5512-00-00	AMS-5512-IN-00	512MB (1x512) ECC 133MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-5064-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5128-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5256-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5512-00-00	64M bit x 72 Synchronous Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-6256-00-00	AMD-6256-IN-00	256MB ECC (4x64) 60ns DIMM Memory Upgrade kit
AMD-6512-00-00	AMD-6512-IN-00	512MB ECC (4x128) 60ns DIMM Memory Upgrade kit
AMD-6010-00-00	AMD-6010-IN-00	1GB ECC (4x256) 60ns DIMM Memory Upgrade Kit
Same characteristics for the AMD-7256-00-00, AMD-6512-00-00 and AMD-6010-00-00.		

TECHNICAL SPECIFICATIONS

AMD-6256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-6512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-6010-00-00	32Mx72bits Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-8256-00-00	AMD-8256-IN-00	256MB ECC (4x64) 50ns DIMM Memory Upgrade kit
AMD-8512-00-00	AMD-8512-IN-00	512MB ECC (4x128) 50ns DIMM Memory Upgrade kit
AMD-8010-00-00	AMD-8010-IN-00	1GB ECC (4x256) 50ns DIMM Memory Upgrade Kit

TECHNICAL SPECIFICATIONS

AMD-8256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-8512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-8010-00-00	32Mx72bits Dynamic RAM high density memory module

HARD DISK DRIVES

- The 5,400rpm EIDE 10.2GB, 15GB HDD
- The 7,200rpm EIDE 12.9GB, 20.4GB HDD
- The 7,200rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 7,200rpm Ultra2 80-pin SCSI 9.1GB, 18.2GB, 36.4GB HDD
- The 7,200rpm Ultra2 68-pin SCSI 9.1GB, 18.2GB HDD
- The 10,000rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 10,000rpm Ultra2 80-pin SCSI 9.1GB, 18.2, 36.4GB HDD

HARD DISK DRIVES

PRICE PERFORMANCE

10.2GB,15GB (1")
5,400rpm
AST : 9/9.5ms
ITR : up to 158Mbit/s
ETR : 33MB/sand
66MB/s
Cache: 128KB to 512KB

12.9GB, 20.4GB (1")
7200rpm
AST : 9ms
ITR : up to 158Mbit/s
ETR : 33MB/s
Cache: 128KB to 512KB

9.1GB, 18.2GB (1")
7,200rpm
68-pin
AST : 6.9 to 8.2ms
ITR : up to 192Mbit/s
ETR : 80MB/s
Cache: 512KB

9.1GB, 18.2GB (1") 36.4GB
(1.6") 7,200rpm 80-pin
AST : 6.9 to 7.6ms
ITR : up to 190Mbit/s
ETR : 80MB/s
Cache: 512KB to 1MB

9.1GB, 18.2GB
(1"),36.4GB (1.6")
10,000rpm
AST : 5.4 to 6.7ms
ITR : up to 231Mbit/s
ETR : 80MB/s
Cache: up to 4MB

9.1GB, 18.2GB
(1"),36.4GB (1.6")
7,2000rpm
AST : 6.9 to 7.5ms
ITR : up to 231Mbit/s
ETR : 160MB/s
Cache: up to 2MB

9.1GB, 18.2G
(1"),36.4GB (1.
10,000rpm
AST : 5.4 to 6.
ITR : up to 231
ETR : 160MB
Cache: up to 2M
with Fibre Cha

AST : Average Seek Time
ITR : Internal Transfer Rate
ETR : External Transfer Rate

EIDE

U2W SCSI

U-160/m SCSI

EIDE vs SCSI

	EIDE	SCSI
ENVIRONMENT		
	Offers low cost and performance equal to SCSI in Entry level servers and Mobile environments.	Delivers excellent performance for network computers with Intel-Based processors. Data-intensive applications and large numbers of users in LAN Environments.
PERFORMANCE		
	In one to one HDD performance comparison EIDE performs equally well.	A SCSI interface offers the performance edge, especially when coupled with Windows NT.
PRICE		
	Generally least expensive. The controller is standard on the system board Chipset.	Drives are a little more expensive for the same capacity and rotational speed as EIDE. May also require a SCSI adapter.
EXPANDABILITY		
	Can support high hard drive capacity, as well as CD-ROM and tape devices up to 4 devices in all.	Holds more than 9GB. Offers high capacity and performance for multiple hard disks, a wide variety of devices and long cable connectors for more convenient attachment of external devices. Backwards compatible.
EASE OF INSTALLATION		
	Although most PCs ship with an EIDE interface, ensure that your system's EIDE interface and BIOS support all the new drive's Functionality.	You may need to install a SCSI adapter.

The 5,400rpm EIDE 10.2GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0110-00-10	ADH-0110-IN-00	10.2GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0100-xx-00
Formatted Capacity	
ADH-0100-xx-00	10.2 GB
Interface	ATA-4/Ultra DMA
DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
ADH-0100-##-00	3
Tracks per Surface (Cylinders)	11,530
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320
PERFORMANCE SPECIFICATIONS	
Buffer Size	256 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.56ms
Rotation Speed (±0.1%)	5,400 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 18.6 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 7.5 sec typical
RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[1] - *Controller overhead not included.*

[2]- Average data error rate allowed with all recovery features activated

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.77 (146.6)
Width inches (mm)	4.02 (102.1)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating ^{0} C	5 to 55
Non-operating ^{0} C	-40 to 71
Operating/Non-operating Relative ^{0} C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb (^{0} C)	27

POWER REQUIREMENTS

MODE	12V ± 5%	5V ± 5%	Power
Spin-up (peak)	1600mA	200mA	20.2W
Seek	650mA	340mA	9.6W
Read/Write	250mA	350mA	4.8W
Idle	250mA	280mA	4.4W
Standby	8mA	160mA	0.9W

The 5,400rpm EIDE, 15GB Hard Disk Drive

- 3.5" high performance hard drives
- Fast average seek time 9.5ms

Fast data transfer rate (up to 66MB/sec)

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0150-00-10	ADH-0150-IN-10	15GB (1") Fast ATA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0150-00-10
Interfaces	Ultra ATA
Formatted Capacity	15.367
DISK DRIVE ORGANISATION	
Heads	3
Disks	2
PERFORMANCE SPECIFICATIONS	
Buffer Size (KB)	512
Buffer type	SDRAM
Typical Seek Times* (ms)	
Average	9.5
Track-to-Track	1
Rotational Speed (rpm)	5,400
Average Rotational Latency (ms)	5.55
Start time (0-drive ready)	7.3sec typical
Integrated Controller	ATA-5/UDMA
Data Zones per surface	16
Bytes per sector/Block	512
DATA TRANSFER RATES	
To/From Interface	Up to 66.7MB/sec
To/From Media VL20 Series	Up to 36.9MB/sec
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles (min)	50,000
Component Design Life (min)	5 years
Non-recoverable Data Errors(per bits read)	<10 per 10^{14}
Annual return rate	<1%
PHYSICAL DIMENSIONS	
Width (Inches /mm)	4.00/102.0
Length-(Inches /mm)	5.78/146.7
Height-(Inches /mm)	1.02/25.9
Weight-(pounds/kg)	1.30/0.59
ENVIRONMENTAL LIMITS	
Operating Temperature(^{0}C)	5-55
Non Operating (^{0}C)	-40 to 71
Operating/Non-operating Humidity %(non-condensing)	5-95
Maximum Wet Bulb (^{0}C)	30

POWER REQUIREMENTS			
MODE	**12V ± 10%**	**5V ± 5%**	**Power**
Spin-up (peak)	2100mA	275mA	
Seek	740mA	420mA	11.0W
Read/Write	295mA	440mA	5.7W
Idle	230mA	380mA	4.7W
Standby	20mA	220mA	1.3W

The 7,200rpm EIDE 12.9GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- 66/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0130-00-11	ADH-0130-IN-11	12.9GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0130-00-11
Formatted Capacity	12.9 GB
Interface	ATA-4/Ultra DMA/66
DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
Recording Surfaces	4
Tracks per Surface (Cylinders)	16,383
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320
PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.55ms
Rotation Speed (±0.1%)	7200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 22.0 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical
RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 10 per 10^{15} bits read

[1] - *Controller overhead not included.*

[2]- Average data error rate allowed with all recovery features activated

PHYSICAL DIMENSIONS

Height inches (mm)	4.00 (101.6)
Length inches (mm)	5.75 ()146.1)
Width inches (mm)	1.00 (25.4)
Weight lbs. (kg)	1.26 (0.5)

ENVIRONMENTAL LIMITS

Temperature	
Operating^0 C	5 to 55
Non-operating^0 C	-40 to 65
Operating/Non-operating Relative^0 C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb^0 C	27

POWER REQUIREMENTS

Nominal Voltage	**+5/ +12**
Voltage Margin (%)	+5/ +12
Typical Power Draw (W)	
Idle	6.2
Operating	8.8
Peak Current (mA on +5/ +12V)	700/1,830

The 7,200rpm EIDE 20.4GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- Up to 33MB/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0200-00-10	ADH-0200-IN-10	20.4GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0200-00-10
Formatted Capacity	20.4GB
Interface	ATA-4/Ultra DMA
DISK DRIVE ORGANISATION	
Data Surfaces/Heads	8
Tracks per Surface (Cylinders)	14,850
Track Density	14,522 tpi
Areal Density	3,800Mb per in^2
Recording Density	204-255 Kbit/inch
Flux Density	217-271 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	240-403
PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	1 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	4.18ms
Rotation Speed (±0.1%)	7,200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 31.2 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.78 (146.7)
Width inches (mm)	4.00 (102.0)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating^0 C	5 to 55
Non-operating^0 C	-40 to 71
Operating/Non-operating Relative^0 C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb^0 C	27

POWER REQUIREMENTS

MODE	12V ± 8%	5V ± 10%	Power
Spin-up (peak)	2400mA	200mA	29.8W
Seek	860mA	340mA	12.1W
Read/Write	460mA	325mA	<8W
Idle	475mA	250mA	<7W
Standby	8mA	160mA	<1W

The 7,200rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Advanced SCSI interface support data transfer rates of up to 160MB/s
- 7,200rpm, 6.19ms average seek time, 21MB/sec maximum sustained
- throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-7945-00-00	CDH-7945-IN-00	9GB Ultra-160/m SCSI,1"
CDH-7845-00-00	CDH-7845-IN-00	18GB Ultra-160/m SCSI,1"
CDH-7645-00-00	CDH-7645-IN-00	36GB Ultra-160/m SCSI,1.6"

KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-7945-00-00	CDH-7845-00-00	CDH-7645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	2	4	8
Number of heads	4	8	16
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
Rotational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1011	10 per 1011	10 per 1011
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.60/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91

NVIRONMENTAL LIMITS			
Operating Temperature	5* to 55*	5* to 55*	5* to 55*
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	1.0	1.0	1.0
Sound Power (bels, Idle)	3.6	3.6	4.0
Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (|G, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC+ 5%/12V DC+ 5%/	5V DC+ 5%/12V DC+ 5%/	5V DC+ 5%/12V DC+ 5%/
Typical Power Draw (W, Idle)	6.5	7.9	10.8
Typical Current Draw (A, Operating)			
5V	0.5	0.5	0.5
12V	0.85	0.90	1.20

The 7,200rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 80MB/s
- 7,200rpm, 4.17ms average latency

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-794#-00-00	BDH-794#-IN-00	9.1GB Ultra2 SCSI,1"
BDH-784#-00-00	BDH-784#-IN-00	18.2GB Ultra2 SCSI,1"
BDF-764#-00-00	BDF-764#-00-00	36.4GB Ultra2 SCSI,1.6"

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500	8	
1		3		5		7	HX4500, HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-794#-00-00	BDH-784#-00-00	BDF-764#-00-00
Interface	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
DISK DRIVE ORGANISATION			
Number of disks	3	5	10
Number of heads	5	10	20
Areal density (maximum)	N/A Mbits/sq.inch	N/A Mbits/sq.inch	N/A Mbits/sq.inch
Recording density (maximum)	223,000 bits/inch	223,000 bits/inch	223,000 bits/inch
User cylinders	11,737	11,721	11,721
Track density (T/inch)	12,580	12,580	12,580
Sector size	512 Bytes	512 Bytes	512 Bytes
Recording Method	16/17 EPR4	16/17 EPR4	16/17 EPR4
PERFORMANCE SPECIFICATIONS			
Data buffer	1,024KB	1,024KB	1,024KB
Rotational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	80MB/s	80MB/s	80MB/s
Average seek time	6.9/7.4ms	6.9/7.4ms	7.6ms
Track-to-Track	0.8ms	0.8ms	0.9ms
Full track	15ms	15ms	16ms
RELIABILITY SPECIFICATIONS			
Non recoverable read errors	10 per 10^{15}	10 per 10^{15}	10 per 10^{15}
S.M.A.R.T	Yes	Yes	Yes
MTBF (hours)	1,000,000	1,000,000	1,000,000
PHYSICAL DIMENSIONS			
Height in/mm	1.0/25.4	1.0/25.4	1.63/41.7
Width in/mm	40.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146	5.75/146	5.75/146
Weight (max.)lb/ kg	1.5/0.68	1.5/0.68	2.0/0.91

ENVIRONMENTAL LIMITS			
Idle Accoustics (mean/max Bels)	4.1/4.4	4.1/4.4	4.2/4.5
Operating Temperature	5* to 50*	5* to 50*	5* to 50*
Nonoperating temperature	-40* to 70*	-40* to 70*	-40* to 70*
Operating Shock	15	15	15
Nonoperating shock	75	75	75
Operating vibration (5-350 Hz)	0.5	0.5	0.5
Nonoperating vibration (350 Hz)	2.0	2.0	2.0
POWER REQUIREMENTS			
Start up current (amps)	1.4	1.5	1.4
Idle power (typ.Watts)	9.8	9.8	13.4

The 7,200rpm 68-pin Ultra2 SCSI 9.1GB, 18.2GB, Hard Disk Drives

- Formatted capacities of 9.1 to 36.4 Gbytes
- 7,200-rpm, 4.17 msec average latency
- Ultra2 SCSI (LVD) and Fibre Channel Interfaces
- Advanced SCSI Architecture (ASA II)
- MR heads, embedded servo and PRML channel

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-7930-00-00	BDH-7930-IN-00	9.1GB LVD Ultra2SCSI 68-pin
BDH-7830-00-00	BDH-7830-00-00	18.2GB LVD Ultra2SCSI 68-pin

KIT CONTENTS
HDD + 4 screws

CAPACITY & INTERFACE	BDH-7930-00-00	BDH-7830-00-00
Formatted Gbytes	18.2	36.4
Interface	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)
Interface type	68-pin	68-pin
PERFORMANCE		
Internal Transfer Rate	137 to 240 Mbits/s	137 to 240 Mbits/s
Internal Formatted Transfer Rate	12.9 to 22.5 Mbytes/s	12.9 to 22.5 Mbytes/s
External Transfer Rate -Mbytes/s Ultra2 SCSI/Fibre Channel	80/100 per loop	80/100 per loop
Multisegmented Cache, Ultra2 SCSI/FC	1,024 (4,096 optional)	1,024 (4,096 optional)
Track to Track Seek, Read/Write	0.8/1.1 msec	0.8/1.1 msec
Average Seek, read/Write	6.9/7.4 msec	7.4/8.2 msec
Average Latency	4.17 msec	4.17 msec
Spindle speed	7,200	7,200
Disks/Heads	3/5	5/10
[illegible]	Embedded	Embedded
Sectors/ track (512bytes/sector)	304	304
Cylinders	11,737	11,721
Recording Method (PRML)	16/17 EPR4	16/17 EPR4
S.M.A.R.T Capable	Yes	Yes
Recoverable Read Errors per Bits Read	10 per 10^{12}	10 per 10^{12}
NonRecovarable Read Errors per Bits Read	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	10 per 10^{8}	10 per 10^{8}
Service Life/Limted Warranty	5/5 years	5/5 years
POWER REQUIREMENTS		
+ 12 VDC + 5% (amps) Ultra SCSI, Ultra2 SCSI	0.9/0.9	1.2/1.2
+ 5 VDC + 5% (amps) Ultra SCSI/Ultra2 SCSI	0.8 [1.2]	1.2 [1.25]
Power (Idle watts) Ultra SCSI/Ultra2 SCSI [FC]	9.75 [11.3]	13.35 [15]
ENVIRONMENTAL		

Idle Acoustics (mean/max bels)	4.1/4.4	4.2/4.5
Operating Temperature (^{0}C)	5 to 50	5 to 50
Nonoperating Temperature(^{0}C)	-40 to 70	-40 to 70
Shock (Gs) Operating/Nonerating	15/75	15/75
Vibration (Gs) Operating(5-350Hz)		
Nonoperating (-350 Hz)		
Shock (Gs) Operating	0.5 (5-350 Hz)	0.5 (5-350 Hz)
Nonoperating	2.0 (<350Hz)	2.0 (<350Hz)

PHYSICAL

Height (in/mm)	1.0/25.4	1.63/41.7
Width (in/mm)	4.0/101.6	4.0/101.6
Depth (in/mm)	5.75/146.0	5.75/146.0
Weight (lb/Kg)	1.5/0.68	2.1/0.93

The 10,000rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 160MB/s
- 10Krpm, 5.0ms Seek time, 26MB/sec sustained throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-1945-00-00	CDH-1945-00-00	9GB Ultra-160/m SCSI,1"
CDH-1845-00-00	CDH-1845-00-00	18GB Ultra-160/m SCSI,1"
CDF-1645-00-00	CDF-1645-00-00	36GB Ultra-160/m SCSI,1.6"

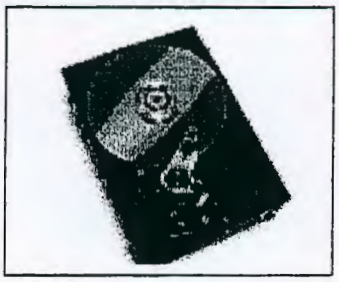
KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-1945-00-00	CDH-1845-00-00	CDF-1645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	3	6	12
Number of heads	6	12	24
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
Rotational speed	10Krpm	10Krpm	10Krpm
Latency (average)	3.0ms	3.0ms	3.0ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1012	10 per 1012	10 per 1012
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.6/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91

NVIRONMENTAL LIMITS			
Operating Temperature (@C)	5 to 50	5 to 50	5 to 50
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	0.5	0.5	0.5
Sound Power (bels, Idle)	4.0	4.0	4.2

Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (|G, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC± 5%/+12V DC± 5%/	5V DC± 5%/+12V DC± 5%/	5V DC± 5%/+12V DC± 5%/
Typical Power Draw (W, Idle)	8/10	10/12	15.5/17.5
Typical Current Draw (A, Operating)			
5V	0.50	0.50	0.55
12V	0.65	0.80	1.25

The 10,000 rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives



- 10,000rpm 3.5 inch disc drive
- Average seek times as fast as 5.2ms
- Unsurpassed formatted data rates of 14.5 to 21.3 Mb/S
- High-Performance Ultra2 SCSI interface

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-194#-00-00	BDH-194#-IN-00	9.1GB HDD Ultra2 SCSI, 1'
BDH-184#-00-00	BDH-184#-IN-00	18.2GB HDD Ultra SCSI, 1'
BDF-164#-00-00	BDF-164#-IN-00	36.4GB HDD Ultra SCSI, 1.6'

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500 (9GB only)	8	
1		3	ST8000	5	LC1400, MC2400, ST1400	7	HX4500/ HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-194#-xx-00	BDH-184#-xx-00	BDF-164#-xx-00
Formatted GB (512 bytes/sector)	9.1GB	18.2GB	36.4GB
Interface	Ultra2 SCSI	Ultra2 SCSI	Ultra2 SCSI
Interface type	80-pin	80-pin	80-pin
DISK DRIVE CONFIGURATION			
Disks/Heads	3 / 6	6 / 12	12 / 24
Sectors per drive (512 Bytes/Sector)	21	28	28
Cylinders	6,962	9,801	9,772
Recording Method	16/17 PR4	16/17 PR4	16/17 PR4
PERFORMANCE SPECIFICATIONS			
Internal Transfer Rate (Mbits/s)	152 to 231	193 to 308	179 to 313
Internal Formatted Transfer Rate (MB/s)	15 to 21	18 to 28	18 to 28
External Transfer Rate	80	80	80
Multi-segmented Cache (KB)	1,024	1,024	1,024
Optional Cache (KB)	4,096	4,096	4,096
Track-To-Track Seek (Read/Write/ms)	0.6 / 0.9	0.6 / 0.9	0.6 / 0.9
Average Seek, Read/Write (ms)	5 / 6	5.2 / 6	5.7 / 6.5
Maximum Seek, Read/Write (ms)	12.2 / 13.2	12.2 / 13.2	14 / 15
Average Latency (ms)	2.99	2.99	2.99
Spindle Speed (RPM)	10,025	10,025	10,016
RELIABILITY SPECIFICATIONS			
MTBF (Power-On hours)	1,000,000	1,000,000	1,000,000
S.M.A.R.T.	Yes	Yes	Yes
Recoverable Read Errors (per Bits)	1 per $10^{10^{\wedge}}$	1 per 10^{10}	1 per 10^{10}
Non-recoverable Read Errors (per Bits)	1 per 10^{15}	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	1 per 10^{8}	1 per 10^{8}	1 per 10^{7}
Service (years)	5	5	5

PHYSICAL DIMENSIONS			
Height (mm)	25.4 (1")	26.1 (1")	40.6 (1.6")
Width (mm)	101.6	101.6	101.6
Depth (mm)	146.1	147	146.1
Weight (kg)	0.54	0.59	0.91
ENVIRONMENTAL LIMITS			
Non-operating Temperature (°C)	-40 to 70	-40 to 70	-40 to 70
Operating Temperature (°C)	5 to 50	5 to 50	5 to 50
Operating Shock (Gs @ msec)	2	5	5
Operating Vibration (Gs @ 5-530 Hz)	0.5	0.5	0.5
Non-Operating Vibration (Gs @ 5-530 Hz)	2	2	2
POWER REQUIREMENTS			
+12 VDC± 5% (amps typical)	0.3	1	1.5
+5 VDC± 5% (amps typical)	0.8	1.1	0.8
Power (Idle watts)	11.1	10.4	15.6

STORAGE CONTROLLERS

PCI SCSI Controllers

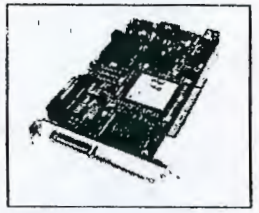
- The PCI Ultra - Wide Single-Ended Differential SCSI-3 Single Channel Controller Card
- The PCI Ultra-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI Single channel Controller Card

PCI RAID Controllers

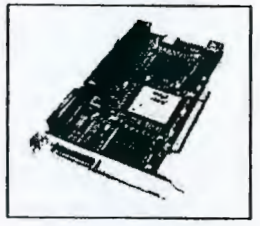
- The SecuRaid 110, PCI RAID Ultra2 SCSI Single Channel RAID Card
- The SecuRaid 210, PCI Ultra-2 SCSI Single Channel RAID card
- The PCI RAID Ultra-Wide SCSI-3 Single Channel RAID card
- The SecuRaid 530 64 bit PCI Ultra2 SCSI Tri-channel
- The Differential Ultra-Wide SCSI to SCSI RAID Kit

RAID CONTROLLERS

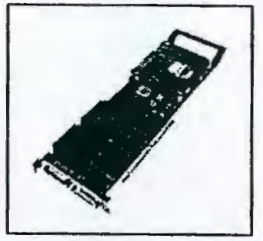
PRICE PERFORMANCE



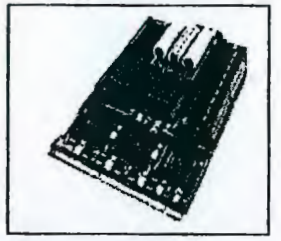
SecuRAID110
1-channel ; Ultra2 Wide SCSI
33Mhz i960 RISC processor
4MB and 16MB cache



SecuRAID210
1-channel ; Ultra2 Wide SCSI
66Mhz i960 RISC processor
8-16-32-64MB cache



SecuRAID530
3-channel ; Ultra2 Wide SCSI
233Mhz StrongArm processor
16-32-64MB cache with or without battery backup



U/W SCSI to SCSI RAID
3-channel (2 drive – 1 host)
U/W SCSI
33Mhz i960 RISC processor
16-32-128MB cache

Internal Storage (PCI based)

The PCI Ultra- Wide SCSI-3 Single Channel Controller Card

- 40 MB/s Ultra Wide SCSI data transfer rate
- Connectivity for up to 15 SCSI peripheral devices in a single PCI slot
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0585-00-00	AIF- 0585-IN-00	Ultra-Wide SCSI-3 Single-Channel
AIF-0586-00-00	AIF-0586-IN-00	Ultra-Wide Differential SCSI-3 Single Channel

KIT CONTENTS
32 Bit Single-ended/Differential SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0585-xx-00 AIF-0586-xx-00
Computer Bus	32-bit PCI Local Bus
PCI Compliance:	PCI 2.0 specification, (PCI 33MHz)
Interface Protocol	Bus master DMA
Host bus Burst data Rate	133 MB/s
Peripheral Bus	8-bit and 16-bit wide Ultra SCSI
SCSI Synchronous	40 MB/s
SCSI Asynchronous data Rate	3.3 MB/s
Device Protocol	SCSI-1, SCSI-2, SCSI-3, Wide Ultra SCSI
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	One 68-pin high density
External Connectors:	One 68-pin high-density
External Drivers :	
IF-0585-xx-00	Single-ended, active termination
AIF-0586-xx-00	Differential, active termination
Device Support	Up to wide 15 devices

OPERATING SYSTEM SUPPORT	
Regulatory Compliance:	FCC Class B, CE, IEC

PHYSICAL DIMENSIONS	
Length inches (cm)	6.87 (17.0)
Height inches (cm)	3.87 (9.5)

ENVIRONMENTAL LIMITS	
Storage Temperature ^{0}C	-55 to 85
Operating Temperature ^{0}C	0 to 55
Operating Humidity %	10 to 90, non-condensing
Power Requirements	5 V +/-5% at 2.0 amps maximum

The PCI Ultra-Wide SCSI-3 Dual channel Controller Card

- Up to 80 MB/s across two SCSI channels in a single PCI slot
- Connection for up to 30 SCSI devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0587-00-00	AIF-0587-IN-00	PCI Ultra-Wide SCSI-3 Dual Channel

KIT CONTENTS
SCSI Controller Card
EZ-SCSI software

CONTROLLER SPECIFICATIONS	AIF-0587-xx-00
Computer Bus	PCI Local bus PCI 2.0 specification, (PCI 33MHz), Two fully independent PCI SCSI channels bridged to systems PCI bus
Interface Protocol	Bus master DMA
Device Protocol	16-bit Ultra SCSI
Host Bus Data Transfer Rate	Up to 133 MB/s
SCSI Synchronous Data Rate	80 MB/s (6 MB/s per channel)
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	Two 68-pin, high-density internal connector
External Connector	One 68-pin, very high density external connector
Electrical Drivers	Single-ended, active termination
Device Support	Up to 30 devices

OPERATING SYSTEM SUPPORT	
I/O Operating Environment	DOS, Windows, Windows95, Windows NT, Windows for Workgroups, OS/2, NetWare, UNIX (SCO, UnixWare)
Regulatory compliance	FCC class B, CE, IEC

PHYSICAL DIMENSIONS	
Length inches (cm)	6,875 (17.463)
Width inches (cm)	4.0 (10.16)

ENVIRONMENTAL LIMITS	
Operating Temperature: °C	-5 to 60
Storage Temperature°C	-60 to 95
Operating Humidity %	10 to 95, non-condensing
Power requirements	5V ± 5% at 2.0 amps max.

The PCI Ultra-Narrow SCSI-3 Single channel Controller Card

- Easy Plug and Play installation of up to seven Fast SCSI hard drives, CD-Re-writaeable drives, scanners, DAT and DLT media peripherals
- Fast SCSI data transfer rate of up to 10MB/sec

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0588-00-00	AIF-0588-IN-00	PCI Ultra-Narrow SCSI-3

KIT CONTENTS
SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0588-xx-00
PC Bus Type	32-PCI
Interface Transfer Method	Bus Master DMA
Total Devices supported	7 total (internal or external)
Data Transfer rate	10MB/s
Supported Protocols	SCSI-1, SCSI-2, and Fast SCSI-2
Boot support	Bootable (on board BIOS)
Internal Connector	50-pin standard (male)
External Connector	50-pin high-density SCSI-2 (female)
OPERATING SYSTEM SUPPORT	IBM-compatible PC-486, Pentium, or above Windows NT, Windows 95, Windows 3.1, MS-DOS 6.0, OS/2, SCO UNIX or UnixWare OS, PCI expansion slot SCSI peripheral
PHYSICAL DIMENSIONS	
Length inches (cm)	4.7" (11.9)
Height inches (cm)	3.0 (7.6)
Weight lbs	Approx 1.5
ENVIRONMENTAL LIMITS	
Operating temperature	-5 to 60
Non-Operating temperature	-55 to 60
Relative Humidity	10 to 90 non-condensing
	5.0v+ /-0.25 at 2.0 amps maximum

The PCI Ultra2 Wide SCSI-3 Single channel Controller Card

- Up to 80MB/s across one SCSI channel in a single PCI slot
- Connection for up to 15 SCSI-2 or SCSI-3 devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0589-00-00	AIF-0589-IN-00	PCI Ultra 2-Wide SCSI-Single Channel

KIT CONTENTS
Symbols SYM8952U

CONTROLLER SPECIFICATIONS	AIF-0589-00-00
SUPPORTED BUSES	
	32-bit, PCI Local bus 16-bit, Wide SCSI bus Single-ended SCSI asynchronous transfers, single-ended Fast/Ultra SCSI synchronous transfers, LVD Ultra2 SCSI Synchronous transfers
SCSI BUS TERMINATION	
	Active, automatic terminating, Universal LVDlink with automatic switching to single-ended Termination power: current limited, self-resetting
SCSI BUS CONNECTION	
	Up to 15 SCSI, SCSI-2 or SCSI-3 devices
BOARD CONNECTORS	
Internal	68-pin, right angle, high density, SCSI bus 4-pin for off-board SCSI Active LED
External	68-pin, high-density connector interconnect
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI asynchronous	Up to 14 MBps
SCSI synchronous single ended	
FAST	Up to 20MBps
ULTRA	Up to 40MBps
SCSI synchronous LVD	
ULTRA2	Up to 80 MBps
PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size	3.5in. x 6.0in
Form Factor	PCI 2.1 universal board
Bracket	ISA/EISA style
Operating temperature	5^0C to 55^0C
Relative humidity range	5^0 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage Temperature	-40^0C to 85^0C
Electrical	5V +/- 5% (1,5A max) 12V +/-5% (50mA max)
MTBF	<500,000 hours
PCI Maximum power dissipation	15 Watts
PRSNT1#	Open
PRSNT2#	**Ground**

The PCI Ultra2-Wide SCSI Dual channel controller Card

- Supports Fast/ Ultra SCSI bus speeds of up to 20 or 40MBps
- Connects up to 15 Fast or Ultra devices

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0590-00-00	AIF-0590-00-00	PCI - ULTRA2 SCSI Dual Channel Host Adapter

KIT CONTENTS
Symbios SYM21002

	AIF-0590-00-00
JPPORTED BUSES	8-/16-bit Fast/Ultra SE SCSI bus (up to 15 SCSI devices 16-bit Ultra/Ultra2 SE or LVD SCSI bus (up to 15 SCSI devices) up to 80 MBps (Channel B)
SCSI BUS TERMINATION	Active Termination with Tolerant. (active negation) technology on both channels Channel A: Single-ended SCSI Channel B: Universal LVDlink SCSI with automatic switching to single-ended when single-ended devices are connected to SCSI bus
SCSI BUS CONNECTION	Up to 15 Fast SCSI Ultra SCSI peripherals on Channel A Up to 15 Fast SCSI, Ultra or Ultra2 SCSI peripherals on Channel B
)ARD CONNECTORS	
Internal	Universal, 32-bit PCI edge connector Channel A 68-pin, right angle, high density latching SCSI bus Channel A 50-pin low density Channel B 68-pin, right angle, high density latching SCSI bus
External	Channel A 50-pin High Density
Off-board LED Indicator:	Channel A and B SCSI Bus Active 4-pin header for off-board LEDs
On-board jumpers:	The standard SYM21002 is a jumper-less solution

PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 14 MBps (per channel)
SCSI Synchronous single-ended	Fast-up to 40 MBps (per channel)
SCSI Synchronous LVD	Ultra-up to 40 MBps (per channel) Ultra2-up to 80MBps (per channel)

PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS

Board Size:	Approximately 4in. X 7.5in.
Form Factor:	PCI 2.1, 32-bit Universal Board
Bracket:	ISA/EISA style
Operating temperature	0^0C to 55^0
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-40^0 C to 85^0C
MTBF	>400,000 hours
Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts
	PRSNT1#- open
	PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B
	CE
	VCCI
	UL94V0

The PCI Ultra-Narrow SCSI Single channel controller Card

- Fastest standard systems bus available today, offering high performance Fast SCSI I/O technology
- Connects up to 7 SCSI devices
- Data transfer rate of up to 10MBps.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0591-00-00	AIF-0591-00-00	PCI - Fast SCSI host adapter

KIT CONTENTS
Symbios SYM20810

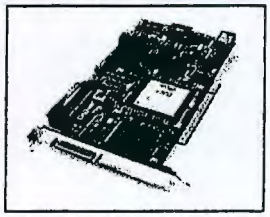
SUPPORTED BUSES	AIF-0591-00-00
	32-bit, DMA bus master, PCI local bus 8-bit, single-ended SCSI-1, SCSI-2 (Fast SCSI)
SCSI BUS TERMINATION	
	Single-ended with active, auto termination for SCAM (SCSI Configured Automatically) support. Fused, self - resetting termination power
SCSI BUS CONNECTION	
	Up to 7 SCSI or SCSI-2 devices
BOARD CONNECTORS	
Internal	50-pin, low density 8-bit SCSI (SYM20810 only)
External	50-pin, high density 8-bit SCSI (SYM20810 / SYM20811)
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 7 MBps
SCSI Synchronous	Up to 5 MBps
Fast SCSI-synchronous	Up to 10 MBps
Direct(bus master) memory access for low overhead, 32-bit data burst transfers at PCI bus bus transfer rates	✓
Zero wait state PCI transfer rate	✓
Up to 64-byte PCI burst size to maximise the PCI data transfer rate	✓

PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size:	
Form Factor:	2.5" x 4.75"
Bracket:	ISA/EISA style .
Operating temperature	5 to 55
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-55 to 8'c
MTBF	>400,000 hours

Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts
	PRSNT1#- open
	PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B
	CE
	VCCI
	UL94V0

The SecuRAID 110, PCI Ultra2 Wide SCSI Single channel RAID card

- Onboard Intel i960RP 33MHz RISC processor
- Single Channel PCI-to-Ultra2 SCSI LVD
- I_20 Ready
- Quick and easy configuration with (GAM) DACCF Software



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0677-00-00	AIF-0677-IN-00	PCI Ultra2 SCSI Single Channel

KIT CONTENTS
RAID card 4MB.16MB cache

CONTROLLER SPECIFICATIONS **AIF-0677-xx-00**

- Intel i960RP 33MHz RISC processor
- PCI 2.1 compliant
- I_2O compliant
- ECC EDO RAM
- 4MB cache, Flash EEPROM, 512K x 8 (72 pin JEDEC SIMM)
- BIOS resident configuration Utility

Internal Connectors
- 1 68-pin High-Density

External Connector
- 1 68-pin Very High-Density

SCSI SPECIFICATIONS

- 1 Ultra2 LVD channel on controller
- SISL Features
- Up to 80MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect/reconnect
- 64 concurrent host commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- RAID Clustering
- Transparent disk drive rebuild
- Background Initialisation
- Immediate RAID Availability
- RAID Migration
- RAID expansion
- Drive travelling during Power-Off
- Automatic detection of failed drives
- Automatic and transparent re-build of replacement drive
- On-line RAID expansion
- Hot Spare drive support

- Hot Drive Swapping support
- SAF-TE enclosure management
- RAID configuration stored on disk and NVRAM

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client Server GUI Interface
- Create, manage, expand and monitor program
- Error statistics and performance
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEMS SUPPORT

- Windows 95 & Windows 98
- Windows NT 3.51, 4.0 Workstation and Server
- NetWare 3.x, 4.x, 5.x & SMP
- SCO UnixWare 2.1
- SCO UNIX OSR 5.x
- DOS 5.x, 6.x & above
- 120 supported platforms and OS environments

PHYSICAL DIMENSIONS

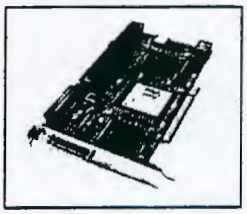
Length inches	7.225
Width inches	4.2
Max.Component inches	0.105 solder side
Height	0.570 component side
Board	Not to exceed the width of one PCI slot

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to + 55
Non-operating Temperature ^{0}C	-20 to +70
Operating Humidity %	10 to 90 relative humidity (non-condensing)
Non-Operating Humidity %	10 to 90 relative humidity (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

The SecuRaid 210, PCI Ultra2 Wide SCSI Single Channel RAID card

- 32bit PCI Ultra2 Single Channel RAID controllers
- Embedded Intel i960RD 66MHZ processor
- Monolithic NT driver that increases overall system throughput



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0685-00-HU	AIF-0685-IN-HU	PCI RAID Ultra2 SCSI Single Channel
AMR-0508-00-00	AMR-0508-IN-00	8MB Cache Memory Module for SecuRAID 210
AMR-0516-00-00	AMR-0516-IN-00	16MB Cache Memory Module for SecuRAID 210
AMR-0532-00-00	AMR-0532-IN-00	32MB Cache Memory Module for SecuRAID 210
AMR-0564-00-00	AMR-0564-IN-00	64MB Cache Memory Module for SecuRAID 210

KIT CONTENTS
RAID card Documentation

CONTROLLER SPECIFICATIONS — AIF-0685-xx-HU

- Intel i960RD RISC Processor / 66MHz
- PCI 2.1 Compliant
- I_2O Ready
- 8/16/32/64MB cache
- ECC EDO RAM in a 72 pin JEDEC SIMM
- RAID firmware on 1 MB Flash EEPROM
- Hardware XOR
- ECC Memory Support

SCSI SPECIFICATIONS

- Supports SCSI1, SCSI2, Ultra SCSI and Ultra2 SCSI devices
- Full support for Low Voltage Differential (LVD) devices
- SISL Features
- Up to 80 MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect / reconnect
- 64 concurrent host commands
- 256 tagged commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- Transparent disk drive.rebuild
- On-Line RAID expansion (M.O.R.E.)
- Up to Eight Controllers per System (NT)
- Logical drive size of 2 Terabytes, 32 logical drives per controller
- Background initialisation; Immediate RAID Availability
- RAID migration

- Variable stripe size per controller
- Variable cache line size per controller
- Up to 8 non-disk devices per controller
- Drive travelling during power off
- SAF-TE enclosure management
- Automatic error recovery
- Write through or write back cache support / logical device
- Automatic detection of failed drives
- Automatic rebuild of hot spare drive
- Hot drive swapping support
- ECC detection/correction on cache memory
- Support for SMART capable drives
- Configuration data stored on disk and NVRAM

RAID MANAGEMENT

- Client Server GUI Interface
- Global Array Manager
- Create, manage, expand and monitor program
- Error statistics and performance information
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEM SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare 3.x, 4.x (non NWPA) & SMP
- SCO UnixWare 2.1, 7.0, UNIX OSR 5.x
- OS/2.x,3.x &SMP
- DOS 5.x, 6.x and above

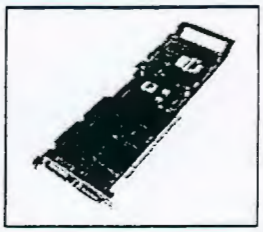
PHYSICAL DIMENSIONS

- Half Length PCI Footprint (7.225" x 4.2")

ENVIRONMENTAL LIMITS

Operating Temperature^{0}C	0 to 55
Power Requirements	+5.0V (+- 5%), 3.5 A (max); 17.5 watts max.
MTBF Hrs	200,000

The SecuRaid 530 64 bit PCI Ultra2 Wide SCSI Tri-channel RAID card



- A 64bit PCI Ultra2 SCSI RAID Controller for extreme performance
- Intel's leading edge DSP a 233MHZ StrongArm micro-controller
- Offers Uncompromising fault tolerance, data availability , superior configuration and management flexibility.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0690-00-HU	AIF-0690-IN-HU	64 bit PCI Ultra2 SCSI Tri-channel
AMR-0616-00-00	AMR-0616-IN-00	16MB Cache Memory Module for SecuRAID530
AMR-0617-00-00	AMR-0617-IN-00	16MB Cache Memory Module+ Battery Backup Unit for SecuRAID53
AMR-0632-00-00	AMR-0632-IN-00	32MB Cache Memory Module for SecuRAID530
AMR-0633-00-00	AMR-0633-IN-00	32MB Cache Memory Module + Battery Backup Unit for SecuRAID5
AMR-0664-00-00	AMR-0664-00-00	64MB Cache Memory Module for SecuRAID530
AMR-0665-00-00	AMR-0665-00-00	64MB Cache Memory Module + Battery Backup Unit for SecuRAID5

KIT CONTENTS
RAID card
Disks
Documentation

CONTROLLER SPECIFICATIONS	AIF-0690-xx-HU
	- Intel DSP 233MHz RISC micro-controller - 64Bit PCI Hot plug support - 8MB to 64MB - 1_2O Hardware ready - SDRAM in a 72 pin JEDEC SIMM - RAID Hardware on 4MB FLASH EEPROM - Hardware XOR - ECC Memory Support

SCSI SPECIFICATIONS
- 3 Ultra2 SCSI channels - Full support for Low Voltage Differential (LVD) devices - Up to 80Mb/s Burst data rate - Automatic SCSI bus termination - Disconnect/reconnect - Support of embedded SCSI controllers through a specific I/O Slot (SSIL feature) - 256 tagged commands per controller - Automatic sector re-mapping - Ultra2 SCSI (LVD) cable length up to two devices or 12m for 15 devices

FAULT TOLERANCE
- RAID Levels 0,1,0+1, 5 and JBOD - Transparent disk drive rebuild - Up to 16 controllers per system (NT) - Onboard BIOS: Embedded in the firmware

- On-line RAID expansion (M.O.R.E)
- Automatic Detection of failed drives
- Automatic and transparent re-build of replacement drives
- Automatic error recovery
- SAF-TE enclosure management
- Write through or write back cache support/ logical device
- Hot Drive Swapping support
- RAID configuration stored on disk and NVRAM
- Memory write and Invalidate command

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client GUI Interface (GAM client)
- Create manage, expand system drives, error statistics and performance information
- BCU BIOS config utility with RAID manager (DACCF)

OPERATING SYSTEMS SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare3.x, 4.x & SMP
- SCO UnixWare 2.1
- SCO UnixWare 2.1
- DOS 5.x, 6.x & above
- Sun Solaris
- I_2O supported platform and OS environments

PHYSICAL DIMENSIONS

Length inches	12,280
Width inches	4,750
Max Component inches	0.105 solder side of board
Height inches	0.570 component side of board

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to +55
Non-Temperature ^{0}C	-20 to +70
Operating Relative Humidity %	10 to 90 (non-condensing)
Non-Operating Relative Humidity %	10 to 90 (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

SERVER OPTIONS

Server Management

- The ISA Server Management Board

Network & Communication

- The 32bit PCI 10/100Mbps Ethernet (Intel Pro100+ Server)Adapter
- The 32bit Dual Port 10/100Mbps Ethernet (Intel Pro100+Dual Port Server) Adapter
- The 32 bit PCI 10 / 100Mbps Ethernet Adapter (3COM)
- The External Fax Modem 56Kbps
- The 32 bit PCI Gigabit Ethernet (Alteon ACenic)Adapter

CD-ROM Drives

- The 40x Internal SCSI CD-ROM drive
- The 40x Internal IDE CD-ROM drive

Tape Backup Options

- The 4GB IDE Internal Tape Drive
- The DDS2 4/8GB, DDS3 12/24GB, Autoloader 48/96GB SCSI DAT Tape Backup
- The DDS4 20/40GB SCSI DAT Tape Backup
- The 20/40GB SCSI DLT External/Internal Tape Drive
- The 35/70GB SCSI DLT External/Internal Tape Drive

ISA Server Management Board

- Supported in ESMPRO Management Suite 1.5 and above
- Optional External modem
- Security (user name, password, call back feature)

CUSTOMER INTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0702-00-00	AIF-0702-IN-00	ISA Server Management Board

KIT CONTENTS
ISA Server Management Board
AC Power Module
Cables x 2
Installation Documents

! Requires an external modem

FUNCTIONS	AIF-0702-000
BUSI/F	ISA
Processor	H8/3003
NVRAM	128K
Serial port	Dual A sync Serial port
Battery	Internal
AC adapter	External
Modem	External
RTC	Internal
Reset I/F	Requires same cable as NEC's SMB
Power control	Requires same cable as NEC's SMB
Sensor	Temperature, Voltage, Optic chassis open
Interrupt	1
WDT	Internal
MONITORING	✓
Post monitoring	✓
BOOT monitoring	✓
Watch dog Timer+	✓
Shutdown (Shut down at trouble, User shut down)	✓
Temperature, Voltage, Chassis open	✓
OS Hang (Stall panic)	✓
LOG	
HW Error Log (ex. Troubles detected by monitoring)	✓
NT Event Log (System, Application, Security)	✓
OS Event Log area	✓
ALERT	
Information capturing (POST code)	✓
WAN (Atomic Alert)	✓
Pager	✓

REMOTE MAINTENANCE	
Shutdown	✓
Remote Power Control (Reset, Power OFF, ON)	✓
Remote SMB configuration	✓

OTHER	
FW update	N/A
Set Threshold	✓
Security (user name. ID, Password)	✓

SOFTWARE ENVIRONMENT	
ESMPRO	✓
EV2701	✓
Windows NT,	✓
Netware	✓

The 32bit PCI 10/100Mbps Ethernet (Intel Pro 100+ Server) Adapter

- Scalable performance (up to 800Mbps) reduces server bottlenecks
- Redundant connections maximise server uptime
- Remote Server Management increases IT staff efficiency

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0519-00-00	ALN-0519-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter
1 NT disk
1 Netware disk
1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0519-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Connectors	Single: RJ-45
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	6K cache
Interrupt levels	INTA
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558

NETWORK-MANAGEMENT	
WfM baseline v2.0 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
Intel Pro/	✓
SNMP-manageable	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓

Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓

ENVIRONMENTAL LIMITS

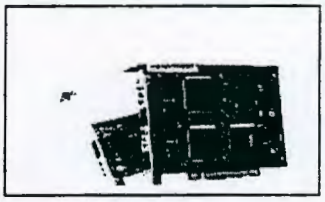
Operating temperature ^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT

.67 Watts @ +5VDC

The 32bit PCI 10/100Mbps Ethernet (Intel Ethernet Pro 100+Dual Port Server) Adapter

- Two 10/100Mbps ports on one card
- Aggregate bandwidth up to 800Mbps
- PCI Hotplug lets you swap out an adapter with the server
- High-link availability through Adapter Fault Tolerance



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0619-00-00	ALN-0619-IN-00	

CONTROLLER SPECIFICATIONS	ALN-0619-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	Dual: PILA8472
Connectors	Dual: RJ-45
ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	12K cache
Interrupt levels	INTA and INTB
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558
NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
SNMP-manageable	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓
Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓
OS/2	✓
DOS	✓

ENVIRONMENTAL LIMITS	
Operating temperature ^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT	
	6.5 Watts @+5VDC

The 32bit PCI 10/100Mbps Ethernet Adapter (3COM)

- DMI 2.0 support which enables PC asset Management and diagnostics via standard DMI browsers
- Integrated Managed PC Boot Agent (MBA) allows for after hour updates, installations and repairs.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0922-00-00	ALN-0922-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter
1 NT disk
1 Netware disk
1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0918-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	3C905B-TX
Connectors	Single: RJ-45 (female)
ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5 packs
Switchless board configuration	
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	
Data rate(s) supported per port	10 & 100Mbps
On-board memory	4K cache
Interrupt levels	
IEEE support	802.3
Data path width	32-bit
Hardware certifications	
Data transfer mode	
Controller or processor	
NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	
DMI 2.0 support	✓
Board and network diagnostics	
SNMP	Optional
RMON	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓

Windows* 95,98	✓
Novell NetWare* 3.x and 4.x server drivers	✓
SCO UnixWare*	✓
OS/2 ODI	✓
DOS Windows 3.x	✓
Windows for Workgroups	✓
SCO Open Server 5	✓
LAN Manager	✓

ENVIRONMENTAL LIMITS

Operating temperature°C	0-70
Operating humidity %	10-90%

The NICs described in the table above can support the latest 3 sophisticated technologies:

- ✓ **Adapter Fault Tolerance**
- ✓ **Asymmetric Port Aggregation (aka "Adaptive Load Balancing")**
- ✓ **Symmetric Port Aggregation (aka "Fast EtherChannel")**

For more information visit our website at www.neccsd-europe.com and look in our Technology section.

The 32bit PCI 1Gigabit Ethernet Adapter (Alteon ACEnic)

- Full-duplex Gigabit Ethernet Interface
- Replaces multiple 100Mbps interfaces in congested servers
- Adaptive interrupt frequency
- Completely interoperable with existing Ethernet equipment

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0400-00-00	ALN-0400-IN-00	32-bit PCI Gigabit Ethernet Adapter

KIT CONTENTS
Server Adapter 1 NT disk 1 Netware disk 1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0400-00-00
Bus interface	PCI bus master, 32/64-bit, 33/66 MHz Adaptive DMA
Connections	SC Fiber connector for 62.5/125 micron fiber or 50/125 micron fiber

ADAPTER PRODUCT FEATURES	
Adaptive Interrupt Technology	✓
Separate Read & Write DMA	✓
Aggregate bandwidth	2Gbps
Full-duplex capable	✓
Data rate(s) supported per port	1Gbps
IEEE support	802.1Q
Data path width	32-bit
Maximum IP addresses per adapter	64
Embedded 32-bit RISC processor	✓

OPERATING SYSTEM SUPPORT	
Windows NT 4.0	✓
Novell NetWare 4.10 & 4.11	✓
Solaris 2.5.1, 2.6 & 2.7	✓

ENVIRONMENTAL LIMITS	
Operating temperature °C	0-50
Operating humidity %	5-85% (non-condensing)

OPERATING DISTANCES	
62.5 MICRON MM fiber	2-260 meters
50 mi	2-550 meters

The External Fax/Modem 56 Kbps

- Up to 56 Kbps Internet Connectivity
- K56flex upgradeable to ITU/TIA standard
- Enhanced ADPCM/PCM voice operation with concurrent DTMF detection

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESRIPTION
ACC-0056-**-00		External Modem 33.6KBps

**country code BB=British, FF=French, DD=German, TT=Italian, EE=Spanish, JJ=Dutch, SS=Swedish, AA=Danish, NN=Norwegian, YB=Belgian/English, CF=Swiss/French.

KIT CONTENTS
Modem adapter
Cable for power socket

MODEM FEATURES	DCC-115-AO
Modem Speed	56 Kbps Internet connectivity
Chipset Resolution	Rockwell RCVDL56ACFW/SP modem chip Downloadable MCU & Data Pump firmware from Host
DATA Modem	56 Kbps Internet connectivity (K56flex upgradeable to ITU/TIA standard) V.34bis (33.6) V.34 (28.8 Kbps) V.32 bis (14.4 Kbps) V.32, V.23, V.22, V.22 A/B, V.21 Bell 212A, Bell 103
Data Compression	V.42 bis, MNP 5
Error Correction	V.42LAPM, MNP 2-4
Fax Modulations	V.17, V.29, V.27ter
Fax Control/Protocol	Class 1, V.21 Channel 2 and Group 3 fax mode
OPERATING SYSTEM SUPPORT	
	Windows 3.1x Widows 95 Windows NT3.5x TAPI compliant
MODEM COMPONENTS	
Indicator lights	AA (auto Answering lights up when the modem is configured to answer the ring automatically TR (Data Terminal Ready) lights up when the computer raises the Data Terminal Ready (DTR) line, indicating it is ready to begin communications. CS (Clear to send) lights up when the data transfer path is clear for data transmission. OH (Off Hook) lights up when modem is connected to another modem and off hook CD (Data Carrier Detect) lights when modem detects a carrier signal the telephone line. SC (Send Data) lights up when the modem transmits data to the computer RD (Receive Data) lights up when data is receive by the modem.
CONNECTORS AND SWITCHES	
	1 x ON/OFF rocker switch 1 POWER socket for supplied cable 1 x 9-pins SERIAL PORT connector RJ11 Telephone socket for telephone line/handset 3.5mm jack for Mono Mic-Input

The 40x Internal SCSI, CD-ROM

- Up to 6,000KB/s Sustained Transfer Rate
- SCSI Interface
- 80ms Average Random Access
- 256KB Buffer

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADO-5703-00-00	ADO-5703-IN-00	40x internal SCSI CD-ROM

KIT CONTENTS
CD-ROM + Screws
Users Guide

CAPACITY AND INTERFACE	ADO-5703-xx-00
Interface	Internal SCSI-2 (ID 0 to 7)
FORMAT SPECIFICATIONS	
Average Random Access (32X)	80 ms
Compatible CD Roms Standards:	Red-Book, Yellow-Book, CD-ROM XA, CD-I Bridge (Photo-CD, Video CD), CD-I, CD-I Ready, CD-G and Multisession (Photo-CD, CD-Extra, CD-RW, CD-R), CD-TEXT
PERFORMANCE SPECIFICATIONS	
Sustained Mode 40X	2,595KB/s (20MB/s Sync.)
Burst (SCSI)	6,000 KB/s (20MB/s Sync)
Buffer Cache Size	256KB
RELIABILITY SPECIFICATIONS	
ERROR RATES	
UNRECOVERABLE-Mode 1	< 1 in 10^{15}
UNRECOVERABLE-Mode 2	< 1 in 10^{12}
Seek	< 1 in 10^{6}
MTBF	1000,000 POH @ 20% Duty Cycle
ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 50
Storage Temperature ^{0}C	-10 to 60
Operating Humidity %	8 to 80 non-condensing
Wet Bulb	27 ^{0}C max
POWER REQUIREMENTS	
Avg. DC +12v, +5v (± 5%)	6.9W
Standby DC +12v, +5v (± 5%)	0.5W

The 40x Internal IDE CD ROM

- 6 MB/sec maximum data transfer rate
- 100 ms average access time
- 256 KB buffer memory
- MPC-III compliant
- E-IDE/ATAPI interface

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADR-0400-00-10	ADR-0400-IN-10	40x Internal IDE CD-ROM

KIT CONTENTS
CD-ROM + Screws Users Guide

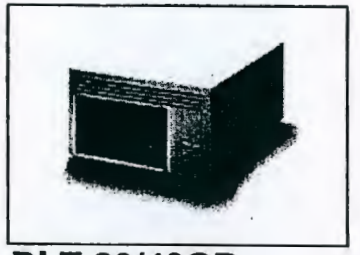
CAPACITY AND INTERFACE	ADR-0400-00-10
Interface	E-IDE/ATAPI
FORMAT SPECIFICATIONS	
Supported Formats	ISO 9660, High Sierra Group, Photo CD multisession, CD-ROM XA Mode 2 Form 1 & 2, CD-ROM mode 1& 2, CD-i FMV*, Video CD*, CD-DA, Enhanced-CD, MPC-III compliant, CD-RW, CD-R
PERFORMANCE SPECIFICATIONS	
Transfer Rate	Maximum data transfer rate 6 MB/sec
Average Access Time	100 ms(typical)
Rotation Method	CAV (constant angular velocity)
Buffer	256 KB
RELIABILITY SPECIFICATIONS	
MTBF	: 60,000 hours 10% duty cycle
PHYSICAL DIMENSIONS	
Width inches (mm)	5.87,5.87, 5.87(149)
Depth inches (mm)	7.95, 7.87, 7 (202) (200) (178)
Height inches (mm)	1.65, 1.65, 1.65 (42)
Weight kg (lbs)	1.0kg (2.2)
ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 40
Storage Temperature^{0}C	-10 to 60
Relative Humidity %	20% to 85%RH
POWER REQUIREMENTS	
Voltage Tolerance-5V DC	± 5%
Voltage Tolerance-12V DC	± 5%
Ripple+Noise Tolerance-peak to peak-5V DC	< 90 mVpp
Ripple+Noise Tolerance-peak to peak-12V DC	< 90 mVpp
Hold Track (max.)-5V DC	1200mA
Hold Track (max.)-12V DC	500mA
Seeking current (peak)-5V DC	1200mA
Seeking current (peak)-12V DC	700mA

BACKUP TAPES

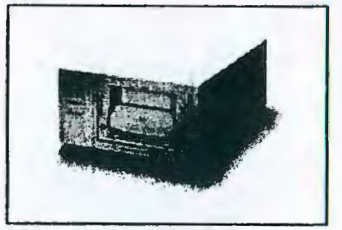
PRICE PERFORMANCE

Travan 4/8GB
STR: 300/600KB/s
Interface : IDE ATAPI (4MB/s)

DDS-2 4/8GB,
DDS-3 12/24GB
DDS-4 20/40GB
DDS-3 Autoloader 48/96GB
STR DDS2-Autoloader:
1,100/2,200KB/s
STR DDS3: 550/1,100KB/s



DLT 20/40GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast
(10MB/s)



DLT 35/70GB
DLT 40/80GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast/Wide
(20MB/s)

STR : Sustained Transfer Rate

Travan

DAT

DLT

The 4GB IDE Internal Tape Drive

- Up to 2,000- Kbyte per second native transfer rate
- Read-after-write , four head design
- High-performance 1-Mbyte buffer
- Compatible with most popular operating systems

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0800-00-00	ADT-0800-IN-00	4GB ATAPI Tape Drive

KIT CONTENTS
Internal Tape Drive
Cleaning Kit
4 screws
Tape Band
Users Guide

CAPACITY AND INTERFACE	ADT-0800-xx-00
Capacity	
Native	4.0
Interface	
Physical	IDE/ATAPI

TAPE FORMAT SPECIFICATIONS	
Compatibility	
Read only Media Compatibility	QIC-3020 QIC-3010 QIC-80
Read/Write Media Compatibility	3M Travan TR-4 Seagate8000TR4 Seagate 4000QT Sony QW-3080XLF

PERFORMANCE SPECIFICATIONS	
Performance	
Transfer Rate (Kbytes/sec)	600/450/300**
Tape Speed Read/Write (ips)	92/69/46
Search/Rewind (ips)	100
Backup Rate, Sustained (Native Mbytes/min, max)	30

RELIABILITY SPECIFICATIONS	
Read While write	No
MTBF (20% duty cycle)	330,000

PHYSICAL DIMENSIONS
1-inch high; configurable as 3.5-inch x 1.0-Inch or 5.25-inch x half-height (1.7inch)

ENVIRONMENTAL LIMITS	
Operating Temperature	
Internal ^{0}C	5 to 45
External ^{0}C	5 to 35

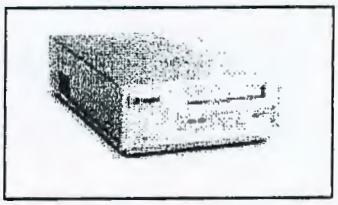
Non-Operating Temperature^{0}C	-40 to 65
Relative Humidity %	20 to 80 non-condensing
Wet Bulb Temperature	26^{0}C

POWER REQUIREMENTS	+5V ± 5%		+12V ± 5%
Operating Internal			
Idle/Stepping (amps)	0.63/1.0		0.25/1.8
Idle Watts		0.15	
Normal Watts		15	
Max Watts		17.0	

**Based on fast sense capability

The DDS2 4/8GB, DDS3 12/24GB,DDS3 Autoloader 48/96GB SCSI DAT Tape Backup

- Native transfer rates up to 1,100 Kbytes per second
- Read-after-write, four head design
- High-performance 2-MB buffer
- Compatible with most popular operating systems



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0409-00-00	ADT-0409-IN-00	4/8GB DDS-2 DAT
ADT-2400-00-00	ADT-2400-IN-00	12/24GB DDS-3 DAT
ADT-4896-00-00	ADT-4896-IN-00	48/96GB DDS-3 DAT Autoloader

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-0409-xx-00	ADT-2400-xx-00	ADT-4896-xx-00
Compressed (GB)2			
90 Metre Tape	4.0	4.0	16.0
120 Metre Tape	8.0	8.0	32.0
125 Metre Tape	NA	24.0	96.0
Native			
90 Metre Tape	2.0	2.0	8.0
120 Meter tape	4.0	4.0	16.0
125 Metre tape	NA	120	48.0
Internal Connector			
TAPE FORMAT SPECIFICATIONS			
Recording Method	DDS-DC, DDS Helical Scan (R-DAT) ANAI/ECMA	DDS-DC,DDC Helical Scan (R-DAT) ANAI/ECMA	DDS-2, DDS-3 DDS-C, DDS Helical Scan (R-DAT) ANSI/ECMA
PERFORMANCE SPECIFICATIONS			
Transfer rate			
Native/Compressed(Kbytes/sec)	550/1,100	1,1000/2,200	1,100/2,200
Tape Speed (in/sec, mm/sec)	0.47/11.9	0.47/11.9	0.47/11.9
Head to Tape Speed (in/s, mm/s)	270/6,858	270/6,858	270/6,858
Search/Rewind speed (x normal speed)	200	200	200
Average access Time			
90 Metre Tape (sec.)	30	30	30
120 Metre tape (sec.)	40	40	40
125 Metre Tape (sec.)	NA	40	40
Buffer (Mbytes)	Flash	Flash	Flash
EEPROM	DDS-2	DDS-2	DDS-2, DDS-3
RELIABILITY SPECIFICATIONS			
MTBF (20% duty cycle)			

Internal (hours)	265,000	265,000	135,000
External (hours)	150,000	150,000	80,000
Error Rate (bits)	<1 per 10^15	<1 per 10^15	<1 per 10^15
Limited Warranty(years)	2	2	2
MTTR	<30 minutes	<30 minutes	<30minutes

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)			

ENVIRONMENTAL LIMITS

Operating Temperature			
Internal (hours)	5 to 45	5 to 45	5 to 45
External (hours)	5 to 35	5 to 35	5 to45
Non-operating Temperature Relative °C	-40% to 65	-40 to 65	-40 to 65
Humidity (%non-condensing)	20°C to 80	20 to 80	20 to 80
Wet Bulb Temperature (°C)	26	26	26

POWER REQUIREMENTS

Internal +5V+12V	0.44/0.28	0.48/0.3	1.5/0.8
Watts (typ)	5.5	5.5	17.0
External (VAC universal)	100 to240	100 to 240	100 to240

The DDS4 20/40GB SCSI DAT Tape Backup

- Compressed data-transfert rates up to 5.5 Mbytes per second and 20Gbytes per hours
- Highest reliability with an MTBF of over 400,000 hours
- Read-after-write, four-head design
- High-performance 8-Mbyte buffer
- Compatible with most popular operating systems

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2000-00-00	ADT-2000-IN-00	20/40GB DDS-4 DAT

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-2000-xx-00
Compressed (Gbytes)	
90 Meter Tape	4.0
120 Meter Tape	8.0
125 Meter Tape	24.0
150 Meter Tape	40.0
Native	
90 Metre Tape	2.0
120 Meter tape	4.0
125 Metre tape	12.0
125 Metre tape	20.0
Interface	Ultra2 SCSI

PERFORMANCE SPECIFICATIONS	
Transfer rate	
Native/Compressed(Mbytes/sec)	2.75/5.5
Tape Speed (in/sec, mm/sec)	0.81/20.4
Cylinder speed (RPM)	10,000
Search/Rewind speed (x original DDS-1 speed)	400
Average access Time	
90 Metre Tape (sec.)	9.5
120 Metre tape (sec.)	12.6
125 Metre Tape (sec.)	13.2
150 Metre Tape (sec.)	15.8
Buffer (Mbytes)	8
Recording Method	DDS-4, DDS-3, DDS-2, DDS-DC,DDS, Helical Scan, ANSI/ECMA

RELIABILITY SPECIFICATIONS	
MTBF (20% duty cycle)	
Internal (hours)	>400,000
External (hours)	>200,000
Error Rate (bits)	<1 per 10^{15}
Limited Warranty(years)	3

MTTR	<0.5

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)	✓

ENVIRONMENTAL LIMITS

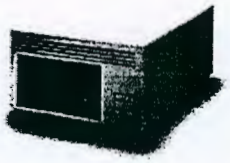
Operating Temperature	
Internal (°C)	5 to 45
External (°C)	5 to 45
Non-operating Temperature Relative ^{0}C	-40 to 65
Humidity (%non-condensing)	20 to 80
Wet Bulb Temperature (°C)	0 to 90

POWER REQUIREMENTS

Internal +5V +/- 5%	0.7/1.5
Internal +12V +/- 10%	0.05/0.25
Watts (typ)	10.5
Auto-ranging Input Voltage (external)	100 to 240

The 20/40GB SCSI DLT External/Internal Tape Drive

- 5MB/sec native transfer rate
- 20 GB native capacity
- 64-bit Cyclical Redundancy Check (CRC)
- SCSI-2 Bus and internal data path.



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2040-00-00		20/40GB SCSI DLT External Tape Drive
ADT-4000-00-00	ADT-4000-IN-00	20/40GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes cable
Blank Cartridge
Cleaning Kit
Documentation

CAPACITY AND INTERFACE	ADT-2040-xx-00 ADT-4000-xx-00
Formatted Capacity	
Native (GB)	20
Compressed (GB)	40*
Average File Access (sec)	68
Interface	SCSI-2 Fast Single-End
Internal Connector	50-Pin

TAPE FORMAT SPECIFICATION	
Recording Format	128 track serial serpentine
Recording Density	82 kbits per inch
Track Density (tpi)	256
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20GB native capacity
DLT Cleaning Tape	20 uses
Read/Write Compatible With All Previous DLT Formats	
Archive Storage	More than 30 years with less than 5% loss in demagnetisation (at 20oC and 40% non-condensing humidity)
Durability	Average 1,000,000 head passes in Typical office/computer environment

Actual transfer rate and capacity will vary depending on data.

PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	1.5
Compressed	3.01
Burst Transfer Rate (MB/sec) Synchronous	10

RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	10,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 x 1017 bits read
Undetected Error Rate	1 x 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including Media
Non-operating Temperature ^{0}C	-40 to 151
Non-Condensing Humidity	10% to 95%
Condensing Humidity %	20to 80

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	25 watts

The 35/70GB SCSI DLT External/Internal Tape Drive

- 5 MB per second native transfer rate
- 35 GB native capacity
- Recording head life of more than 30,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLTtape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-3570-00-00		35/70GB SCSI DLT External Tape Drive
ADT-7000-00-00	ADT-7000-IN-00	35/70GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-3570-xx-00 ADT-7000-xx-00
Formatted Capacity	
Native (GB)	35
Compressed (GB)	70*
Interface	SCSI-2 Fast /Wide Single-ended
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	86 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10 GB native capacities
DLTtape IIIXT	15 GB native capacity
DLTtape IV	20 and 35 GB native capacities
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	5
Compressed	10*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	30,000 hours

Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 1017 bits read
Undetected Error Rate	1 X 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	37 Watts

Read/Write compatible with all previous DLT formats

**Actual transfer rate and capacity will vary depending on data*

***Excluding bezel*

The 40/80GB SCSI DLT External/Internal Tape Drive

- 6 MB per second native transfer rate
- 40 GB native capacity
- Recording head life of more than 50,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLT tape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-4080-00-00		40/80GB SCSI DLT External Tape Drive
ADT-8000-00-00	ADT-8000-IN-00	40/80GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-4080-xx-00 ADT-8000-xx-00
Formatted Capacity	
Native (GB)	40
Compressed (GB)	80*
Interface	SCSI-2 Fast /Wide (SE/LVD or HVD)
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	98 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
MEDIA/FORMAT COMPATIBILITY	
DLTtape III	10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20, 35 and 40GB native capacities
Read/write compatible with all previous	DLT formats
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	6
Compressed	12*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	250,000 hours @ 100% duty cycle
Head Life	50,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 10^{17} bits read
Undetected Error Rate	1 X 10^{27} bits read

PHYSICAL DIMENSIONS	External	Internal**
Width - inches (mm)	6.88 (174.8)	5.7 (144.8)
Length - inches (mm)	12.8 (325.1)	9.0 (228.6)
Height - inches (mm)	6.48 (164.6)	3.25 (82.5)
Weight–pounds (kg)	14 (6.35)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	28 Watts

Read/Write compatible with all previous DLT formats

**Actual transfer rate and capacity will vary depending on data*

***Excluding bezel*

UNINTERRUPTIBLE POWER SUPPLIES

UPS Tower Format

- Smart UPS 230V/ 700VA,
- Smart UPS 230V/1000VA
- Smart UPS 230V/1400VA
- Smart UPS 230V/3000VA

UPS Rack Format (only for AZA-xx-xx rack frames)

- 3U Rackmountable 230V/1400VA UPS
- 3U Rackmountable 230V/2200VA UPS
- 3U Rackmountable 230V/3000VA UPS

UPS Accessories

- Smart Slot Interface Expander
- UPS Share Box
- Signal cable for Interface Expander and Share Box
- Link Power Cord for UPS or PDU

Uninterruptible Power Supplies

- UPS Tower based format
- Increased data protection by supporting network grade batttery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-0700-00-00	Smart UPS 700VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1000-00-00	Smart UPS 1000VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1400-00-00	Smart UPS 1400 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3100-00-00	Smart UPS 3000 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

	ABA-0700-00-00	ABA-1000-00-00	ABA-1400-00-00	ABA-3100-00-00
OUTPUT				
Output Power Cap..VA/ watts	700 / 450	1000 / 670	1400 / 950	3000 / 2250
Output Voltage	230 V	230 V	230 V	230V
Output connections	(4) IEC-320-C13	(4) IEC-320-C13	(4) IEC--320-C13	(8)IEC-320-C13
Waveform Type	Sinewave	Sinewave	Sinewave	Sineware
Transfer Time (ms)	2 (4 ms max)	2 (4 max)	2 (4 ms max)	2 (4 ms max)
Nominal input voltage	230V	230V	230V	230V
Input frequency (auto sensing)	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz
Input connection	IEC- 320-C14	IEC- 320-C14	IEC- 320-C14	IEC- 320-C20
BATTERIES				
Typical backup time (at half load)	18.2 min	20.1 min	24.0 min	18.1 min
Battery type	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte leakproof	Lead-Acid + suspended electrolyte leakproof
Recnarge time (hrs)	4.0	4.4	5.14	4.5
Replacement battery catridge	RBC5	RBC6	RBC7	RBC11
COMMUNICATIONS AND MANAGEMENT				
Interface port	RS-232 port	RS-232 port	RS-232 port	RS-232 port
Management Software	PowerChute Smart-UPS bundle	PowerChute UPS bundle	PowerChute Smart-UPS bundle	PowerChute Smart UPS bundle
Control panel (LED status display withload and battery bar-graphs and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓	✓
Audible alarm	✓	✓	✓	✓
Emergency Power Off (EPO)	Optional	Optional	Optional	Optional
SURGE PROTECTION AND FILTERING				
Surge Energy rating (joules)	320	320	320	320
Filtering				

Full time multi pole noise filtering;	✓	✓	✓	✓
% IEEE surge let-through	0.7	0.3	0.3	0.3
0 clamping response time	✓ 0	✓ 0	✓ 0	✓ 0
meets UL 1440	✓	✓	✓	✓

PHYSICAL DIMENSIONS

Height (inches / cm)	6.2 / 15.7	8.5 / 2.6	8.5 / 21.6	17 / 43.2
Width (inches / cm)	5.4 / 13.7	6.7 / 17.0	6.7 / 17.0	7.7 / 19.6
Depth (inches / cm)	14.1 / 35.8	17.3 / 43.9	17.3 / 43.9	21.5 / 54.6
Weight (lbs / kg)	29.0 / 13.2	41.5 / 18.8	58 / 26.3	123 / 55.8

ENVIRONMENTAL

Operating temperature °C / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions °C / F	-15-45 / 32-120	-15-45	-15-45	-15-45
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	41 dBA	41 dBA	45 dBA	53 dBA
On line thermal dissipation	85 BTU / hr	100 BTU / hr	135 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Uninterruptible Power Supplies

- Rack based format
- Increased data protection by supporting network grade battery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-1401-00-00	3U Smart UPS (SU1400RM),1400VA4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-2201-00-00	3U Smart UPS (SU2200RM), 2200VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3001-00-00	3U Smart UPS (SU3000RM), 3000VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

TECHNICAL SPECIFICATIONS	ABA-1401-00-00	ABA-2201-00-00	ABA-3001-00-00
Output Power Capacity VA/ watts	1400 / 950	2200 / 1600	3000 / 2250
Output Voltage	230V	230V	230V
Output connections	(4) IEC-320-C13	(8)-IEC-320-C13 (1)-IEC-320-C19	8)-IEC-320-C13 (1)-IEC-320-C19
Waveform Type	Sinewave	Sinewave	Sinewave
Transfer Time (ms)	2 (4 max)	2 (4 max)	2 (4 max)
Nominal input voltage	230V	230V	230V
Input frequency	50 / 60 Hz +/- 5 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)
Input connection	IEC-320-C14	IEC-320-C20	IEC-320-C20
BATTERIES			
Typical backup time (at half load)	16.9 min	23.2 min	12.4 min
Battery type	Lead-Acid, suspended electrolyte; leakproof	Lead-Acid suspended electrolyte; leakproof	LeadAcid,suspended electrolyte; leakproof
Recharge time (hrs)	4.2	4.5	4.5
Replacement battery catridge	RBC8	RBC12	RBC12
COMMUNICATIONS AND MANAGEMENT			
Interface port	RS-232	RS-232	RS-232
Management Software	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle
Control panel (LED status display withload and battery bar-graphs and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓
Audible alarm	✓	✓	✓
Emergency Power Off (EPO)	optional	optional	Optional
SURGE PROTECTION AND FILTERING			
Surge Energy rating (joules)	320	320	
Filtering			✓
Full time multi pole noise filtering;	✓	✓	✓
% IEEE surge let-through	0.3	0.3	✓
0 clamping response time	✓	✓	✓
meets UL 1440	✓	✓	

PHYSICAL DIMENSIONS			
Height (inches / cm)	5.2 / 13.2	5.2 / 13.2	5.2 / 13.2
Width (inches / cm)	19.0 / 48.3	19.0 / 48.3	19.0 / 48.3
Depth (inches / cm)	14.0 / 35.6	25 / 63.5	25.0 / 63.5
Weight (lbs / kg)	58 / 26.3	103 / 46.8	114 / 51.8
Rack height	3U	3U	3U
ENVIRONMENTAL			
Operating temperature °C / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions °C / F	-15-45 / 32-120	-15-45 / 32-120	-15-45 / 32-120
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	45dBA	47 dBA	47 dBA
On line thermal dissipation	135 BTU / hr	275 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Smart Slot Interface Expander and UPS Share Box

- Enables thorough management of servers in mixed OS environments
- Essential tools to properly managing signalling from a single UPS

CUSTOMER INSTALLABLE	DESCRIPTION
AEX-2200-00-00	Smart Slot Interface Expander to manage up to 2 additional servers
AEX-2008-00-00	UPS Share Box to manage up t o 8 servers

FEATURES AND BENEFITS	AEX-2200-00-00 AEX-2008-00-00
Central UPS Management	Use one server to manage the power environment for servers with multiple UPS
Integrates with PowerChute Software	Each server runs its own copy of PowerChute plus software, for monitoring and power management of the UPS
WARRANTY AND APPROVALS	
Product Warranty	2 year warranty
Approvals	Smart Slot Interface Expander :FCC Class B, EN50022, En50082-1 Share UPS-:FCC Class A, EN50082-1

Signal Cable for Interface Expander or Share Box

CUSTOMER INSTALLABLE	DESCRIPTION
ACN-2000-00-00	Kit of 1 Cable for Interface Expander or Share Box
ACN-2001-00-00	Kit of Link Power cord for UPS or PDU

DESCRIPTION	ACN-2000-00-00
Smart Signalling UPS Link Cable	Smart Signalling RS-232 communication cable

DESCRIPTION	ACN-2001-00-00
Power cord	Smart Signalling RS-232 communication cable

MISCELLANEOUS

- Ultra2 SCSI cable Kit for internal HDD and Media device support
- SCSI cable Kit for internal UN Media device support
- SCSI cable Kit for internal UW Media support
- SCSI cable Kit with 68-pin High density External connector
- Y-shape SCSI-3 Termination cable
- SCSI Wide (68-pin) to Narrow (50-pin) connector

Ultra2 SCSI cable Kit for internal HDD and Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0025-00-00	ACN-0025-IN-00	68-Pin internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal Cable to connect Media and HDD SCSI devices

CONNECTORS	7
TYPE	68-pin
Hard Disk	3
Media Devices	3 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	37

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0026-00-00	ACN-0026-IN-00	50-pin Narrow Internal SCSI cable

KIT CONTENTS
SCSI Cable

External 50-pin conductor ribbon for Huron Chassis

CONNECTORS	
Type	50-pin
Media Devices	4
CD-ROM	✓
DAT/DDS 2	✓
DLT	To Be Confirmed
Adaptec 2920	1
PHYSICAL DIMENSIONS	
Length inches	53

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0027-00-00	ACN-0027-IN-00	68-pin Internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
Tape Drive	1 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	10.25

SCSI cable kit with 68-pin High Density External Connector

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0028-00-00	ACN-0028-IN-00	68-pin External SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
External SCSI (HD)	1
Internal SCSI (HD)	1 (50-pin)
PHYSICAL DIMENSIONS	
Length cm	45

SCSI Wide (68-pin) narrow (50-pin) converter

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACT-0010-00-00	ACT-0010-IN-00	SCSI Internal converter 68 pin HD female pins to 50 pin female pins.

KIT CONTENTS
SCSI Converter

Mouse

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
MSS-0392-01-00	MSS-0392-02-00	2 Button Mouse

KIT CONTENTS
1x 2 Button Mouse

TECNICAL SPECIFICATIONS

- 2 Button Mouse
- Resolution 320 dpi
- Microsoft complient

The 16 Bits Sound Card

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASX-0591-00-00	ASX-0591-00-00	16 Bits ISA Sound Card

KIT CONTENTS
1 16 Bits Sound Card

TECNICAL SPECIFICATIONS

- 16 Bits CD-Quality stereo recording and playback
- 32 voices of wave table audio with Creative
- WaveSynth/WG

eyboard

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AKB-0587-00-00	AKB-0587-00-00	104 Keys Keyboard

KIT CONTENTS
1 x 104 keys Keyboard

MONITORS

	VR 15 Affordable Viewing Comfort	HR 15 Superior Quality for Advanced Needs	VR 17 Perfect for Business Applications
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT	CRT
Screen diagonal	15"	15"	17"
Viewable diagonal	13.8"	13.7"	16"
Anti-Glare Coating	Yes	Yes	Yes
Anti-Static Coating	Yes	Yes	Yes
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.28	0.28	0,27
Video Bandwidth (MHz)	Over 85	Over 95	Over 110
Horizontal scan frequency (kHz)	30-54	30-70	30-70
Vertical refresh rate (Hz)	50-120	50-150	55-120
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			
Contrast ratio			
Top flicker-free VESA (>75Hz)	800 x 600 @ 85Hz	1024 x 768 @ 85Hz	1024 x 768 @ 85Hz
Max non-interlaced resolution	1024 x 768 @ 60Hz	1280 x 1024 @ 60Hz	1280 x 1024 @ 60Hz
Resolutions supported	640 x 480 @ 60, 75, 85Hz 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60Hz	640 x 480 @ 60, 85, 120Hz 720 x 400 @ 70Hz 800 x 600 @ 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz, 1280 x 1024 @ 60Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz 1280 x 1024 @ 60Hz
OTHER SPECIFICATIONS			
Front panel control	Digital Control	On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	Yes	Yes
TCO 95	No	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 H1		
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 NO	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	380 x 360 x 381mm	376 x 365 x 396mm	420 x 403 x 418mm
Weight	12.5 kg	11.9 kg	15.5 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	Up to 3 years on site	Up to 3 years on site	Up to 3 years on site
Reference	**NCM-1520-H1-00** **French price list only**		
Reference	**NCM-1520-N0-00** **Rest of Europe only**	**NCM-1550-H0-00**	**NCM-1720-N0-00**
Notes	**Our monitors can only be sold together with a PC.**		

CRT and LCD MONITORS

	HR 17	HR 19	LR 15
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT short length tube	Colour TFT active matrix
Screen diagonal	17"	19"	15"
Viewable diagonal	16"	18"	15"
Anti-Glare Coating	Yes	Yes	-
Anti-Static Coating	Yes	Yes	-
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.26	0,25	0.297
Video Bandwidth (MHz)	Over 200	Over 202	Over 95
Horizontal scan frequency (kHz)	30-95	30-95	31-69
Vertical refresh rate (Hz)	50-150	50-150	56 - 85
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			200cd/m^2
Contrast ratio			200:01:00
Top flicker-free VESA (>75Hz)	1280 x 1024 @ 85Hz	1280 x 1024 @ 85Hz	-
Max non-interlaced resolution	1600 x 1200 @ 75Hz	1600 x 1200 @ 75Hz	-
Resolutions supported	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 75, 85Hz, 1600 x 1200 @ 75Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 60, 75, 85Hz, 1600 x 1200 @ 60, 75Hz	640 x 350 @ 70, 85Hz 640 x 400 @ 70, 85Hz 720 x 400 @ 70Hz 640 x 480 @ 60, 72, 75, 85Hz 800 x 600 @ 56, 60, 72, 75, 85Hz 1024 x 768 @ 60, 70, 75, 85Hz
OTHER SPECIFICATIONS			
Front panel control	One Touch On Screen Display	One Touch On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	No	No
TCO 95	Yes	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO			
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	419 x 410 x 447mm	480 x 468 x 419 mm	384 x 380 x 174 mm
Weight	17.3 kg	22,0 kg	5,0 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	up to 3 years on site	up to 3 years on site	up to 3 years on site
Reference	**NCM-1750-H0-00**	**NCM-1950-H0-00**	**NCL-1500-H0-00**
Notes	**Our monitors can only be sold together with a PC.**		

RACK SOLUTIONS

- The 27U, 36U and 42U 19" Rack Mount Frame
- Rack Mount Concentrator and Options
- The 24A Power Distribution Unit

The 27U, 36U and 42U 19"Rack Mount Frame

- Available in 27U, 36U or 42U form factors
- Designed to host your chosen combination of rackmountable Express5800 servers and storage units

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AZA-2700-00-00	N/A	19" rack mount frame 27U
AZA-3600-00-00	N/A	19" rack mount frame 36U
AZA-4200-00-00	N/A	19" rack mount frame 42U

KIT CONTENTS
Front/Rear metal vented doors and front stabiliser

PHYSICAL DIMENSIONS

U	27	36	42
Width (mm)	600	600	600
Height (mm)	1400	1800	2000
Depth (mm)	1000	1000	1000
Colour	Mist White	Mist White	Mist White

Rack-Mount Concentrator and Options

- 8-port model
- Control up to 64 servers from one console
- Patented OSCAR (On-Screen Configuration and Activity
- Reporting) user Interface allows for very easy access and control.
- Programmable scanning, naming, security and broadcast functions.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AEX-8000-00-00	N/A	1U 8 Port Monitor/Keyboard/Mouse Concentrator
ACN-0009-00-00	N/A	7' BSU to Concentrator Monitor / keyboard/ Mouse cable
ACN-0010-00-00	N/A	12' BSU to to Concentrator Monitor / keyboard/ Mouse cable
ACN-0011-00-00	N/A	12' Keyboard/Mouse/Monitor extension Cable Extension

KIT CONTENTS
8 Port Concentrator /3 cable Kit

TECHNICAL SPECIFATIONS	AEX-8000-00-00
OSCAR	On-screen pop-up menu system
Windows NT	Microsoft certified
Password security	Restrict system access through the switch
Broadcast Commands	Send the same keyboard or mouse commands to multiple computers (configurable)
Programmable scanning	Set system view time and selection pattern
SnapShot	Manages communication with the CPU during power-down
Long-line operation	Separate switch and CPUs by up to 12'
On-screen diagnostics	Displays technical assistance information on-screen
Automatic System Restart	Provides unattended reboot without administrative intervention
Power Supply	Auto senses 100-240 VAC internal
Flexible applications	SVGA, VGA, XGA, and PS/2 support Serial mouse capable with ACN-00xx00-00
Video	VGA, SVGA XGA
Regulatory	FCC-A, UL, cUL, TUV/GS, CISPER-A, VCCI, CE Mark, NEMKO
Connections	
Output:	
Console Video	HD15
Console Keyboard	PS/2
Console Mouse	PS/2
Input:	
System Video	HD15
System Keyboard	PS/2
System Mouse	PS/2
PHYSICAL DIMENSIONS	
Height inches (cm)	1.75 (4.45)
Depth inches (cm)	10.8 (27.7)
Width inches (cm)	17.0 (43.2)
Wight lbs (Kg)	9.0 (4.09)
ENVIRONMENTAL LIMITS	
Temperature (^{0}C)	10-40

The 230V Rackmountable Power Distribution Unit

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASP-0001-00-00	N/A	24A Power Distribution Unit, including 10 outlets

KIT CONTENTS
Power Distribution Unit 3 connection cords 1 power cord

TECHNICAL SPECIFICATIONS

AC Input	120/240 V
AC Output	120/240V
Current	24A/16A
Max. Current	30A/20A
Circuit Breaker	30/20/20
EMI/RFI Filter	30A
Transient Protection	6500PA
Receptacle Outlets	10, 14/16
Receptacle type	NEMA/IEC
Power Cord	12/3 - 15'
Power Plug 220V	L5-30P

	EXPRESS5800 120Ld	EXPRESS5800 120Mc2
DESIGN		
Form factor	Tower or 5U Rack	Tower or 6U Rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 2 (SMP)
Type	Pentium® III 600 to 800 MHz	Pentium® III 600 to 800 MHz
Slot type	Slot 1	Slot 1
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	256KB ECC L2 on-die
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	133 MHz
ARCHITECTURE		
Chipset	ServerSet III LE	ServerSet III LE
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	64MB/ 2GB / ECC SDRAM
Memory slots	4 DIMM	4 DIMM
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	All
MEDIA AND STORAGE		
CD ROM drive	40x EIDE	40x EIDE
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives EIDE 5400 RPM		
Hard Disk Drives EIDE 7200 RPM		
Hard Disk Drives SCSI 7200 RPM	U2W: 9.1/18.2GB	U 160/m: 9.1/18.2GB
Hard Disk Drives SCSI 10 kRPM	U2W: 9.1/18.2GB	U 160/m : 9.1/18.2GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board
RAID controller	Option	Option
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	3 / 2	4 / 3
3.5" Media bays (total / free)	1 / 0	1 / 0
3.5" Non-Hot Swap HDD bays	4 x 1.6" ***OR***	-
3.5" Hot swap HDD bays	6 x 1" (choose one type)	7 x 1" or (3 x 1.6" and 4 x 1")
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	4MB/4MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	-/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	1xUW SCSI	Option
System Management	Integrated	Integrated
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	300W
Hot-Plug PSU option	-	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1	1 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	445x220x620mm	533x289x591 mm
Weight	30 kg	30 kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35° C, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1

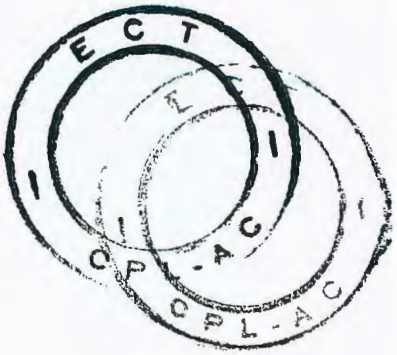
Standard warranty	3 year on-site	3 year on-site
Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes NTSL certified
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 1400 (option)

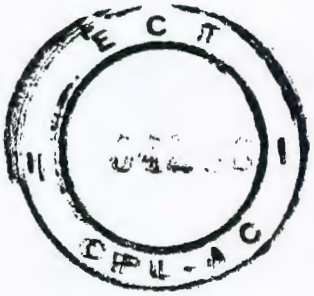
SERVERS AT A GLANCE

	EXPRESS5800 120Mc3	EXPRESS5800 HX4600
DESIGN		
Form factor	Tower or 7U Rack	Dual Tower or 14U rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 4 (SMP)
Type	Pentium® III Xeon 733-800MHz	Pentium® III Xeon 550MHz
Slot type	Slot 2	Slot 2
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	512KB or 1MB or 2MB ECC L2
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	100MHz
ARCHITECTURE		
Chipset	ServerSet III LE	Intel 450NX
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	256MB / 8GB / ECC RAM
Memory slots	4 DIMM	16 or 32 DIMM (with add. Memory board)
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	4 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	3 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
MEDIA AND STORAGE		
CD ROM drive	40xEIDE	40x SCSI
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives SCSI 7200 RPM	U 160/m: 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Hard Disk Drives SCSI 10 kRPM	U 160/m : 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x U2W SCSI on board 1x UN SCSI on board
RAID controller	Option	Standard (U2/W tri)
Maximum Internal Storage capacity	127.4GB (7x18.2)	436.8GB (12x36.4)
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	4 / 3	4 / 3
3.5" Media bays (total / free)	1 / 0	2 / 1
3.5" Non-Hot Swap HDD bays	-	-
3.5" Hot swap HDD bays	7 x 1" or (3 x 1.6" and 4 x 1")	8 or 12 x 1" or 1.6"
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	2MB/2MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	Yes/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	Option	1x UN SCSI
System Management	Integrated	Optional board
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	560W
Hot-Plug PSU option	Yes	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1 standard + 1 option	2 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	533x289x591 mm	620x445x678 mm
Weight	30 kg	77 Kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35°, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1
WARRANTY		

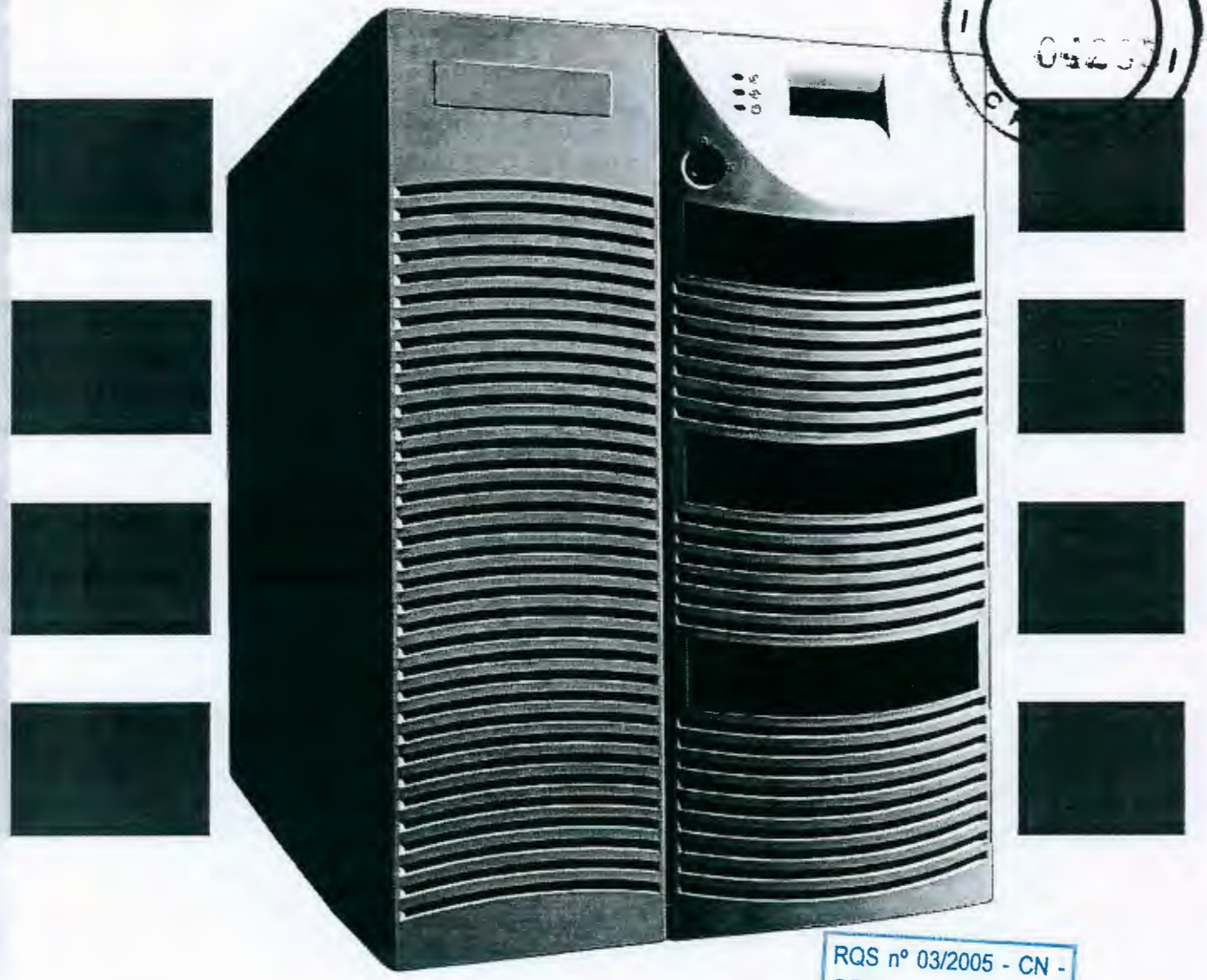
Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 2200 (option)

(1) 4-way : 1 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit ; 8-way : 2 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit
(2) 4-way : 1 standard + 1 option ; 8-way : 2 standard + 1 option
(3) Additional Disk Unit option and UPS option are mutually exclusive





PRODUCT INFORMATION GUIDE



Item 03 – Servidor Tipo INT3
Manual Técnico 3

EXPRESS5800 HX4600

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PRODUCT OVERVIEW

Express5800 HX4600

Redefining power erformance in Enterprise Computing

The Redefinition, the Express5800 HX4600 is more than just an enterprise server, it is designed to optimise system performance making full use of the latest innovations in server technology. The HX4600 is fully equipped with 4 of the much-appraised Pentium III Xeon processors at a maximum of 500MHz supported by the Intel 450NX chipset. The Express5800 HX4600 has been especially created for high availability, expandability and unparalleled price/performance ratios.

Each Pentium III Xeon 500MHz processors can support 512KB, 1MB or 2MB of L2 ECC cache. Sustaining up to **8GB of ECC protected memory** and the **fully-featured SecuRAID530 Ultra2 SCSI RAID controller as standard**, the HX4600 ensures maximum data integrity. With Integrated SCSI controllers and powerful 7,200rpm Ultra2 SCSI or the unprecedented performance 10,000rpm **Ultra2 SCSI hot swappable Hard Disk Drives** your server is guaranteed for outstanding data throughput.

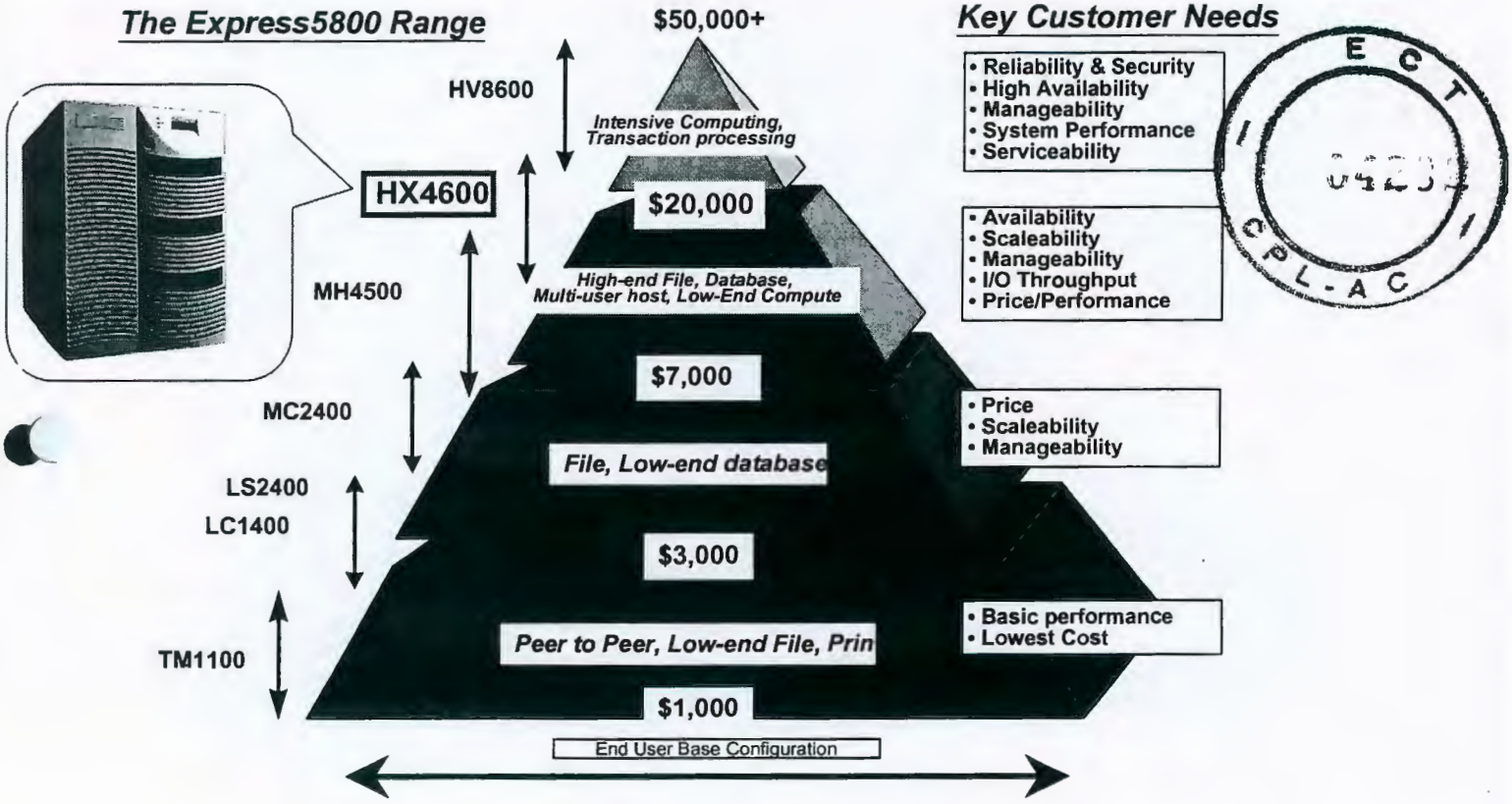
What more, the HX4600 features a complete range of redundant/hot-swap components including **redundant cooling redundant hot-swappable power supplies, and the essential** availability of hot-plug PCI. The Express5800 HX4600 comes with **8 or 12 highly configurable HDD bays** in 3 Ultra2 LVD disk cages (4, 8 or 12 disk drives) for a **massive internal storage of 436.8GB**, **11 expansion slots** (9 PCI/2 ISA) and **32 memory sockets** for facilitated expansion and upgrade. Moreover, all the HX4600 servers are **14U Rack-mountable** for all your business expansion requirements.

Facilitated set-up and manageability, the Express5800 HX4600 comes standard with **ExpressBuilder** set-up/configuration software and **ESMPRO** management software. Thanks to our assemble-to-order (ATO) capability, Express5800 HX4600 systems will be ready for immediate installation, right up to the optional preloading of Microsoft Windows **NT** Server 4.0 or NT Server 4.0 Enterprise Edition.

Ideal for distributed department and enterprise computing applications, the Express5800 HX4600 outdoes itself when handling business-critical applications, large database processing and decision support, transaction processing and server application consolidation.

Designed with ultimate availability, expandability and unmatched price performance as key considerations, the Express5800 HX4600 gives a redefinition to power performance in enterprise computing.

TARGET AUDIENCES



POINTS WORTH NOTING

- Up to 500MHz Quad Pentium III Xeon design for premium power performance
- Optimised data throughput with 100MHz system Front Side Bus and the Intel 450NX chipset
- A maximum of 8GB memory with ECC protection providing superior scalability for easy expandability
- Up to 436.8GB of hot-swap disk capacity of 8 or 12 highly configurable Ultra2 SCSI disk bays
- Flexible choice between a powerful 7,200 rpm or the increasingly eminent performance of 10,000 rpm Ultra2 SCSI HDDs
- Added data security using the utmost in RAID controllers SecuRAID530 Ultra2 SCSI as standard
- Redundant hot-swap power supplies, Hot swap PCI and redundant cooling maximising system uptim
- Integrated 3Com Network Interface controller
- Microsoft Windows NT Server 4.0 or NT Enterprise Edition preload option
- 14U Rack-mountable

KEY PRODUCT FEATURES & USER BENEFITS

The Accelerated Power Performance Pentium III Xeon processing

The Express5800 HX4600 supports up to 4 Pentium III Xeon processors, each packaged in a Single Edge Contact (S.E.C.). The S.E.C. cartridge includes the processor core with an internal 16KB primary (L1) cache, the secondary (L2) cache, a thermal plate and a back cover. A retention module attached to the baseboard secures the cartridge.

Pentium III Xeon processors feature either 512KB, 1MB or 2MB ECC L2 cache configurations as standard and come with frequencies of 500MHz Added to this, the HX4600 supports the new Intel 450NX chipset and a high-speed 100MHz Front Side Bus for optimised data throughout and superior system performance.

Advanced Memory architecture

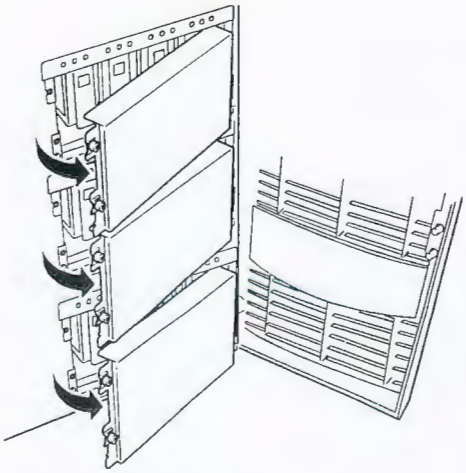
Express5800 HX4600's memory capacity is scaleable from 256MB (4 x 64 in bank #1) up to 8GB memory (32 slots occupied) using industry-standard EDO DIMMs with a 4-way interleave memory organisation. The HX4600 comes with one memory board as standard allowing up to 4GB of ECC Memory and an additional optional memory board enabling a maximum of 8GB. The HX4600 allows an easy expansion of system's capabilities to memory-intensive environments and comes standard with 9-bit parity/ECC protection for maximum data integrity.

Exceptional expandability with a maximum of 436.8GB hot swap storage capacity

The Express5800 HX4600 allows flexible configuration of HDD capacity for large data storage (up to 436.8GB with 12 x 1.6" hot swap Ultra2 SCSI HDDs) and offers 6 media bays (including two 3.5" bays with one occupied by a 1.44MB floppy drive and four 5.25" bays with one occupied by a 32x speed SCSI CD-ROM drive).

The Express5800 HX4600 can accommodate 2 kinds of hot-swappable HDDs:

- Powerful 7,200 rpm Ultra2 LVD SCSI (4.5GB, 9.1GB, 18.2GB, 36.4GB)
- High-performance 10,000 rpm Ultra2 LVD SCSI (9.1GB, 18.2GB)



Ultra2 SCSI Hard Drive Cages

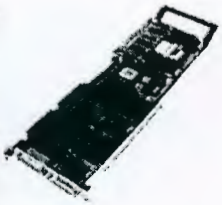
Integrated I/O controllers

The Express5800 HX4600 comes built with:

- an onboard single-channel Wide/Narrow SCSI controller on the PCI-A bus providing a narrow SCSI interface for 5.25" devices (SCSI CD-ROM drive, DAT, DLT)
- an onboard single-channel Ultra2 SCSI LVD controller on the PCI-B bus providing an Ultra2 SCSI interface.

Three-channel Ultra2 SCSI RAID board as standard

Every Express5800 HX4600 comes standard with the fully-featured SecuRAID530 Ultra2 SCSI RAID board for advanced levels of performance and fault-tolerance when running demanding server applications and databases.



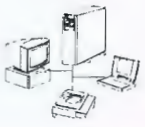
The SecuRAID530 RAID controller integrates a 233MHz Intel StrongArm on-board RISC processor with Mylex's own newly enhanced intelligent firmware. It also supports 3 Ultra2 SCSI channels, 16/32MB of cache with or without battery backup unit, Synchronous DRAM memory and 4MB of flash EEPROM. The SecuRAID530 allows advanced RAID 5 operation through hardware XOR and provides many fault detection and fault tolerance features such as automatic detection and transparent rebuild of failed drives, hot swap drive support, on-line RAID capacity expansion, hot spare drive support or RAID configuration stored in both disk and in non-volatile RAM, SMART capable drive support and SAF-TE enclosure management. The SecuRAID530 enables administrators to improve storage system performance simply by adding extra drives

Added to this, the board helps prevent system failure and protects valuable data with absolute flexibility and management features.

Integrated 10/100Mbps Ethernet

The HX4600 comes with a 3Com Network interface controller that is integrated on the motherboard.

Optional auto-sensing 10/100Mbps Ethernet



The Express5800 HX4600 can support optional auto-sensing 10/100Mbps EtherExpress PRO/100+ Server Adapter from Intel, optimising server performance and providing immediate network-readiness. By installing multiple PRO/100+ server adapters, several high-availability (load balancing, fault tolerance) and top performance (server bandwidth scaleable up to 800Mbps) features are provided for the most demanding networking environments.

Video

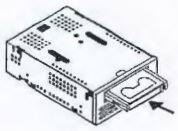
The HX4600 also features an onboard SVGA controller with 2MB of Video memory offering high-performance graphics capability to display high-quality images with a wide selection of colours. Supported resolutions include:

Resolution	*Number of colors*
640 x 480	16 700 000
800 x 600	16 700 000
1024 x 768	64 000
1280 x 1024	256

Optional Backup devices

The system can also accommodate multiple options for faster performing and efficient back up:

- DAT (12/24GB)
- DAT Autoloader (48/96GB)
- Internal or external DLT (20/40GB, 35/70GB)



Comprehensive network protection with MacAfee Netshield

With every Express5800 HX4600 ordered with the NT Server preload, McAfee's NetShield Antivirus software is included free of charge with a 2-year free update. MacAfee is an extremely flexible and easily manageable software package giving comprehensive protection to your entire network by detecting and eliminating more than 96% of known viruses.

NT Server preload option

Preloaded Microsoft NT Server 4.0 or NT Enterprise Edition allow companies to have the server up and running with the most up-to-date network operating system. Added to this, is the free inclusion of McAfee's reputed Netshield software (see above).

Operating Environments

The Express5800 HX4600 is certified for the following OS: Windows NT Server 4.0, Novell Netware 4.11 and 5.0 SMP and IntranetWare, SCO 5 OpenServer and UnixWare 7.0, SunSoft Solaris SMP 2.5.

System management software: ESMPRO

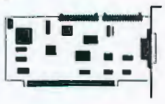
The Express5800 HX4600 includes the SNMP-based ESMPRO Suite to enable system administration within the frame of a networked environment. Included in the ESMPRO Suite are the following components:

- **the SNMP agents (for the Windows NT and NetWare environments) accommodating all Express5800 servers**
- **a complete standalone Server Management framework for organisations without any existing system administration solution**
- **WebAccess for easy management of the network from an Internet web browser**
- **a snap-in application to comprehensively integrate Express5800 systems into HP OpenView for Windows or Bull OpenMaster (AIX) management platforms.**

System installation software: ExpressBuilder

All Express5800 HX4600 systems include ExpressBuilder set-up and configuration software providing a logical and comprehensive process by which the server may be configured to best suit individual customer needs.

11 I/O expansion slots



The server's expansion capabilities meet the needs of enterprise/database servers for high-performance I/O by providing a combination of 4 PCI 64-bit, 4 PCI 32-bit hot plug, 2 PCI 32-bit and 1PCI/ISA. All the I/O expansion slots are Plug and Play ready and PCI connectors are parity enabled.

PCI/ISA Plug and Play

The Express5800 HX4600 supports PCI/ISA Plug and Play in the BIOS. By using Plug and Play compliant operating systems and options, users can easily upgrade and auto-configure the system.

External Device Connectors

The external I/O connectors of the Express5800 HX4600 provide support for a PS/2-compatible mouse and a keyboard, connectors for VGA monitor, two 9-pin serial port connectors and one 25-pin parallel port connector. It also provides a narrow SCSI external connector.

Rack-mount kit

The Express5800 HX4600 is 14U rack-mountable to respond to your expanding business requirements.

Hot Plug PCI

Customers today need high-availability solutions that minimise or eliminate downtime, that is why the Express5800 HX4600 comes as standard with 4 Hot Plug PCI. The technology allows a PCI adapter to be added, upgraded, or replaced while the host system is running and while other adapters in the system provide uninterrupted service. Generally speaking, a fully capable hot-plug system includes the hot-plug system hardware, hot-plug aware software and Os support, hot-plug capable device drivers, and a hot-plug aware user interface. All these elements enable enhanced PCI flexibility without powering down the Server. Incidentally Hot Plug PCI can only be integrated with the support of the NT2000 software, which will be available

Hot-swap Redundant power supplies and redundant cooling,

Two 560-Watt auto-voltage-sensing power supplies provide system power. These supplies auto-sense between 110V (60Hz) and 220V (50Hz) AC inputs, supporting use in most parts of the world. Both power supplies are designed to operate together during system operation. They comply with existing emissions standards and provide sufficient power for a fully loaded system configuration. An optional third power supply can be added to the system as a backup unit.

The HX4600 can also support a maximum of 7 fans for efficient cooling and airflow: 4 redundant fans for CPUs (front and rear) 2 fans not redundant for chipset cooling, 1 fan for I/O slots cooling not redundant.

System security

The Express5800 HX4600 design ensures secure operation in unattended environments. Physical security include lockable front doors and side panels which restrict access to the disk bays, floppy drive, CD-ROM and power or reset switches. Key integrated features include intrusion sensors, which are fitted to lockable accesses to warn system administrators (via ESMPRO) of any system violations, as are temperature sensors that monitor and control internal cooling. Lock loops are also fitted to the power supply units to avoid unwanted removals. Internal switches disable BIOS update, set-up access and floppy write protection, all preventing unauthorised access. The SCU utility controls the enabling/disabling of all I/O ports, including the floppy drive, preventing unauthorised booting of the system. Logical password protection is ensured by the dual level (Supervisor and User) password.

Warranty

The Express5800 HX4600 systems are backed with a three-year on-site warranty and optional extended service contracts which protects customer's investment assuring a lasting and reliable performance.

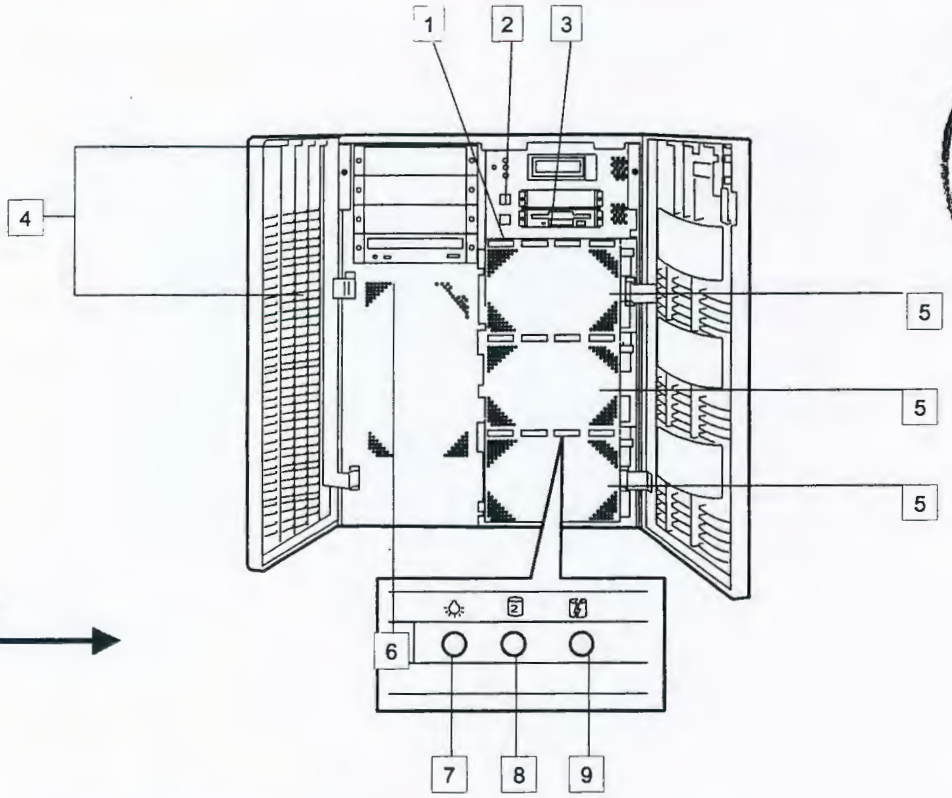
COMPETITION ANALYSIS

July 1999

	EXPRESS5800	COMPAQ	COMPAQ	HEWLETT PACKARD	IBM	DELL
	HX4600	**ProLiant 6000 Xeon**	**ProLiant 7000 Xeon**	**NetServer LH 4 PII Xeon**	**Netfinity 7000 M10**	**PowerEdge 6300**
Form factor	Dual Tower or 14U rack	Dual Tower or 14U rack	14U Rack	Tower or 8U rack	Tower or 11U rack	Minitower or 7U rack
Max # of CPU supported	4	4	4	1 or 4	4	4
Processor Type	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz
Chipset	Intel 450NX	-	-	-	Intel 450NX	Intel 450NX
L2 Cache	512K to 2MB ECC	512K to 2MB	512K to 2MB	512KB/1MB	512KB, 1MB and 2MB ECC	512KB/1MB ECC
Bus speed	100MHz	100MHz	100MHz	100MHz	100MHz	100MHz
Max RAM capacity	8GB ECC EDO	8GB ECC EDO	8GB ECC EDO	4GB ECC EDO	8GB ECC EDO	4GB ECC EDO
Memory Slots	16 DIMM (32 option)	16 DIMM	16 DIMM	16 DIMM	16 DIMM	16 DIMM
HDD controllers	1 integrated UW SCSI	2 Integrated U/W SCSI	2 Integrated U/W SCSI	2 Integrated U2W SCSI	Integrated dual-channel U/W SCSI	2 integrated U2W SCSI 1 Integrated U/N SCSI
RAID	Integrated 3-channel U2W SCSI on board	2-channel U2W SCSI board	Integrated 3-channel U/W board	Integrated 3-channel U2W board option	3-channel U2W SCSI board option	1 or 2-channel U/W or U2W S board options
CD-ROM	32x speed SCSI	32x speed IDE	24x speed SCSI	32x speed EIDE	32x speed IDE	32x speed SCSI
HDD type	U2W SCSI 7200rpm/10Krpm	UW SCSI 7200rpm/10Krpm	UW SCSI 7200rpm/10Krpm	U2W SCSI 7200rpm/10Krpm	UW SCSI 7200rpm/10Krpm	U2W SCSI 7200rpm/10Krpm
Max internal disk capacity	436.8GB	327.6GB	327.6GB	144GB	72.8GB	126GB
# of drive bays	8 or 12 x 1" or 1.6"	18x1" or 12x1.6"	18x1" or 12x1.6"	8x1.6"+12x1"	4x1" or 2x1.6"	6x 1.6" or 8x1"
Hot swap disks	8 or 12 x 1" or 1.6"	18x1" or 12x1.6"	18x1" or 12x1.6"	8x1.6"+12x1"	4x1" or 2x1.6"	6x 1.6" or 8x1"
# of media bays	6 (4x5.25+2x3.5)	6 (5x5.25+1x3.5)	6 (5x5.25+1x3.5)	4 (3x5.25" + 1x3.5")	2 (1x5.25" + 1x3.5")	5 (3x5.25" + 1x3.5")
Total I/O expansion slots	11 (1PI+10P)	10 (9P+1I)	10 (9P+1I)	8 (7P+1P/I)	12P	7P
32 bits PCI slots	4H + 2	4	5 H	8	7 H	3H
64 bits PCI slots	4	5	4 H	-	5 H	4H
Ethernet	10/100Mbps board option	Integrated 10/100Mbps board	10/100Mbps board option	Integrated 10/100Mbps board	Integrated 10/100Mbps board	Integrated 10/100Mbps boar
Remote management	Option	Option	Option	HP Top Tools board option	option	optional Dell Remote Assista Card
PSU standard capacity	2 x560W RHPS	1x750W RHPS	2x750W RHPS	3HPS	2 x400W RHPS	2x320W RPS
Max PSU optional capacity	3x560W RHPS	3x750W RHPS		4RHPS	3x400W RHPS	1x320W RPS
Cooling fans	redundant	standard 2+1/PSU + option 2 R	2 RH	8 RH	4RH	RH
Server management soft	ESMPRO Management Suite	Insight Manager	Insight Manager	HP OpenView ManageX/SE	Netfinity Manager	DELL Open Manage
Installation software CD	Express Builder	SmartStart	SmartStart	HP Net Server Navigator	Open Manage	DELL DirectStart
Other software	-	-	-	-	-	-
Standard warranty duration	3 years on site	3 years on site	3 years on site	3 years on site	3 years on site	1 year on site + 3 years free pa delivery support
Intervention delay	-	4 hours option	4 hours option	1 day	4 hours (option)	1 day

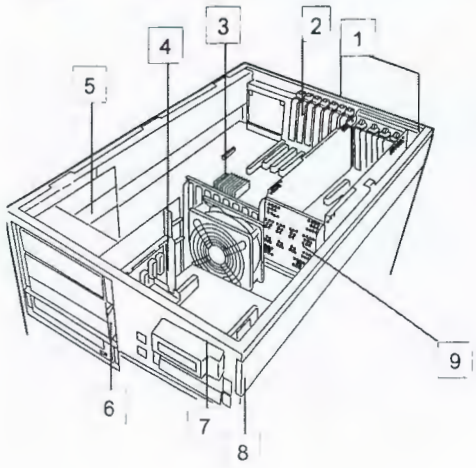
Slots: **P**-PCI, **HSP**-Hot Swap PCI, **I**-ISA, **E**-EISA, **S**-Shared
Bays: **M**-Media, **D**-Disk, **HSD**-Hot Swap Disk
Power: **RHS**-Redundant Hot Swap PSU

EXPRESS5800 HX4600 DETAILED VIEWS



FRONT VIEW

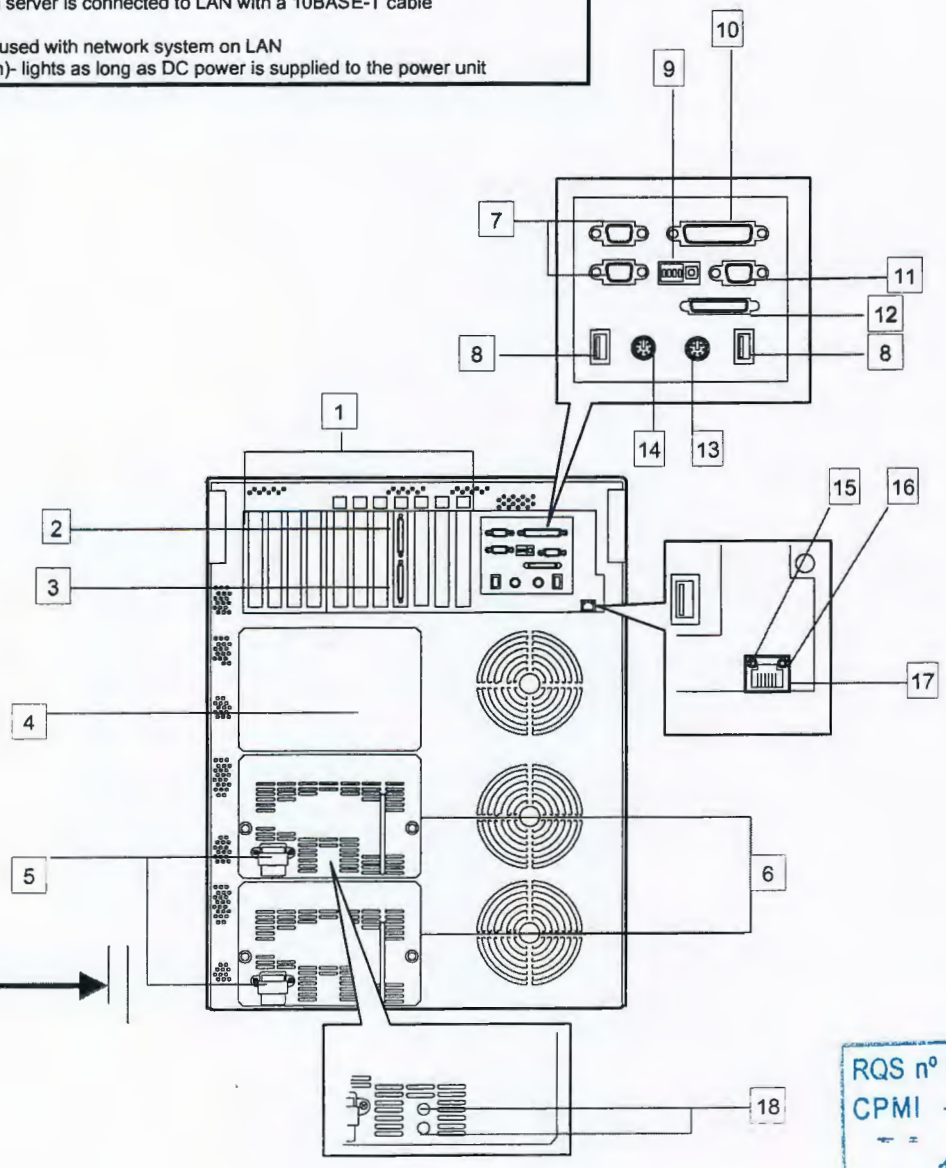
FRONT FEATURES AND CONTROL	
1	Power Switch - used to turn on/off Express 5800 server
2	Sleep Switch - when pressed servers enters power saving mode
3	3.5- inch floppy disk drive
4	5.25- inch device bay used to mount DAT drive or optical magnetic disk drive,
5	3.5- inch device bay - used to mount additional HDD cage to contain optional 3.5" HD's
6	CD-ROM drive- reads data from CD-ROM
7	Disk power lamp- lights when power is supplied to 3.5"hard disks
8	Disk access lamp- lights while 3.5" hard disk is operating
9	Disk error lamp- lights when 3.5-inch hard disk fails



SYSTEM I/O-SERVER TOP VIEW BOARD

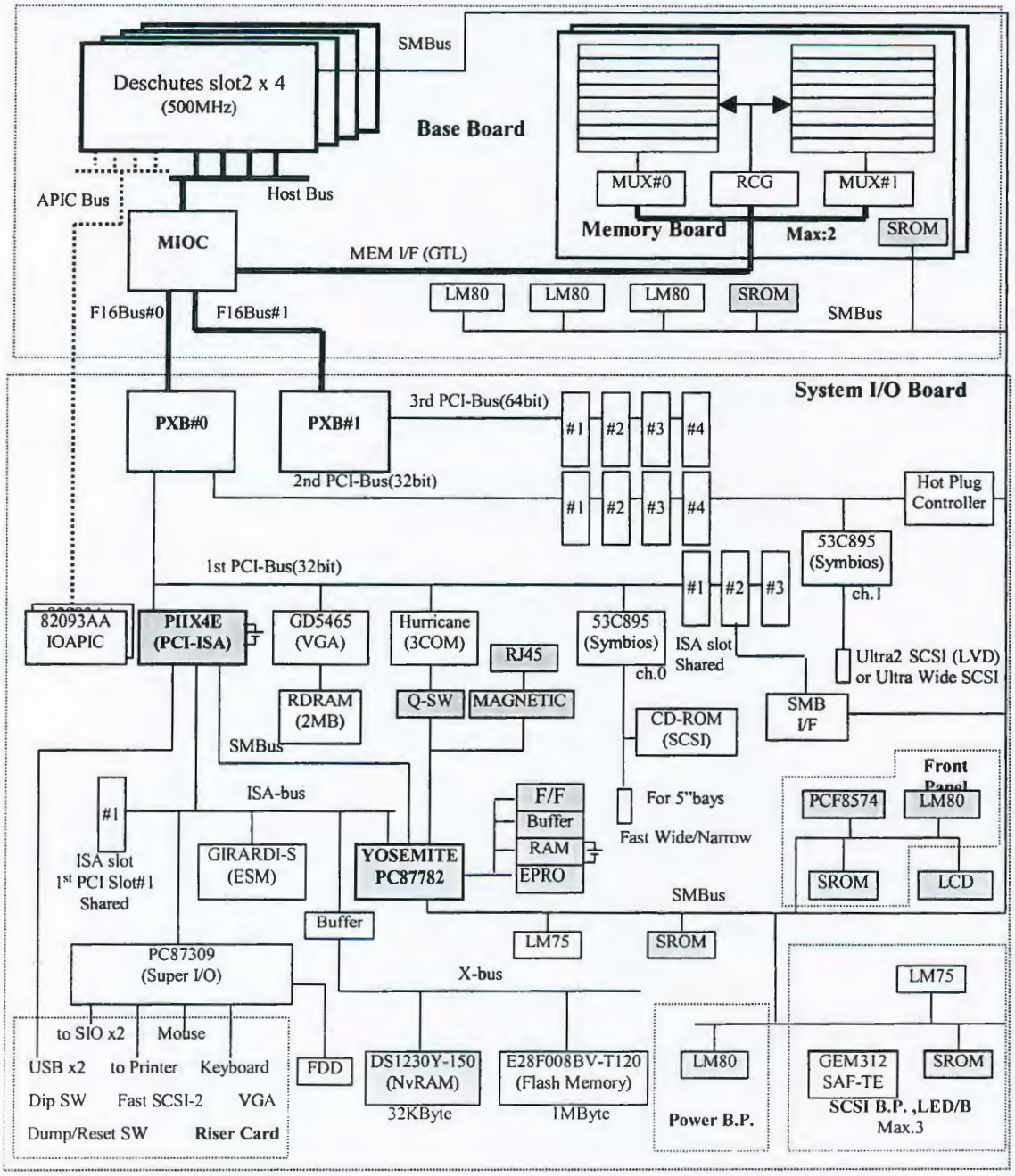
SYSTEM I/O BOARD- SERVER TOP VIEW	
1	Additional PCI/ISA slot
2	Riser card (peripheral device connector repeater card)
3	System I/O board
4	Front panel board
5	5.25" device drive bay
6	CD-ROM drive (standard configuration)
7	LCD
8	3.5" floppy disk drive
9	Cooling fan

REAR VIEW OF FEATURES AND CONTROLS	
1	PCI/ISA board slot
2	Disk array controller connector (ch.0)
3	Disk array controller connector (ch.1)
4	Slot for additional power unit
5	AC inlet - used to connect power cord
6	Power unit - used to supply DC power to the server
7	Serial port 1 - used to connect with device which has a serial interface
8	USB connector- used to connect device supporting the USB interface
9	Control switch- Pressing this switch resets the server or executes dump
10	Printer port connector
11	Monitor connector
12	SCSI connector- used to connect with an external SCSI device which has a SCSI-2 interface
13	Keyboard connector
14	Mouse connector
15	Status lamp- Lights when server is connected to LAN with a 10BASE-T cable
16	Active Lamp
17	100 Base-TX connector- used with network system on LAN
18	Power status lamp (green)- lights as long as DC power is supplied to the power unit

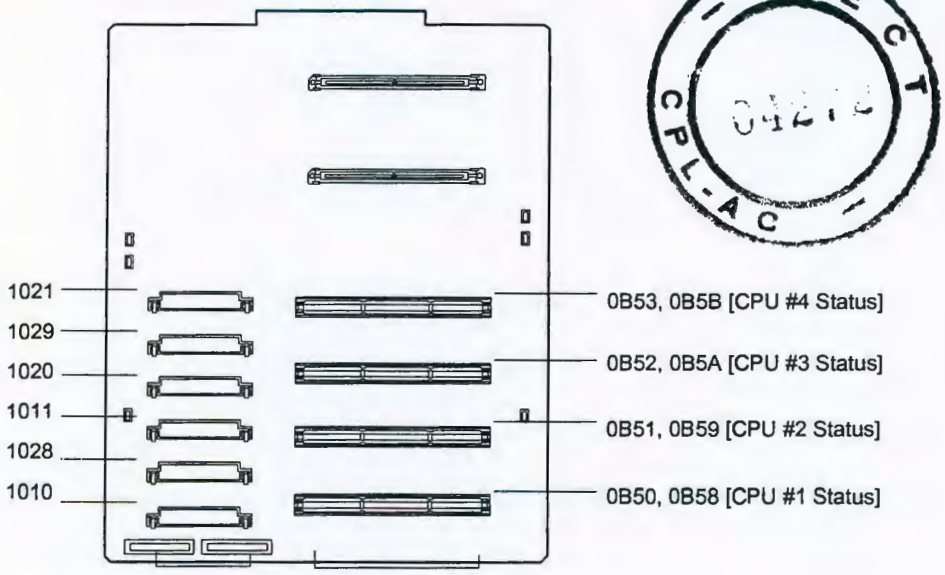


HX4600 SYSTEM BLOCK DIAGRAM

HX4600 Block diagram as follows: 5vs, 3.3vs Devices



CPU BASE BOARD



VRM connectors

Express5800 HX4600

FORM FACTOR	
Tower-Rack convertible	Yes, Dual Tower or 14U Rack
PROCESSOR	
Number of processors	1-4
Type	Pentium III Xeon 500MHz
Socket / slot type	Slot 2 Xeon
Integrated L1 cache	32KB
L2 cache std / max / type	512KB/ 1MB or 2MB
ARCHITECTURE & MOTHERBOARD	
Chipset	Intel 450NX
Processor front side bus (FSB) speed	100 MHz
I2O ready	Yes
MEMORY	
y min / max / type	256/8GB ECC RAM
Memory slots	16/32 (1 or 2 Memory Boards)
STORAGE	
Optional Hard disk drives	4.5 / 9.1 / 18.2 / 36.4GB 7,200rpm Ultra2 SCSI 9.1/ 18.2GB 10Krpm Ultra2 SCSI
HDD and Media controllers	PCI Ultra2 Wide (80MB/s) and Wide/Narrow SCSI
RAID controller	Integrated Ultra2 Wide SCSI RAID board 3 channel Ultra2 64bit PCI
Max internal storage capacity	436.8GB
CD ROM drive	32X SCSI
Floppy disk drive	1.44MB
Disk expansion unit	Optional
BAYS	
5.25" Media bays (total / free)	4 / 3
3.5" Media bays (total / free)	2 / 1
3.5" Hot swap HDD bays	8 or 12 Hot Swap Bays
SLOTS	
Bus slots	11
Bus slots free	10
(ISA/PCI/Combo/AGP)	4 PCI 64 / 4 PCI 32 hot plug / 2 PCI 32/ 1 PCI/ ISA

VIDEO	
Video controller	PCI SVGA
Video memory std / max / type	2MB /2MB /VRAM
NETWORK	
Network interface controller	Integrated (3com)
SECURITY	
2 level passwords	Yes
Limited access to front panel	Yes / Yes
I/O PORTS	
USB Port	2
Mouse / Keyboard port	2
Parallel port	1
Serial port	2
External SCSI connector	1x UN SCSI
Ethernet port	RJ45
POWER SUPPLY	
Power supply specs	560W
Power supply numbers	2 standard + 1 option
Hot-plug power supply	Yes
VENTILATION	
Fan specifications	Redundant, Hot swap
PHYSICAL SPECIFICATIONS	
Size (H x W x D)	620mm x 445mm x 678mm
Weight	77 kg
Operation constraints	5°C to 35°C @ 20% to 80% RH
OS AND SOFTWARE	
Operating System	MS-DOS
Management software	ESMPRO Management Suite
Installation & configuration software	ExpressBuilder Set-up and Configuration software
Vendor certification	Windows NT Server 4.0, Novell NetWare 4.11 and 5.0, SMP and IntranetWare, SCO 5 OpenServer, SCO UnixWare 7.0, Sunsoft Solaris
WARRANTY	
Standard warranty	3 years on-site
Warranty extension	Optional
REGULATORY & SAFETY	
Year 2000 safety ready	Yes
Regulatory compliance	UL, CSA, CE

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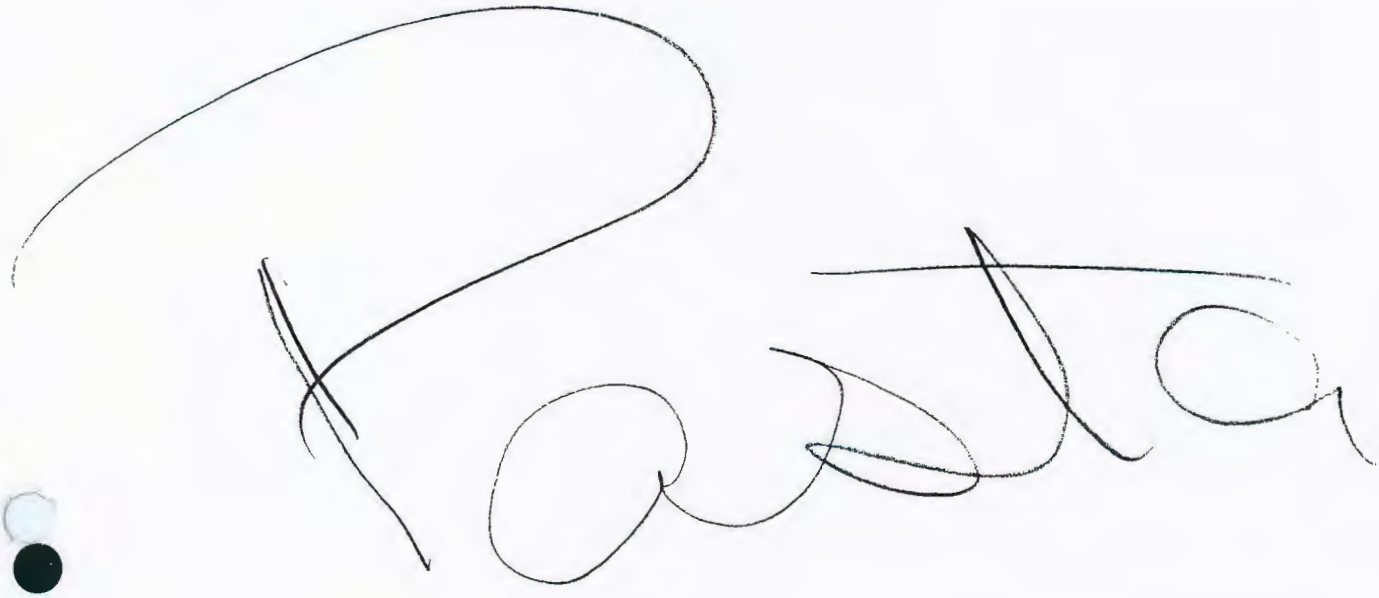
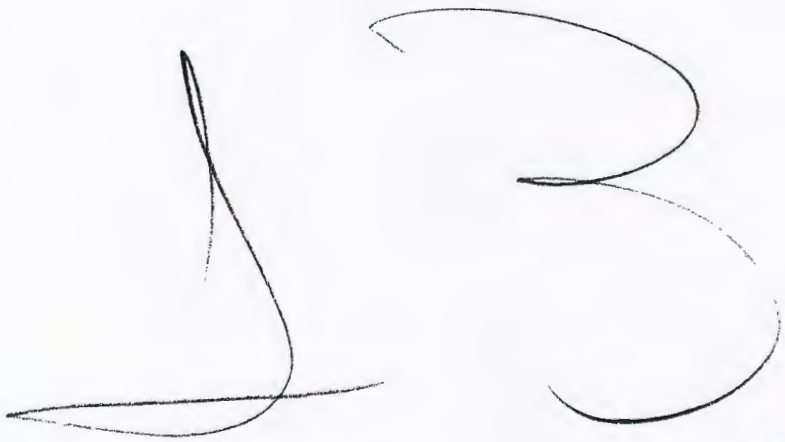
Printed April 2000.







Server HX4600

User's Guide

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Contents

Using This Guide

This User's Guide provides a quick reference to information about your system. Its goal is to familiarize you with your system and the tasks necessary for system configuring and upgrading.

This guide contains the following information:

- Chapter 1, "System Overview" provides an overview of your system and describes your system's major system components. See this chapter to familiarize yourself with your system.
- Chapter 2, "Setting Up Your System" tells you how to select a site, unpack the system, make cable connections, and power on your system.
- Chapter 3, "Configuring Your System" tells you how to configure the system and provides instructions for running the BIOS Setup Utility and the Symbios Configuration Utility. It also provides information on configuring system jumpers and switches.
- Chapter 4, "Upgrading Your System" provides you with instructions for upgrading your system with additional processors, optional memory, option cards, and peripheral devices.
- Chapter 5, "Problem Solving" contains helpful information for solving problems that might occur with your system.
- Appendix A, "System Cabling" includes cabling information for the RAID controller installed in your system.
- Appendix B, "Memory Configurations" defines the allowable memory configurations for your system.
- Appendix C, "Management Workstation Application (MWA)" provides you with information on using MWA for managing your server remotely in a network environment.
- Appendix D, "Hardware Event Log" helps you locate a hardware component in your system that the Hardware Event Log listed as causing an error in your system.
- "Glossary" defines the standard acronyms and technical terms used in this manual.
- "Equipment Log" provides you with a sample equipment log for documenting the system configuration and future updates you may make to your system.

Text Conventions

This guide uses the following text conventions.

Warnings, cautions, and notes have the following meanings:

⚠ WARNING

Warnings alert you to situations that could result in serious personal injury or loss of life.

⚠ CAUTION

Cautions indicate situations that can damage the system hardware or software.

Note: Notes give important information about the material being described.

- Names of keyboard keys are printed as they appear on the keyboard. For example, **Ctrl**, **Alt**, or **Enter**.
- Text or keystrokes that you enter appear as boldface type. For example, type **abc123** and press **ENTER**.
- File names are printed in uppercase letters. For example, AUTOEXEC.BAT.

Related Documents

In addition to this guide, the following system documentation is included with your server either as electronic files on EXPRESSBUILDER or as paper copy shipped with your server.

- *System Release Notes*
  Release Notes provide you with the latest information about your system. This information was not available at the time your user's guide was developed.
- *Getting Started Sheet*
  The Getting Started Sheet provides several easy-to-follow steps to become familiar with your server documentation and to complete your installation successfully.
- *Network Operating System Configuration Guide*
  This guide contains supplemental instructions needed to install and configure your server Windows NT v4.0, Novell NetWare v4.2, Santa Cruz Operation (SCO) OpenServer Release 5.05, and SCO UnixWare 7.01 Network Operating Systems. This document is intended to complement the more detailed procedural documents available from the vendor of the network operating system.

Safety Notices

- **Caution:** To reduce the risk of electric shock which could cause personal injury, follow all safety notices. The symbols shown are used in your documentation and on your equipment to indicate safety hazards.
- **Warning:** Lithium batteries can be dangerous. Improper handling of lithium batteries may result in an explosion. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists.
- **Warning:** The detachable power supply cords are intended to serve as the disconnect devices.
- **Warning:** This equipment has two 3-wire, grounded power cords. To prevent electrical hazards, do not remove or defeat the ground prong on the power cords. Replace any power cord that gets damaged. Contact your dealer for an exact replacement.
- **Warning:** The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, +5vdc is present on the system board whenever the AC power cord is connected between the system and an AC outlet. Before doing the procedures in this manual, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

In the U.S.A. and Canada, each power cord must be a UL-listed detachable power cord (in Canada, CSA-certified), type ST or SJT, 16 AWG, 3-conductor, provided with a molded-on NEMA type 5-15 P plug cap at one end and a molded-on cord connector body at the other end. The cord length must not exceed 9 feet (2.7 meters).

Outside the U.S.A. and Canada, the plug must be rated for 250 VAC, 10 amp minimum, and must display an international agency approval marking. The cord must be suitable for use in the end-user country. Consult your dealer or the local electrical authorities if you are unsure of the type of power cord to use in your country. The voltage change occurs via a switch in the power supply.

- **Warning:** Under no circumstances should the user attempt to disassemble the power supply. The power supply has no user-replaceable parts. Inside the power supply are hazardous voltages that can cause serious personal injury. A defective power supply must be returned to your dealer.

- **PELV (Protected Extra-Low Voltage) Integrity:** To ensure the extra-low voltage integrity of the equipment, connect only equipment with mains-protected electrically-compatible circuits to the external ports.
- **Remote Earths:** To prevent electrical shock, connect all local (individual office) computers and computer support equipment to the same electrical circuit of the building wiring. If you are unsure, check the building wiring to avoid remote earth conditions.
- **Earth Bonding:** For safe operation, only connect the equipment to a building supply that is in accordance with current wiring regulations in your country. In the U.K., those regulations are the IEE.

Care and Handling

Use the following guidelines to properly handle and care for your system.

Protect the system from extremely low or high temperatures. Let the system warm (or cool) to room temperature before using it.

Keep the system away from magnetic forces.

Keep the system dry. Do not wash the system with a wet cloth or pour fluid into it.

Protect the system from being bumped or dropped.

Check the system for condensation. If condensation exists, allow it to evaporate before powering on the system.

Keep the system away from dust, sand, and dirt.

1

System Overview

- Overview
- Chassis
- System Board Features
- Peripheral Devices
- System Power
- Software Locks via the BIOS Setup

Overview

The server is a modular, multiprocessing server based on the Intel® Pentium® II Xeon chip set. The chip set incorporates a modular scaleable architecture that integrates a 64-bit bus interface with three Peripheral Component Interconnect (PCI) buses and an Industry Standard Architecture (ISA) bus. The architecture supports Symmetrical Multiprocessing (SMP) and a variety of operating systems. The chassis and system boards are designed to meet the needs of the server marketplace.

The combination of computing performance, memory capacity, and integrated I/O provides a high performance environment for many applications including network servers and multi-user systems. The server is designed for use in applications where downtime must be minimized. To this end, the server includes or has the option to include the following.

- Power system redundancy; in a system configured with redundant power supplies, the system will continue to operate with a single power supply failure.
- Self-contained power supply units that can be easily installed or removed from the back of the chassis.
- Hot-swap Ultra2 SCSI-3 hard drive bays accessible from the front of the chassis; a failed drive can be removed, and a new drive installed without system power being turned off.
- High degree of SCSI hard disk fault tolerance and advanced disk array management features through the use of RAID (Redundant Array of Independent Disks) technology.
- Hardware monitors (temperature and voltage) and software monitors to indicate failures.
- Easy access to all parts for service.

System Feature Summary

A summary of the system features is included in Table 1-1.

Table 1-1. System Features

Feature	Description
Modular board set	System is intended for use with a modular board set based on Pentium III Xeon processor technology; from one to four 500 MHz processors and up to 8 GB of memory.
Add-in board support	System I/O board supports up to 11 add-in boards (ten PCI boards, including four slots supporting 64-bit PCI boards, and one combination PCI/ISA board slot).
3 1/2-inch diskette drive	3 1/2-inch diskette drive is externally accessible.
One location for a 3 1/2-inch removable media device	One externally accessible 3 1/2-inch half-height bay is available for server expansion.
5 1/4-inch SCSI CD-ROM	5 1/4-inch CD-ROM drive is externally accessible.
Three locations for 5 1/4-inch removable media devices	Three externally accessible 5 1/4-inch half-height bays are available for server expansion (diskette, CD-ROM, and/or tape drives).
12 locations for 3 1/2-inch Ultra2 Wide SCSI-2 hard drives	Three hard disk drive cages; each holding up to four 3 1/2-inch hot-swappable Ultra2 wide SCSI-3 hard drives. Each cage is secured behind a metal EMI door; drives can be swapped in or out of the system without powering it down. The array of drives allows easy setup of RAID applications.
Hot swap-capable backplane	A hot swap-capable backplane is part of each drive cage assembly for SCSI hard drives. The backplane is designed for Ultra2 wide SCSI-3 devices that use the industry standard 80-pin Single Connector Attach (SCA) connector. The backplane consists of a row of four drive connectors.
Power supply	From two to three 560 Watt autoranging power supplies are easily removed/installed for service. In a three-supply system, the third supply is redundant.
Software: utilities, setup	BIOS Setup and Symbios Configuration Utility. The EXPRESSBUILDER CD-ROM contains utilities and drivers. The ESMPRO CD-ROM contains the server management software.
Security	Mechanical: Key lock at the front door. One intrusion sensor for front door to secure diskette, hard disk, removable media device, power on/off switch, reset switch, top cover, and left/right panel access. Three power inter-lock sensors one on each side of the chassis and one on top of the chassis. BIOS: Password enable.

Expanding the Server as Needs Grow

A typical minimum system configuration may include the following:

- Board set consisting of system I/O board, CPU baseboard with one 500 MHz Pentium® III Xeon processor, and one memory board containing 128MB of memory.
- Diskette drive and SCSI CD-ROM drive
- Three SCSI hard drive cages with one hard drive and a RAID controller installed
- Integrated Network Interface Controller (NIC)
- Two 560 watt power supplies (an optional third power supply provides redundant power)
- Onboard 2 MB video memory
- System I/O board has one combination PCA/ISA slot and ten PCI slots for add-in boards. The system I/O board also has a riser board for external I/O (serial, parallel, video) interfaces.
- Chassis can hold six removable media drives: four 5 1/4-inch half-height bays with a CD-ROM drive installed in one bay; and two 3 1/2-inch half-height bays with a diskette drive installed.

As server/client needs grow, you can expand system processor capacity, memory, drives, option boards, and the number of power supplies.

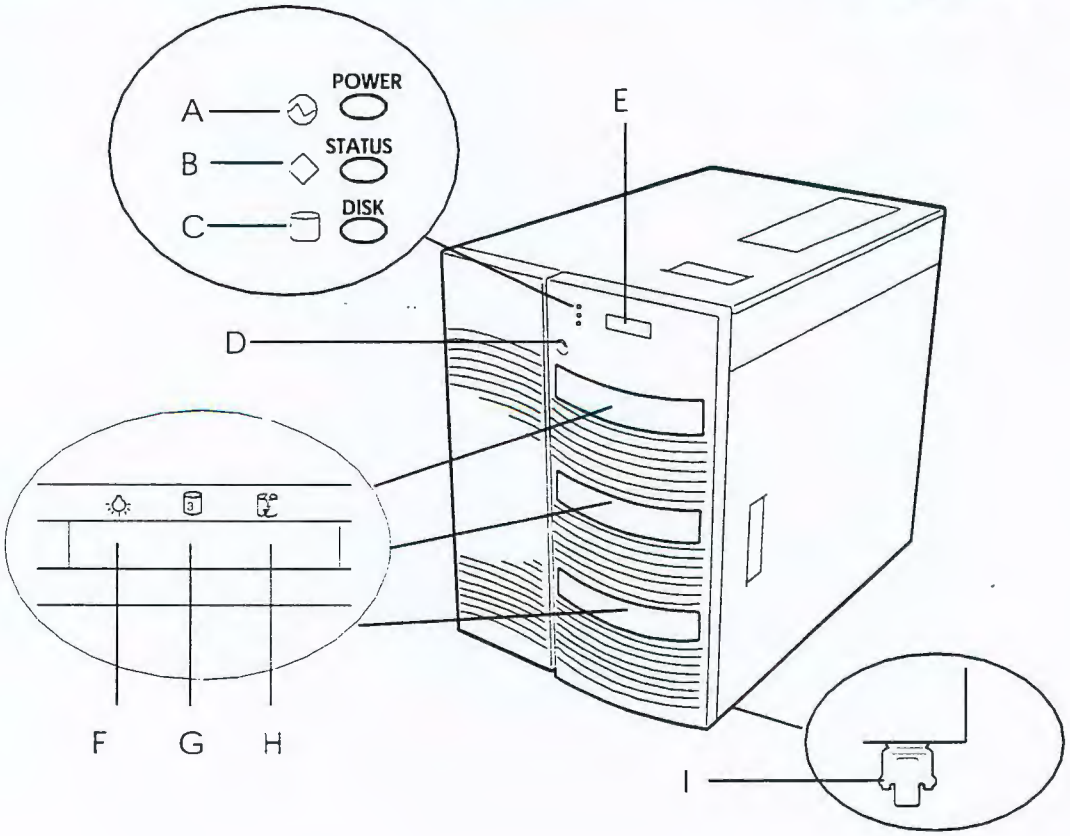
- CPU baseboard has four slots for CPUs, for a configurable range of one, two, three, or four processors.
- Two memory board support 32 DIMM devices for up to a maximum memory size of 8 GB of memory.
- System I/O board has eleven option board slots (ten PCI and one combination PCI or ISA slot).
- Chassis can hold six removable media drives.
- Three SCSI hard drive cages support up to 12 hot-swap bays for 3 1/2-inch Ultra2 wide SCSI-3 hard drives.

Configuration Constraints

The system has four 5 1/4-inch half-height bays accessible from the front. These bays are convenient for diskette, tape, and CD-ROM drives (removable media). Because of the EMI generated by hard drives, the increased susceptibility to ESD, and cooling requirements, hard drives should not be installed in the 5 1/4-inch half-height bays.

Chassis

Figure 1-1 shows the server front chassis features and controls.



A	Power LED	When green, power is present in system. When off, power is turned off or power source is disrupted. See Table 1-2 for a list and description of the system LEDs.
B	Status LED	When green the system is OK. See Table 1-2 for a list and description of the system LEDs.
C	Disk LED	When green, internal disk drives are being accessed. See Table 1-2 for a list and description of the system LEDs.
D	Key lock	Secures both front external doors.
E	LCD panel	Displays information about BIOS and system failures (error and diagnostic information).
F **G** **H**	Drive present/power on Drive active Drive faulty.	Each drive has three LEDs visible above the bay from the front. See Table 1-3 for a list of SCSI disk drive status LED indicators.
I	Casters (4)	Used when moving the server. Fixed by the caster holders.

Figure 1-1. Front Chassis Features and Controls

Status LED Indicator Descriptions

Table 1-2 lists the system status LED indicators along with a description of each LED indicator. Table 1-3 lists the disk drive status LED panel indicators along with a description of each LED indicator. Table 1-4 lists system status abnormal conditions.

Table 1-2. System Status LED Indicators

LED	Status	Description	Response
Power	Off	Power OFF	None required (normal)
	Green	Power ON	None required (normal)
	Amber	Sleep Mode	Power saving mode (This feature must be supported by your operating system).
Status	Off	Power OFF	None required (normal)
	Green	No alarms	None required (normal)
	Amber	Abnormal condition (see Table 1-4)	Check condition
Disk	Off	Not accessing disk drives	None required (normal)
	Amber	Internal disk drive failure	Check disk drive status LEDs
	Green	Accessing disk drives	None required (normal)

Table 1-3. Disk Drive Status LED Panel Indicators

LED	Status	Description	Response
Disk Drive Present	Off	Disk drive not present	None required (normal)
	Green	Disk drive present	None required (normal)
Disk Drive Activity	Off	Not accessing disk drive	None required (normal)
	On	Accessing disk drive	None required (normal)
Disk Drive Status	Off	No alarms	None required (normal)
	Amber	Disk drive failure	Replace disk drive.

Table 1-4. System Status Abnormal Conditions

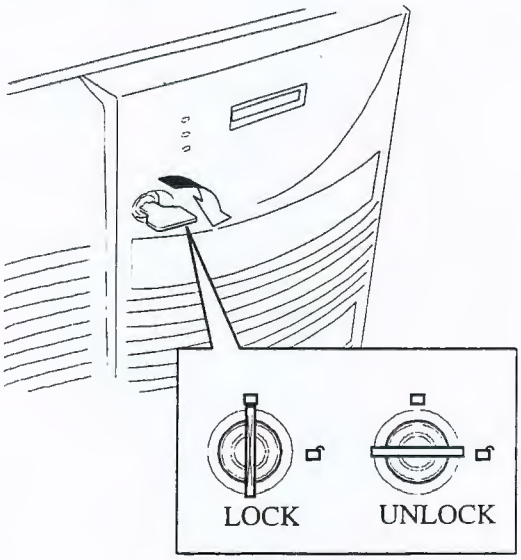
LED (Amber)	Conditions
System Status	Chassis intrusion (front cover) Unit fan alarm Memory multi-bit error (SERR) Temperature Voltage CPU thermal trip CPU, memory or option board error or failure Power supply failure

Opening the Front Doors

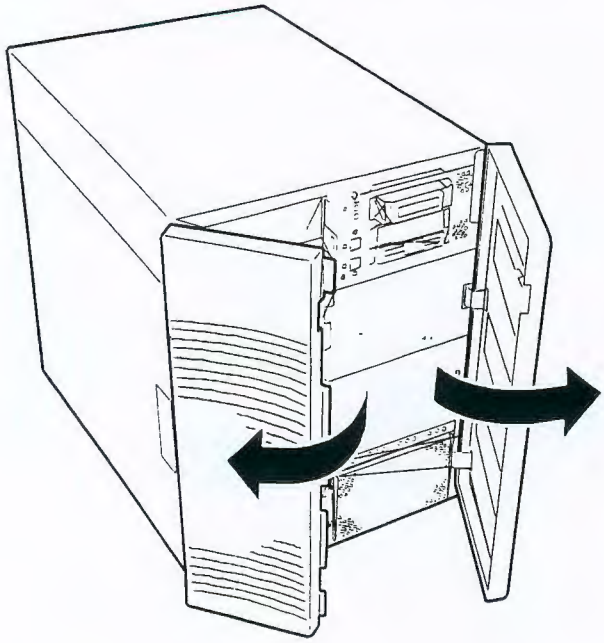
You must open the right front door to turn the server power on or off, mount or dismount a floppy disk, or mount or dismount a hard disk drive. Open the left front door to mount or dismount 5 1/4-inch removable media devices.

Open the front doors as follows.

1. To open the front doors, you need to use the security key provided with the server. Insert the security key into the key slot and turn the key to the right (see the following figure).

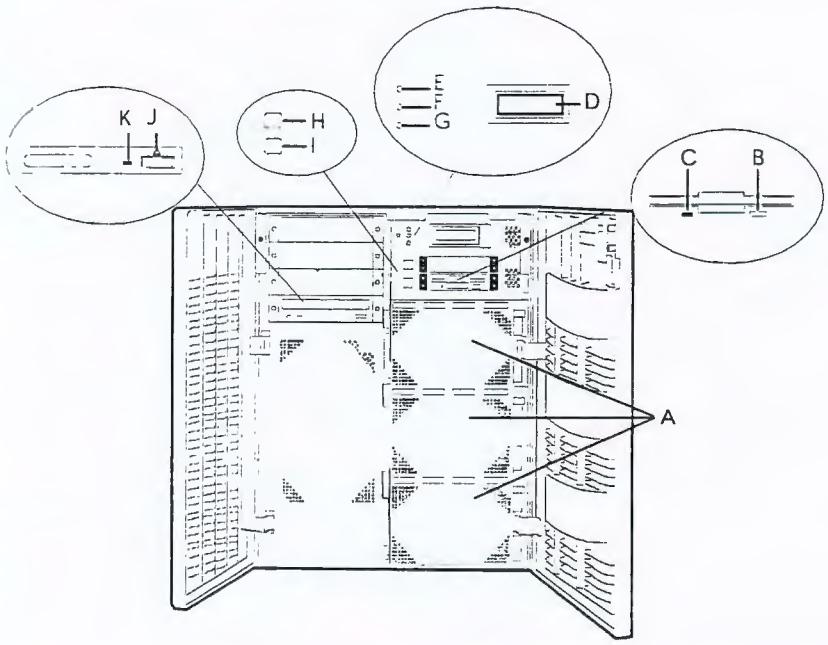


2. First open the right front door, then open the left door (see the following figure).



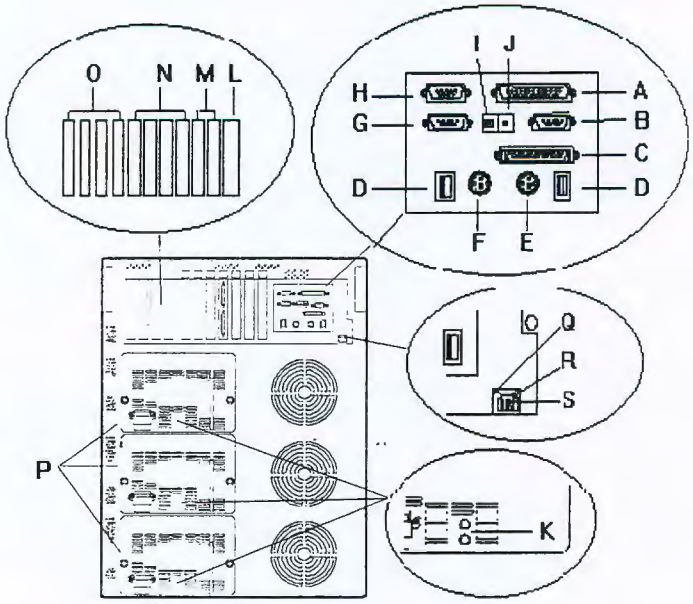
Chassis Features and Controls

Figure 1-2 shows the server front chassis features and controls. Figure 1-3 shows the server rear chassis features and controls.



A	SCSI hard drive cages (3)	Each cage contains four disk drives. Above each drive are three status LEDs. Refer to Table 1-3 for information on disk drive status LEDs.
B	Ejector button, 3 1/2-inch diskette drive	Press to eject diskette.
C	Activity light, 3 1/2-inch diskette drive	When lit, drive is in use.
D	LCD panel	Displays information about BIOS and system failures (error and diagnostic information).
E	Power LED	When green, power is present in system. When off, power is turned off or power source is disrupted. See Table 1-2 for a list and description of the system LED indicators.
F	Status LED	When green the system is OK. See Table 1-2 for a list and description of the system LED indicators.
G	Disk LED	When green, internal disk drives are being accessed. See Table 1-2 for a list and description of the system LED indicators.
H	DC power switch	Press to turn system DC power on or off.
I	Sleep switch	Press to enter power saving (sleep) mode. Press again to enter normal mode of operation. This feature must be supported by your operating system.
J	Load/eject button, CD-ROM drive	Press to load CD and eject CD.
K	Activity light, CD-ROM drive	When lit, drive is in use.

Figure 1-2. Front Chassis Features and Controls (front doors opened)

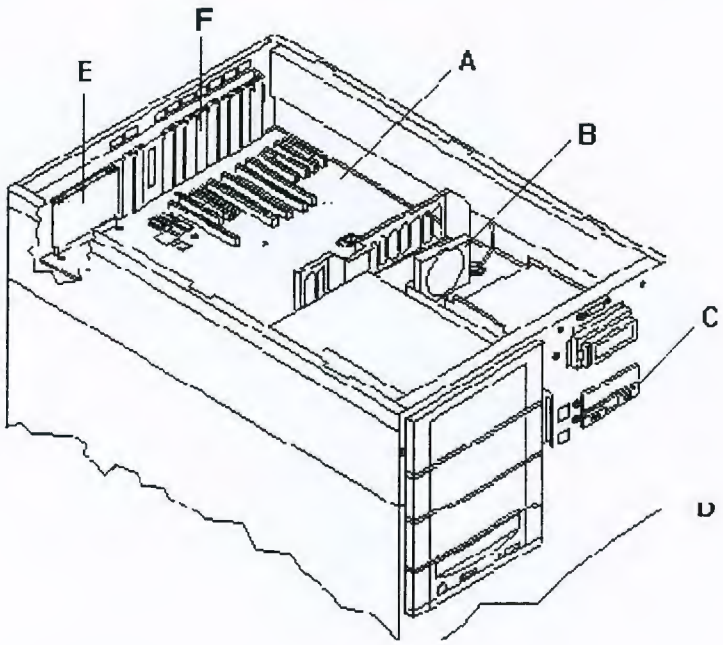


A	Printer	LPT1 25-pin parallel port connector.
B	Monitor	VGA monitor 15-pin connector.
C	External-SCSI	Narrow-SCSI 50-pin connector
D	USB	USB interface connector. Appropriate driver required.
E	Keyboard	PS/2-compatible 6-pin mini-DIN connector.
F	Mouse	PS/2-compatible 6-pin mini-DIN connector.
G	COM2	COM2 serial port 9-pin connector.
H	COM1	COM1 serial port 9-pin connector.
I	Function select switches	See *Configuring Switch and Jumper Settings* in Chapter 3 of this User's Guide.
J	Reset Button	Press to reset system.
K	Power status LEDs	Both indicators are green during normal operation. Either or both indicators go off when power supply fails.
L	ISA/PCI slots	One ISA/PCI (PCI#11) combination add-in board slot.
M	PCI Slots	Two PCI add-in board slot locations (PCI #12 and PCI #13).
N	PCI Slots	Four 64-bit add-in board slot locations (PCI # 31, PCI #32, PCI#33. and PCI#34).
O	PCI slots	Four PCI add-in board slot locations (PCI #21, PCI #22, PCI #23, and PCI #24).
P	Power supplies (three shown)	Possible configurations, installed from bottom most bay: 2 supplies (nonredundant), 3 supplies (one redundant). Each power supply has a separate AC input power connector.
Q	Status LED	Lit when system is connected to a 10Base-T LAN Network; not lit when system is connected to a 100Base-TX LAN Network
R	Active LED	Lit when information packets are exchanged between the system and the network.
S	LAN	10Base-T/100Base-TX network LAN connector.

Figure 1-3. Rear Chassis Features and Controls

System Board Features

The board set includes the system I/O board, CPU baseboard, and one or two memory board. The system I/O board is mounted at the top of the system. Figure 1-4 shows the system with the top cover removed.



A System I/O Board

B Option board Fan

C Diskette drive

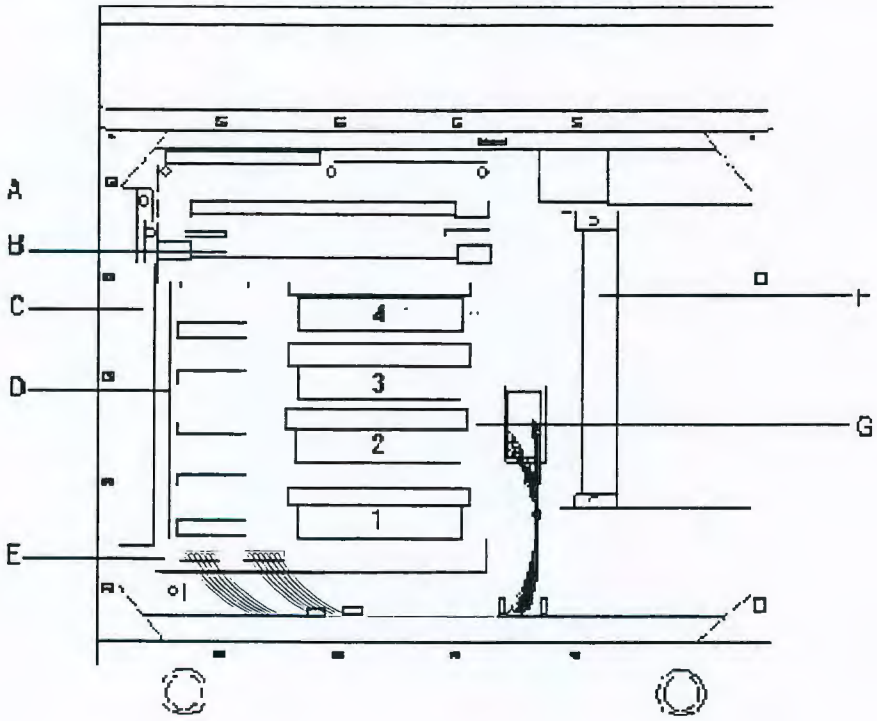
D Four 5 1/4-inch half-height bays with a CD-ROM drive installed in bottom bay

E I/O riser board

F Expansion slot covers

Figure 1-4. System I/O Board Location

The CPU base board plugs into the underside of the system I/O board and the memory board plugs into the CPU base board. Figure 1-5 shows the system with the left side cover removed.



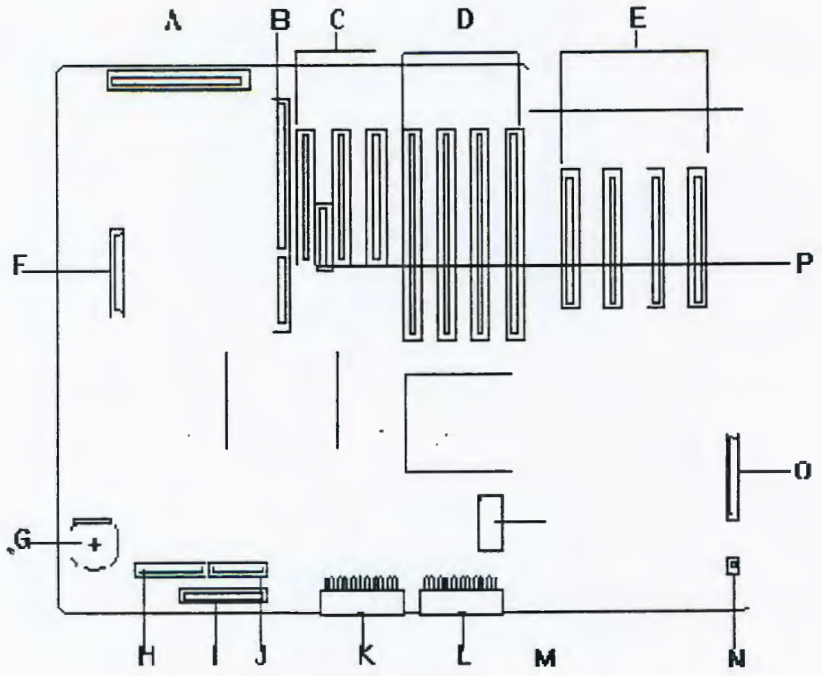
A	Memory Board #2 or Memory Terminator Board
B	Memory Board #1
C	Rear Fans (3) Top fan cools memory; bottom two fans cool CPUs
D	Voltage Regulator Module sockets (VRM1 - VRM6)
E	CPU Baseboard
F	Front Fans (3) Top fan cools memory; bottom two fans cool CPUs
G	Pentium III Xeon processors (1 - 4)

Figure 1-5. CPU Base Board and CPU Board Location

Figures 1-6, 1-7, and 1-8 show the major components on the system I/O board, CPU baseboard, and memory board. Table 1-5 summarizes the features of the board set.

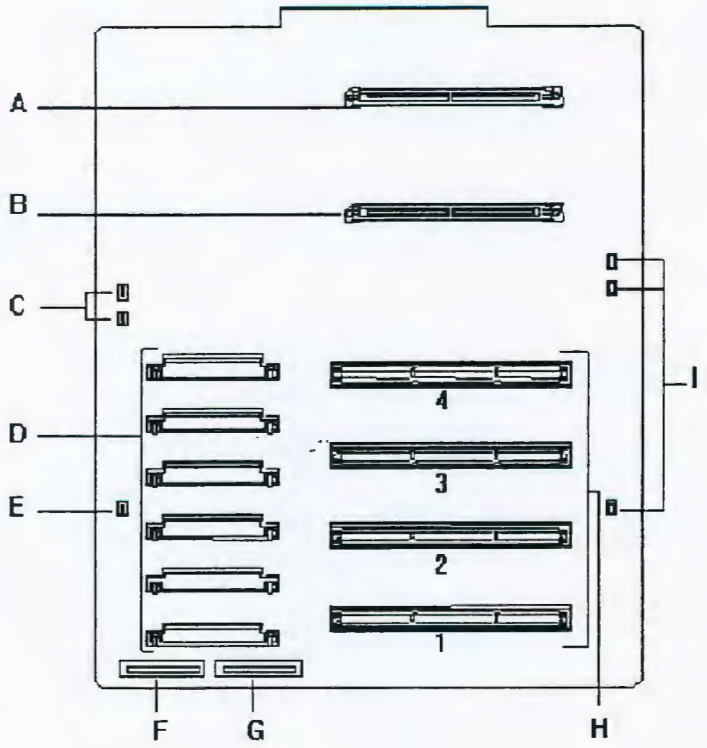
Table 1-5. Features of the Board Set

Feature	Description
Multiple processor slots	Four processor sockets on the CPU baseboard.
Upgradable memory	Sixteen DIMM sockets on each of two memory board, supporting up to 8 GB memory using 256 MB DIMMs.
Add-in board support	One combination ISA/PCI bus slot, four dedicated 64-bit PCI bus slots and six 32-bit PCI bus slots on the system I/O board.
SCSI controller	Dual onboard SCSI-2 controller (PCI-based).
BIOS	Flash memory-based BIOS (Basic Input Output System) and Setup utilities.
Video	Integrated super VGA controller ships with either 2 MB of video memory.
External device connectors	Onboard connectors for two serial ports. parallel port, narrow SCSI port, PS/2-compatible keyboard, mouse, VGA monitor and 10/100Base-TX Network LANs.
Clock	Real-time clock/calendar (RTC).
System hardware monitoring	Detects chassis intrusion and contains sensors for temperature, voltage, fan failure and Power supply failure.
Configuration utilities	BIOS Select and Symbios Configuration Utility.



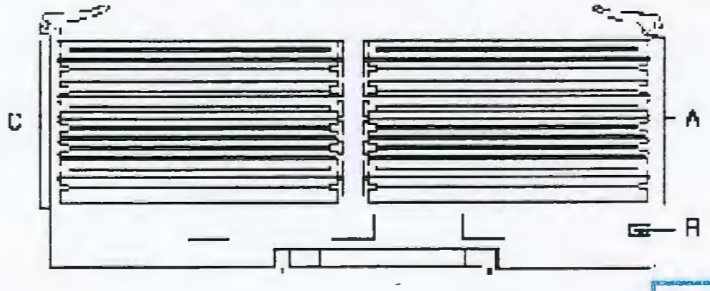
A	Riser Card Connector
B	ISA Board Slot
C	First PCI Board Slots (32-bit) (PCI #11, PCI #12 and PCI#13 from the left).
D	Third PCI Slots (64-bit) (PCI #31, PCI #32, PCI #33 and PCI #34 from the left).
E	Second PCI Board Slots (32-bit) (PCI #21, PCI #22, PCI #23 and PCI#24 from the left).
F	Ultra2 SCSI-3 SCSI Ch1 Connector for 5 ¼" Removable Media Devices
G	Battery (lithium)
H	Power PB Connector
I	Floppy Disk Drive Connector
J	Front Panel Connector
K	Power Connector 1
L	Power Connector 2
M	Non-volatile Memory (NVRAM)
N	Fan Connector
O	Ultra2 SCSI-3 SCSI Ch2 Connector (not used)
P	Server Management Board Connector

Figure 1-6. System I/O Board Connector and Component Locations



A	Memory board connector (Optional)
B	Memory board connector (Standard)
C	Rear Fan Connector (2)
D	Voltage module socket (VRM1 - VRM6)
E	Rear Fan Connector (1)
F	Power Connector 1
G	Power Connector 2
H	Pentium III Xeon Processors sockets (1 - 4)
I	Front Fan Connectors (3)

Figure 1-7. CPU Base Board Component Locations



A	DIMM sockets
B	Configuration jumper
C	DIMM sockets

Figure 1-8. Memory Board Component Locations

Processor

Each Pentium III Xeon processor is packaged in a single edge contact (S.E.C.) cartridge. The cartridge includes the processor core with an integrated 16 KB primary (L1) cache; the secondary (L2) cache (512K, 1MB or 2MB); a thermal plate; and a back cover. The cartridge is secured by a retention module attached to the baseboard. Depending on configuration, your system has one to four processors (see Figure 1-7). Additional Pentium processors enhance performance and enable symmetric multiprocessing (SMP). All processors access the same memory and I/O space and tasks can run on either CPU if your operating system (OS) supports SMP.

Memory

The system supports a maximum of two memory boards. Each memory board contains sixteen 168-pin DIMM sockets (see Figure 1-8, A and C). A minimum system configuration includes 128 MB (using four 32 MB DIMMs) of system memory. Sixteen DIMM sockets on each memory board allow for system memory expansion up to 8 GB (using sixteen 256 MB DIMMs on each memory board). ECC generation/checking is provided for detection and correction of memory errors.

> ***Note:*** Only use DIMMs approved for use in this server system. Call your customer service representative for information.

Bus Master I/O Expansion Slots

The server's expansion capabilities meet the needs of high performance I/O servers by providing a combination of PCI local bus and ISA connectors. The system I/O board offers ten dedicated PCI slots, four of which are 64-bit, and one combination slot that may be configured as a PCI slot or an ISA slot. The ISA architecture supports 32-bit memory addressing and 16-bit data transfers for the CPU, DMA, and bus masters.

Real-Time Clock/Calendar

The real-time clock provides system clock/calendar information stored in a non-volatile memory (NVRAM) (Figure 1-6, M). The real-time clock battery (see Figure 1-6, G) provides power backup for the real-time clock.

BIOS

A BIOS and Setup Utility are located in the Flash memory on the system I/O board and include support for system setup and PCI/ISA Plug-and-Play auto-configuration. A number of security, reliability, and management features are also incorporated to meet vital server needs.

Video

The onboard super VGA controller (PCI) is a high-performance SVGA subsystem that supports:

- BIOS compatibility with VGA, EGA, CGA, Hercules Graphics, and MDA
- 2 MB of Video Memory
- 16-bit bus for high-speed display memory access
- Hardware accelerated bit block transfers (BITBLT)
- 72Hz refresh, non-interlaced at: 640x480, 800x600, or 1280x1024 resolutions
- Up to 16M colors at 640x480 and 800x600 resolutions, 64K colors at 1024x768 resolutions and 256 colors at 1280x1024 resolutions with the optional 2 MB video memory.

> ***Note:*** SVGA drivers may be required to use the high-performance video modes.

SCSI Controller

The system I/O board includes a dual Symbios Ultra2 wide SCSI-3 controller integrated as a PCI bus master. This controller supports data paths of 8-bit (fast/narrow SCSI) at a data transfer rate of 10 MB/sec and 16-bit (fast/wide or ultra /wide SCSI) at a data transfer rate of 20 MB/sec or 40 MB/sec. As a PCI bus master, this controller supports burst data transfer rates up to the maximum of 133 MB/sec.

On this server, Channel 1 is cabled to SCSI devices in the removable media drive bays. Channel 2 is available for optional external SCSI devices.

Peripheral Controller

The advanced integrated peripheral controller supports two serial ports and one parallel port through the I/O riser board (see Figure 1-6, A). The advanced integrated peripheral controller also supports the connection of two diskette drives (see Figure 1-6, I).

External Device Connectors

The I/O panel provides connectors for a PS/2 compatible mouse and a keyboard, connectors for VGA monitor, two serial port connectors, a parallel port connector and two USB interface connectors. It also provides a narrow SCSI external connector.

Keyboard and Mouse

The keyboard/mouse controller is PS/2-compatible.

Fans

In addition to the power supply fans, the system has an option board fan cabled to the I/O board and six fans cabled to the CPU baseboard. The six fans (front and rear) are redundant in configuration. If one fan fails, its associated fan changes its rotating speed to high.

Peripheral Devices

The following paragraphs describe the Ultra2 wide SCSI-3 hard drive bays and 5 1/4-inch removable media drive bays.

Ultra2 Wide SCSI-2 Hard Drive Bays

The right side of the system contains three Ultra2 SCSI-3 hard drive cages for

3 1/2-inch SCSI-3 hard drives (see Figure 1-9). Each hard drive cage has a hot-swap backplane that supports four drives. The backplanes require an 80-pin single connector attachment (SCA) connector on the drives you install.

A drive carrier is required as part of the hot swap implementation. A 3 1/2-inch peripheral between 1.0 and 1.6 inches high can be accommodated in each carrier. A drive is mounted in the carrier with four fasteners, and the carrier is retained in the chassis by a locking handle.

A fault light on the front panel board gives a general indication that there has been a fault on a hot-swap drive. Each drive has a set of three lights to indicate the fault or other status: power-on (green LED), activity (green LED), or fault (yellow LED).

Three hard drive cages

(EMI panel and exterior door shown open)

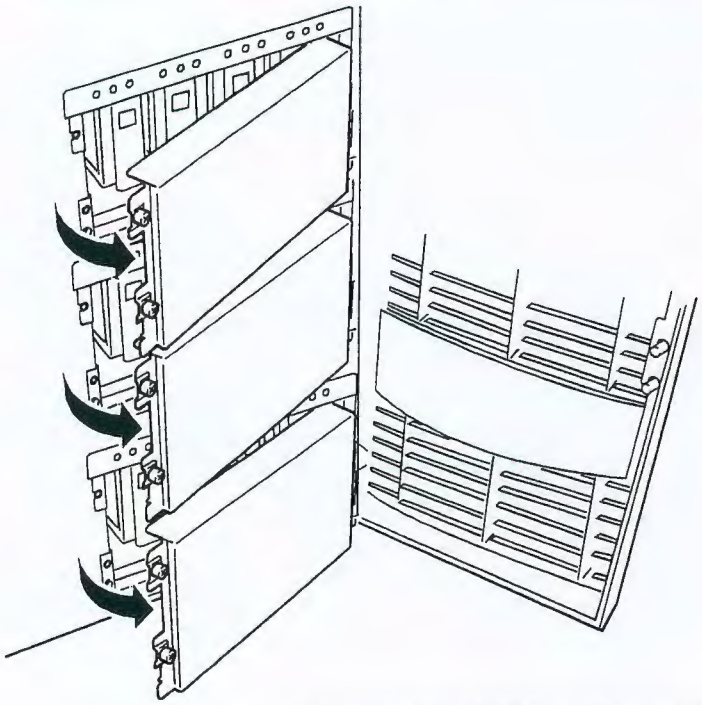


Figure 1-9. Ultra2 Wide SCSI-2 Hard Drive Bays

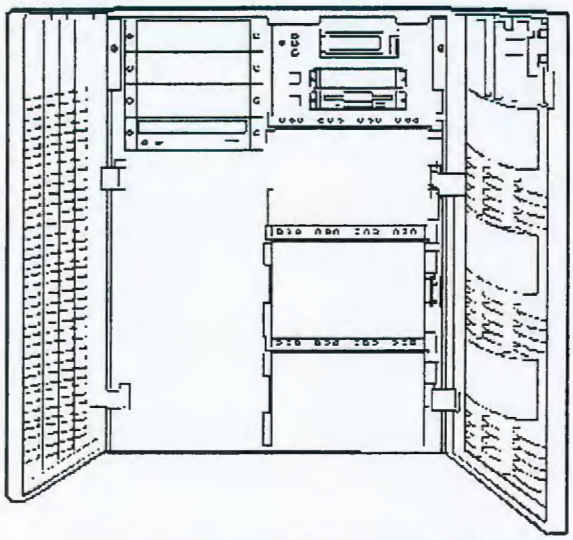
The backplane has two main functions: SCSI drive control and system data logging. Drive status is monitored to detect failing drives and to control LED indicators. The backplane features include the following:

- insertion and removal of hard drives while power is on (referred to as "hot swap")
- simplified cable management
- SCA connectors to simplify inserting and removing hard drives
- SCSI management of fault LEDs.

Each backplane supports SCSI drives with SCA connectors.

Removable Media Drive Bays

On the upper left side of the system, four 5 1/4-inch half-height bays (see Figure 1-10) are designed for peripherals with removable media (diskette, CD-ROM, tape). Two available adjacent 5 1/4-inch bays can be converted to a single full-height bay. The 5 1/4-inch drives can be removed directly from the front of the chassis. Removal of the system top cover may be required to install/remove the device cables. Cosmetic filler panels are installed over all unused 5 1/4-inch bays.



Factory-installed CD-ROM reader plus three bays for removable media drives.

Factory-installed 3 1/2-inch diskette drive plus second bay for removable 3 1/2-inch drive.

(Exterior doors shown open)

Figure 1-10. Removable Media Drive Bays

On the upper right side of the system, below the LCD panel, are two built-in 3 1/2-inch bays. One contains a 3 1/2-inch diskette drive that supports both 720 KB and 1.44 MB media (see Figure 1-10).

> ***Note:*** The SCSI termination resistors must be installed in the last SCSI drive of the daisy chain cabling (bottom media bay). All other devices must have terminators removed.

System Power

The system may be configured with up to three 560 Watt power supplies. Each supply automatically switches between these input voltage ranges:

- 100-125 VAC at 50/60 Hz; 10.5 A maximum current
- 200-240 VAC at 50/60 Hz; 5.5 A maximum current

Each power supply provides DC outputs of +5 V, +12 V, +3.3 V, -5 V, and -12 V. All output grounds connect to the power supply chassis and to earth ground through the AC line cord. Each supply has:

- Individual AC input line cord that plugs into the external side of the power supply
- Isolating device on each DC output so that the failure of one supply does not affect the operation of the others
- Cooling fan integral with each power supply enclosure. The fan circuit implements fan failure detection.

In a system, power is drawn equally from all supplies installed. A system with two power supplies can be fully loaded (all drive bays and add-in board slots filled). The supplies use a forced current-sharing technique that ensures the supplies share within 10 percent at full load. In a high-access system with three power supplies, the third supply gives redundancy, because the load is redistributed if one supply fails.

Software Locks via the BIOS Setup

The BIOS Setup has software features that let you control access to one or more parts of the system:

- Set and enable an administrative password
- Set and enable a user password
- Enable password on boot
- Disable writing to the diskette drive when secure mode is set.

If only a supervisor password is set and enabled, enter this password to boot the server.

If both the user and administrative passwords are set and enabled, enter either one to boot the server. Enter the administrative password to access the BIOS Setup to change the system configuration.

2

Setting Up Your System

- Selecting a Site
- Unpacking the System
- Moving the System to the Site
- Getting Familiar With the System
- Making Connections
- Connecting the Power Cords
- Powering On Your System

Selecting a Site

The system operates reliably in a typical office environment. Choose a site that meets the following requirements.

- Site the system near grounded, three-pronged power outlets.

Note: For the United States and Canada, this means NEMA 5-15R outlets for 100-120 VAC or NEMA 6-15R outlets for 200-240 VAC. For other international sites, this means three-pronged power outlets applicable for the electrical code of the region.

⚠ CAUTION

Be sure the power service connection is through a properly grounded outlet.

Each power cord can be plugged into a separate phase of a main AC supply, assuming the circuit is rated for that load.

Note: For Denmark, the system must be connected to an AC power source rated at 16 amps.

- Select a site that is clean, dust-free, and well ventilated. Keep front and rear ventilating openings free of obstructions. Locate the system away from sources of heat, vibration, or physical shock
- Isolate the system from strong electromagnetic fields and electrical noise produced by electrical devices (such as air conditioners, large fans, large electric motors, radio and TV transmitters, and high-frequency security devices)
- The site should be spacious enough to provide at least five inches (13 centimeters) behind the system and three inches (eight centimeters) on each side of the system for proper cooling, airflow, and cable clearance.
- Allow at least 11 inches (27 centimeters) in front of the system for proper front door clearance.
- Position the system for easy access for system maintenance and installation of system upgrades.

Unpacking the System

CAUTION

Your system weighs between 132 pounds (60kg) and 220 pounds (100 kg) with optional equipment. To avoid personal injury, make sure you have someone help you lift or move the system.

When you receive your system, inspect the shipping containers prior to unpacking. If the shipping boxes are damaged, note the damage, and if possible, photograph it for reference. After removing the contents of the containers, keep the cartons and the packing materials. If the contents appear damaged when you unpack the boxes, file a damage claim with the carrier immediately. To unpack your system, see the unpacking instructions on the shipping carton.

Moving the System to the Site

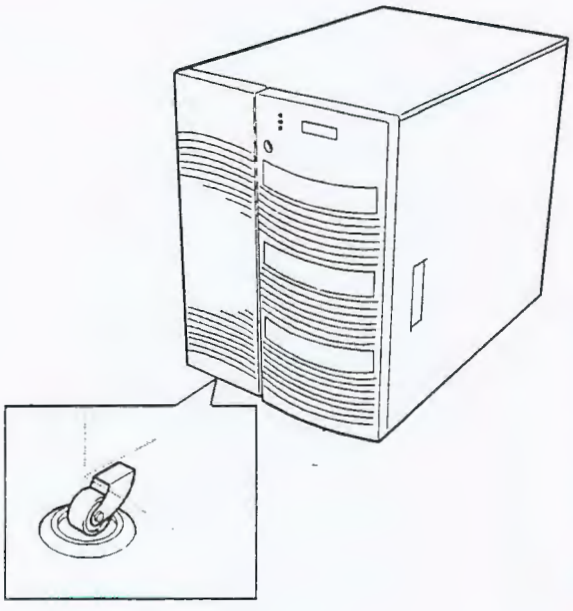
Once you have selected the system installation site, move it as follows.

1. Casters are provided on the bottom of the server. Slowly push the server to the selected installation location.

CAUTION

For safety reasons, be sure to attach the caster holders on the casters when the system is at the selected site.

2. To stabilize the system, attach the caster holders on the casters as shown below.



Getting Familiar With the System

Before setting up your system, see Chapter 1, "System Overview," to become familiar with system features, such as the location of your system's security keylocks and front and rear panel switches, indicators and connectors, etc.

Making Connections

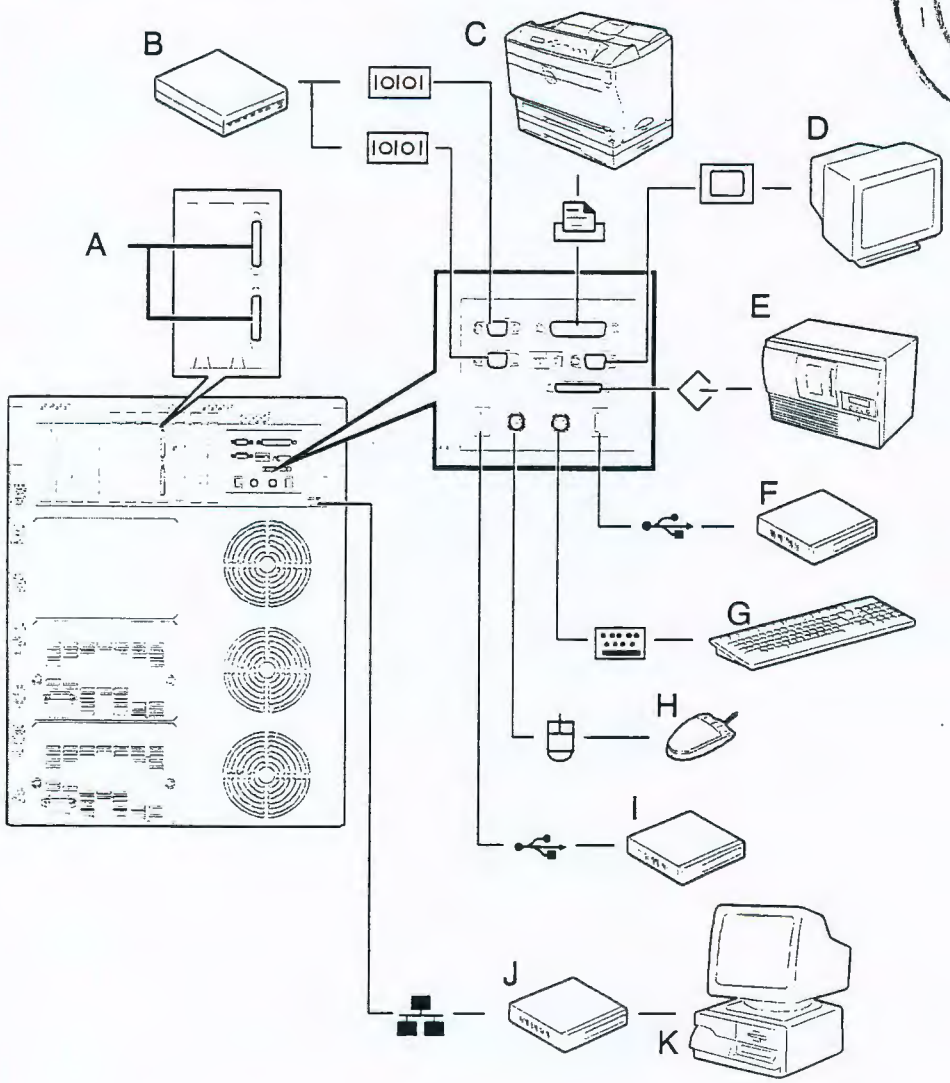
Connect your keyboard, monitor, and mouse (see Figure 2-1). Connect any external peripheral devices such as a printer or modem by following the instructions included with these devices. To connect external SCSI cables, refer to *Cabling* in Appendix A.

⚠ CAUTION

Damage to the system may result if the keyboard cable is inserted or removed when power is applied to the system.

⚠ CAUTION

Inserting a telephone line connector into a LAN board RJ-45 port may result in personal injury and equipment damage.



A. Connections to optional disk cabinet

B. Device with the serial interface such as modem

C. Printer with the parallel interface

D. Monitor display unit

E. External SCSI device

F. Device with the USB interface such as terminal adapter. Requires NOS supporting USB interface.

G. Keyboard

H. Mouse

I. Device with the USB interface* such as terminal adapter

J. Hub (multi-port repeater)

K. Network system on LAN (to be connected via a hub)

Figure 2-1. Making Connections

Connecting the Power Cords

Plug the female end of each AC power cord into the input receptacles on the rear of the power supplies (see Figure 2-2). Plug the male end of each power cord into NEMA 5-15R outlet for 100-120 VAC or NEMA 6-15R outlet for 200-240 VAC. If the power cords supplied with the system are not compatible with the AC wall outlet in your region, obtain a suitable power cord that meets the following criteria.

- The power cord must be rated for the available AC voltage and have a current rating that is at least 125% of the current rating of the system.
- The power cord connector that plugs into the wall outlet must be terminated in a grounding-type male plug designed for use in your region. It must have certification marks showing certification by an agency acceptable in your region.
- The power cord connector that plugs into the system must be an IEC-type CEE-22 female connector.
- The power cord must be less than 1.8 meters (6.0 feet) long.

⚠ WARNING

Your system shipped with two AC power cords. Do not attempt to modify or use the supplied AC power cords if it not the exact type required.

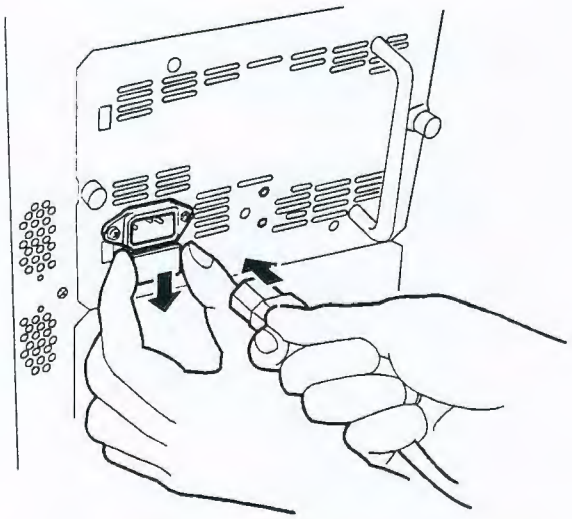


Figure 2-2. Connecting the AC Power Cord

Powering On Your System

Power on your system as follows.

1. Make sure all external devices, such as a video display, keyboard, and mouse (optional) have been connected, and the power cords are connected.
2. Power on the video display and any other external devices.
3. Open the right front door and press the power on/off switch on the front panel (see Figure 2-3).
4. Verify that the Power LED is lit. If it is not lit, ensure the AC power cords are connected to functional AC power sources.

After a few seconds your system begins the internal Power-On Self Tests (POST). POST automatically checks the system, CPU module, memory, keyboard, and most installed peripheral devices. If you have problems powering on your system, refer to *Problem Solving* in Chapter 6.

After you have successfully powered on your system, verify that the system boots to a DOS prompt. You can now run the EXPRESSBUILDER CD-ROM.

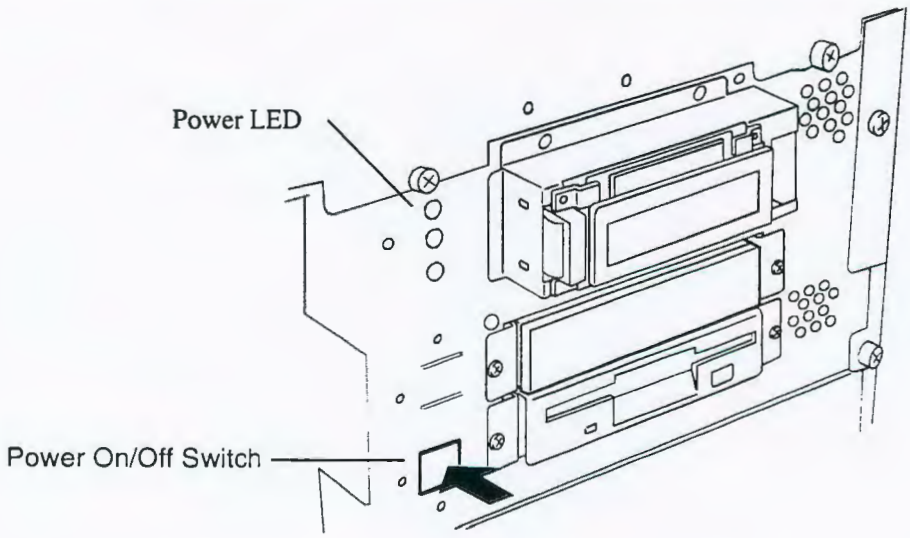


Figure 2-3. Powering On Your System

3

Configuring Your System

- Configuring Your System
- BIOS Setup Utility
- Symbios Configuration Utility
- Configuring the RAID Controller
- Configuring System Jumpers and Switches

Configuring Your System

Configuration and setup utilities are used to change your system configuration. You can configure your system, as well as any option boards you may add to your system, using the BIOS Setup (stored in the system FLASH memory). A diskette is not needed to run BIOS Setup.

The SCSISelect Utility, also stored in the system FLASH memory, is used if you need to configure the SCSI controller in your system or to perform a SCSI disk format or verify disk operation of these drives. A diskette is not needed to run SCSISelect.

A Utilities diskette contains the Event Log Utility. The Event Log Utility is used to read stored system event information.

If your system has been factory configured, the BIOS Setup or SCSISelect utilities do not need to be run unless you want to change the password or security features, add option boards or devices, or upgrade the boards in your system.

There are some system configuration parameters that are set by jumpers. However, these parameters do not usually require change. The following sections provide procedures for running the BIOS Setup, and the Utilities diskette. Also, a section describing the system jumper configurations is presented. Several configuration tables are also provided to record changes you make to the default system configuration.

You use the EXPRESSBUILDER CD-ROM to create the Utilities diskettes.

BIOS Setup Utility

The BIOS Setup Utility, is used to change system configuration parameters. The utility is resident in the system FLASH memory and does not require a diskette or an operating system present to run.

When to Use the BIOS Setup Utility

In most cases, it is not necessary to run the BIOS Setup Utility to change the default parameters. since the default settings support most system configurations. In the following cases, however, you should initiate this utility to change the default settings.

When the set parameters are incorrect: The parameters set with the BIOS Setup Utility are stored to the nonvolatile memory called CMOS. If the contents of this CMOS have been destroyed due some reason, an error message appears on the display during the execution of POST (Power On Self-Test). When an error message appears, press the F2 key to enter the BIOS Setup Utility.

When the CMOS is cleared: A jumper, with which you can clear the contents of the CMOS, is provided on the system I/O board. If this jumper is used to clear the contents of the CMOS, a message appears requesting you to run the BIOS Setup Utility during the execution of POST. Run the BIOS Setup Utility according to the instructions displayed on the screen and provide necessary settings.

When the boot device priority is changed: The defaults instruct the your server to search the boot devices in the following order: floppy disk drive, CD-ROM drive, then the hard disk drive. If you want to change the boot order priority, run the BIOS Setup Utility to change the settings.

When you replace a processor or memory: Your server has a degradation function allowing continuation of operation in the event of a processor or memory error. After replacing the failed processor or memory, run the BIOS Setup Utility to clear the error information.

When you change cache memory configuration: Run the BIOS Setup Utility to enable or disable the memory cache, or to set the cache in memory areas such as system BIOS or video BIOS.

When you change a setup for a PCI or ISA board: Run the BIOS Setup Utility to configure the interrupt request (IRQ) for PCI/ISA devices and PCI and ISA bus slots.

When using the remote power-on function: Enable or disable the remote power-on (Wake On LAN) function, which is used to power up your server remotely through a network.

When using the AC link function: AC link allows you to configure the power ON/OFF state of your server when AC power is restored after a power failure. Run the BIOS Setup Utility to change the power ON/OFF state of your server after a power failure.

When enabling and changing password and other security features: The BIOS Setup Utility includes password setup features and related security features. Run BIOS Setup to enable and change these features. (Do not set the password and security features before installing the operating system.)

When installing an ISA board (not Plug and Play): Run the BIOS Setup Utility to reserve system resources, including IRQ, memory addresses, and I/O addresses used by the board. This ensures that there will not be a conflict with any Plug and Play controllers in your system.

Other: You can also change other BIOS settings including date/time, keyboard features, and standard I/O (serial Port and printer port) interrupt. However, these features can also be changed from your operating system menus.

Using the BIOS Setup Utility

You access the BIOS Setup Utility when you turn on or reboot your system. To run the BIOS Setup Utility, perform the following procedure.

1. Power on or reboot the system. BIOS displays the following:

   Press <F2> to enter SETUP

2. Press **F2**. After BIOS POST completes, the BIOS Setup Utility starts and the Main Menu is displayed. The menu bar at the top of the Main Menu lists the following selections.

Menu	Use
Main	Use this menu for basic system configuration.
Advanced	Use this menu for setting the Advanced Features available on your system.
Security	Use this menu to set User and Supervisor Passwords and the Backup and Virus-Check reminders.
System Hardware	Use this menu for configuring unique Server Features.
Boot	Use this menu to change the boot order of devices in your system.
Exit	Exits the current menu.

Use the arrow keys to select a menu or an item on a displayed menu. Press the value keys (listed in the table below) to cycle through the allowable values for the selected field. Use the Exit menu's "Save Values" selection to save the current values on all the menus.

To display a submenu, position the cursor on a selection that has a submenu and press **Enter**. Selections with submenus are preceded by an arrow.

See the following table for information on the keys you use with Setup. These keys are also listed at the bottom of the Setup menu.

Key	Function in Setup Menu
F1 or Alt-H	General Help window.
ESC	Exit the current menu.
← or → arrow keys	Select a different menu.
↑ or ↓ arrow keys	Move cursor up and down. The cursor moves only to the settings that you can change.
HOME or END	Move cursor to top or bottom of window.
F5 or -	Select the previous value for the field.
F6 or + or SPACE	Select the next value for the field.
F9	Load default configuration values for this menu.
F10	Save current values and exit.
ENTER	Execute command or Select ➨ submenu.

BIOS Setup Configuration Settings

Table 3-1 shows the normal settings for the BIOS Setup Utility and provides a place for you to record any changes you make to these settings.

Table 3-1. BIOS Setup Configurations, Main Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
MAIN MENU		
Processor Type	Displays the type of processor installed.	
Processor Speed	Displays the processor speed.	
Cache RAM	Displays the cache RAM size.	

Table 3-1. BIOS Setup Configurations, Main Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
Cache Memory Press Enter for menu.		
Memory Cache	Enabled	
Cache System BIOS Area	Write Protected	
Cache Video BIOS Area	Write Protected	
Cache Base 0 - 512K	Write Back	
Cache Base 512K - 640K	Write Back	
Cache Extended Memory Area	Write Back	
Cache C800-CBFF	Disabled	
Cache CC00-CFFF	Disabled	
Cache D000-D3FF	Disabled	
Cache D400-D7FF	Disabled	
Cache D800-DBFF	Disabled	
Cache DC00-DFFF	Disabled	
System Memory	640KB (display only) Indicates the total capacity of the basic memory.	
Extended Memory	XXXMB (display only) Indicates the total capacity of the extended memory.	
Language	English	
BIOS Version	Indicates the version of the system BIOS. (display only)	
System Time Enter current time (hour, minutes, seconds on 24 hour clock).	Current Time	
System Date Enter current date.	Current Date	
Floppy Options		
Diskette A: Use +/- to change values; indicates the type of diskette drive installed.	1.44MB, 3 1/2"	
Diskette B: Use +/- to change values; indicates the type of diskette drive installed (Not Installed in your system).	Not Installed	

Table 3-1. BIOS Setup Configurations, Advanced Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
ADVANCED MENU		
Advanced Press **Enter** for menu.		
Plug & Play OS	No	
Reset Configuration Data	No	
Address Bit Permuting	Enabled	
ROMPilot Support	Disabled	
Memory Reconfiguration Press **Enter** for menu.		
Memory Reconfiguration	Enabled	
DIMM Group #1 Status	Normal (display only)	
DIMM Group #2 Status	None (display only)	
DIMM Group #3 Status	None (display only)	
DIMM Group #4 Status	None (display only)	
DIMM Group #5 Status	None (display only)	
DIMM Group #6 Status	None (display only)	
DIMM Group #7 Status	None (display only)	
DIMM Group #8 Status	None (display only)	
Clear DIMM Error	Press **Enter** to clear DIMM error	
DIMM Error Pause	Disabled	
CPU Reconfiguration Press **Enter** for menu.		
CPU Reconfiguration	Enabled	
CPU #1 Status	Normal (display only)	
CPU #2 Status	Normal (display only)	
CPU #3 Status	None (display only)	
CPU #4 Status	None (display only)	
Clear CPU Errors	Press **Enter**	
CPU Error Pause	Enabled	

Table 3-1. BIOS Setup Configurations, Advanced Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
Peripheral Configuration Press **Enter** for menu.		
Serial Port 1:	Enabled	
Base I/O Address:	3F8	
Interrupt:	IRQ4	
Serial Port 2:	Enabled	
Base I/O Address:	2F8	
Interrupt:	IRQ 3	
Parallel Port:	Enabled	
Parallel Mode:	Bi-directional	
Base I/O address:	378	
Interrupt:	IRQ 7	
Diskette Controller:	Enabled	
Mouse	Auto Detect	
SCSI controller 1	Enabled	
SCSI controller 2	Disabled	
LAN controller	Enabled	
Monitoring Configuration Press **Enter** for menu.		
POST Monitoring Observation	POST-END	
Boot Monitoring	Disabled	
PCI Device Press **Enter** for menu.		
PCI IRQ line 1 to PCI IRQ line 17*	Auto Select	
PCI Parity Error		
PCI Bus#1 Parity Error	Enabled	
PCI Bus#2 Parity Error	Enabled	
PCI Bus#3 Parity Error	Enabled	

* See Table 3-2 for PCI IRQ assignments to PCI bus slot or controller.

Table 3-1. BIOS Setup Configurations, Advanced, Security, and System Hardware Menus

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
ISA Device		
Press **Enter** for menu.		
IRQ	None	
DMA Channel	None	
Memory Size	None	
Memory address	None	
Enable Extended Memory Gap	Disabled	
Numlock		
Press **Enter** for menu.		
Numlock	On	
Key Click	Disabled	
Key Board auto-repeat rate	10/sec	
Key Board auto-repeat delay	1 sec	
SECURITY MENU		
Supervisor Password is	Disabled (display only)	
User Password is	Disabled (display only)	
Set Supervisor Password	Press **Enter**	
Set User Password	Press **Enter**	
Password on boot	Disabled	
Diskette Write	Normal	
Power Switch Mask	Unmasked	
Option ROM Menu Mask	Unmasked	
Processor Serial Number	Disabled	
SYSTEM HARDWARE MENU		
Thermal Sensor		
Press **Enter** for menu.		
Thermal Sensor	Enabled	
Upper Limit	45	
Lower Limit	4	
Wake On LAN	Disabled	
AC-LINK	Last State	
ESM IRQ	IRQ 13	
SMI	Yes	
Error Log Initialization	No	

Table 3-1. BIOS Setup Configurations, Boot Menu

Menu Parameter Name	Normal Setting or Display Only	Your Configuration
BOOT MENU		
First boot device	Diskette Drive	
Second boot device	CD-ROM Drive	
Third boot device	Hard Drive	

Table 3-2. PCI IRQ Bus and Controller Assignments

PCI IRQ Line	Assignment
PCI IRQ Line 1	SCSI Channel 1 on system I/O board
PCI IRQ Line 2:	SCSI Channel 2 on system I/O board
PCI IRQ Line 3:	LAN Controller and video controller on system I/O board
PCI IRQ Line 4:	PCI #11 (Int A)
PCI IRQ Line 5:	PCI #12 (Int A)
PCI IRQ Line 6:	PCI #13 (Int A)
PCI IRQ Line 7:	PCI #21 (Int A)
PCI IRQ Line 8:	PCI #22 (Int A)
PCI IRQ Line 9:	PCI #23 (Int A)
PCI IRQ Line 10:	PCI #24 (Int A)
PCI IRQ Line 11:	PCI #31 (Int A)
PCI IRQ Line 12:	PCI #32 (Int A)
PCI IRQ Line 13:	PCI #33 (Int A)
PCI IRQ Line 14:	PCI #34 (Int A)
PCI IRQ Line 15:	PCI #11 (Int B) PCI #12 (Int C) PCI #13 (Int D) PCI #21 (Int D) PCI #22 (Int B) PCI #23 (Int C) PCI #24 (Int D) PCI #31 (Int C) PCI #32 (Int D) PCI #33 (Int B) PCI #34 (Int C)
PCI IRQ Line 16:	PCI #11 (Int C) PCI #12 (Int D) PCI #13 (Int B) PCI #21 (Int B) PCI #22 (Int C) PCI #23 (Int D) PCI #24 (Int B) PCI #31 (Int D) PCI #32 (Int B) PCI #33 (Int C) PCI #34 (Int D)

Table 3-2. PCI IRQ Bus and Controller Assignments

PCI IRQ Line	Assignment
PCI IRQ Line 17:	PCI #11 (Int D) PCI #12 (Int B) PCI #13 (Int C) PCI #21 (Int C) PCI #22 (Int D) PCI #23 (Int B) PCI #24 (Int C) PCI #31 (Int B) PCI #32 (Int C) PCI #33 (Int D) PCI #34 (Int B)

Exiting BIOS Setup

To exit Setup, select Exit from the menu bar to display the Exit Setup menu.

The following describes the options on this menu. Note that ESC does not exit this menu. Select one of the items from the menu or menu bar to exit this menu.

Selection	Description
Save changes and Exit	Stores the selections displayed in the menus in CMOS and exits the Setup program.
Exit without Saving Changes	Exits the program without saving any changes you have made in this session. Previous selections remain in effect.
Get Default Values	Sets default values for all Setup menus. Useful if BIOS detects a problem with the values stored in CMOS.
Load Previous Values	Reverts to previously saved values if the new values have not been saved to CMOS.
Save Changes	Stores the current selections without exiting the Setup program.

Symbios Configuration Utility

The Symbios Configuration Utility detects the two SCSI host adapters located on the system board. Use the utility to:

Change adapter and SCSI device default values

Check and/or change SCSI device settings that may conflict with those of other devices in the server.

Perform low-level formatting or verify operations on SCSI disk drives.

Running the Symbios Configuration Utility

1. Power-on the system. The system boots up.
2. When this message appears on the video monitor:

   Press Ctrl-C to start the Symbios Configuration Utility

   Press **Ctrl+C** to run this utility.
3. The utility starts and the Main Menu displays.

Symbios Configuration Utility Main Menu

Adapter	Port Number	IRQ Level	Status		NVRAM Found
			Current	Next Boot	
SYM53C895 (SCSI 1 - 5 ¼" removable media devices)	4000	11	On	On	Yes
SYM53C895 (SCSI 2 - not used)	5000	15	On	On	Yes

Change Adapter Status – Press ENTER to select and change adapter status.

Adapter Boot Order – Press ENTER to select and change boot order of each SCSI adapter. (not required)

Additional Adapter Configuration – Not used.

Display Mode-Verbose – Press ENTER to change display mode.

Mono/Color – Press ENTER to change display from black/white to color.

Language – Not used.

Help/Quit

The following keys are active for all SCSI Configuration screens:

Key	Action
Arrows	Up and down arrows move from one parameter to another within a screen.
ENTER	Displays options for a configurable parameter. Selects an option.
ESC	Moves back to previous screen or parameter or EXIT if at the Main menu.

Changing the Adapter and Device Configurations

The Symbios Configuration Utility Main Menu lists the two onboard SCSI adapters and shows their current settings. The first adapter listed (SCSI 1) controls the operation of the removable media devices in your system; the second adapter listed normally controls the hard disk drives in the system, however hard disk drives in your system are controlled by a RAID controller.

To configure SCSI devices, perform the following procedure:

1. Using the arrow keys, select the adapter you want to reconfigure. Press **ENTER**.
2. Select "Adapter Setup" and press **ENTER**. The Adapter Setup screen displays.

Adapter Setup Screen

Description	Recommended Setting or Display Only	Your Configuration	
		SYM53C895 1	SYM53C895 2
SCAM Support	Off		
Parity	On		
Host SCSI ID	7		
Scan Order	Low to High		
Removable Media Support	None		
CHS Mapping	SCSI Plug and Play Mapping		
Spinup Delay (Secs)	2		

Help
Restore Default Setup
Exit this menu

3. Highlight the function you want to change and press **ENTER**. You will be prompted to save changes when you exit the configuration utility.

To change device configuration parameters, perform the following steps:

1. At the Symbios Configuration Utility Main Menu, select the adapter which connects to the SCSI device you are reconfiguring. The first adapter listed controls the operation of any SCSI removable media devices installed in your system; the second adapter is not used.

   Press **ENTER**.

2. Select "Device Selections" and press **ENTER**. The Devices 0 to 7 screen displays.
3. Select the SCSI device you are reconfiguring and press **ENTER**.
4. Highlight the function you want to change and press **ENTER**. You will be prompted to save changes when you exit the configuration utility.

SYM53C875 Adapter 1 – SCSI Removable Media Devices

Description	Recommended Setting or Display Only	Your Configuration	
Device Selections	Select device and press ENTER.	Device	Setting
Sync Rate	80		
Width (bits)	16		
Disconnect	On		
Read/Write I/O timeout (secs)	10		
Scan for device at boot time	Yes		
Scan for SCSI LUNS	Yes		
Queue Tags	Enabled		
Initial Boot Device	No		

Format – Format a disk
Verify – Verify disk media
Help
Restore Default Setup
Exit this Menu

Configuring the RAID Controller

The system includes a three channel SecuRAID 530 Redundant Array of Inexpensive Devices (RAID) Controller board (Mylex eXtremeRAID 1100). This board gives your system the added security of fault tolerance and is pre-configured at the factory. Use Table 3-2 to determine how your RAID controller was configured at the factory. If you want to change the RAID level or add additional hard disks to the array, use the RAID Configuration Utility.

If you are adding the RAID controller to an existing system. the RAID Configuration Utility allows you to configure your disk array before installing your network operating system.

Table 3-2. RAID Configurations

Number of Hard Drives	RAID Level Configured	Hard Drives in Array	Description
1	JBOD	1	**JBOD (Mylex RAID 7)** JBOD is an acronym for Just a Bunch Of Disks. Each drive can operate independently as with a common host bus adapter; or multiple drives may be spanned and seen as a single very large drive. No redundancy is provided.
2	1	2	**Mirroring (RAID 1)** Drives are paired and mirrored. All data is 100% duplicated on an equivalent drive (fully redundant).
3	5	3	**Striping with Parity (RAID 5)** Data is striped across several physical drives. Parity protection is used for data redundancy.
4 or more	5	4 (one standby drive)	**Striping with Parity (RAID 5) with a standby drive** The array consists of three ON-LINE drives and one STANDBY drive. The standby replacement drive, or hot spare, is one of the most important features RAID provides to achieve automatic. non-stop service with a high degree of fault-tolerance.

The RAID Configuration Utility utility is included with the RAID controller. The SecuRAID 530 controller supports various versions of RAID technology (referred to as RAID levels). To use any RAID level, you must configure the RAID controller using the RAID Configuration Utility configuration utility prior to installing your Network Operating System. For an explanation of this utility, refer to the *RAID Configuration Utility Utilities Installation Guide and User Manual* that was shipped with the controller. Chapter 2 of the manual (*Configuration Strategies)* describes RAID technology and provides tips on making your array perform well in your specific application. Chapter 3 (*Preparing the Array)* covers array hardware preparation, configuration, and initialization. After completing the steps in Chapter 3, you can install your Network Operating System.

If you want to remotely configure the array (from a PC client); increase array capacity online; or monitor statistics on disk and controller activity, you must install the Global Array Manager (GAM) option provided with your RAID subsystem. The GAM option includes diskettes and user documentation. Use of GAM is documented in the *Global Array Manager 2 Server Installation Guide*. Increasing array capacity is covered in the *MORE User Guide*. This user guide covers enhancements to both the Global Array manager and RAID Configuration Utility utilities software that implement online RAID expansion (MORE) technology.

Configuring System Jumpers and Switches

This section describes the jumpers and switches used on the I/O riser board, memory board, and system I/O board.

Before You Begin

Only a qualified technical person should perform the procedures in this section.

> **Note:** Electrostatic discharge (ESD) can damage the system boards. Modify the boards only at an ESD workstation. Otherwise, wear an antistatic wrist strap attached to chassis ground.

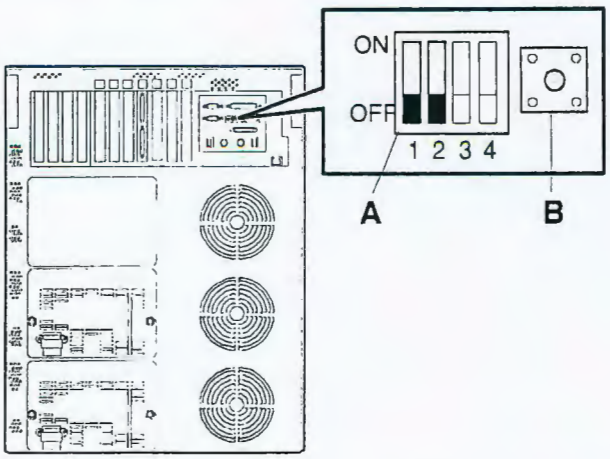
The system jumpers enable you to set specific operating parameters for your system. A jumper is a small plastic-encased conductor (shorting plug) that slips over two jumper pins.

Configuring I/O Riser Board Function Select Switches

The following describes how to configure and set the I/O riser board function select switches for specific operating parameters. The function select DIP switches configure the use of the rear panel reset/dump button.

> **⚠ CAUTION**
>
> Before doing the procedures in this section, make sure that your system is powered off. Unplug all AC power cords from the back of the chassis. Failure to disconnect power before setting switches and moving jumpers can result in personal injury and equipment damage.

Figure 3-1 shows the DIP switches. The switches consist of a block of four switches, accessible on the I/O panel located on the I/O riser board at the rear of the chassis.



Function Select Switches and Reset/Dump Button

A Function select switches

B Reset/Dump Button

(Switches shown in factory default position.)

Figure 3-1. Function Select Switches

> **Note:** The switches are set correctly at the factory for your system configuration. If your system requires a switch change, change only the switch setting for that condition. Otherwise keep the switches at their factory settings.

Table 3-3 shows the switch configurations and functions. Set the switches per Table 3-3 and the following steps. To change a switch setting, use the following procedure.

> **Note:** Power must be completely off before setting the switches, otherwise the settings will not be recognized.

1. At the front of the server, press the power switch off.
2. At the rear of the server, locate the Function Select DIP switch (see Figure 3-1) that you want to change.
3. Set the appropriate switch on or off, according to Table 3-3.
4. Press the main power switch on.

Table 3-3. Function Select Switch Settings

Switch	Description	Settings	Function
SW1	Dump/Reset pushbutton control	Off (factory setting)	Enables the Reset/dump button.
		On	Disables the Reset/dump button.
SW2	Dump/Reset pushbutton mode control	Off (factory setting)	Sets the Reset/dump button to Reset mode. Pressing the button resets the system.
		On	Sets the Reset/dump button to Dump mode. Pressing the button dumps the system memory. This function used only by qualified technical personnel.
SW3	Reserved for future use.	Off (factory setting) On	
SW4	Reserved for future use.	Off (factory setting) On	

Configuring Memory Board Function Jumpers

The system memory board jumpers enable you to specify the DIMM speed parameter. Figure 3-3 shows the location of the jumpers. The jumpers should be configured for 50ns as shown in Figure 3-2.

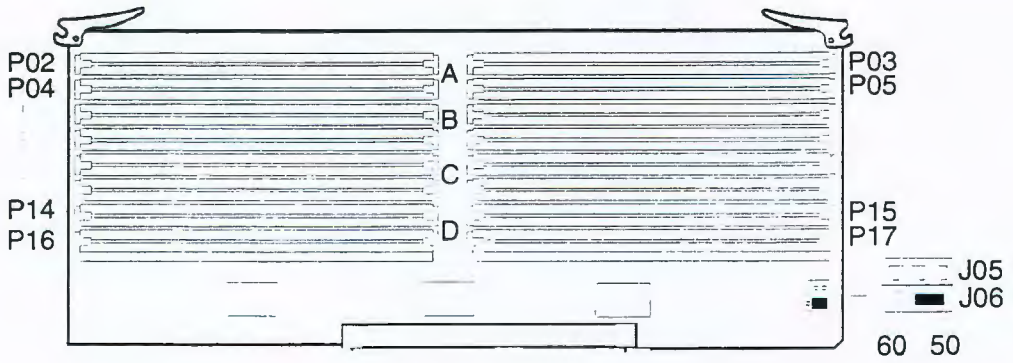


Figure 3-2. Memory Board Jumpers

Configuring System I/O Board Switches and Jumpers

The system I/O board jumpers enable you to set specific operating parameters for your system. Figure 3-3 shows the location of the jumpers. Table 3-4 lists the system I/O board switches and jumpers and their factory default settings.

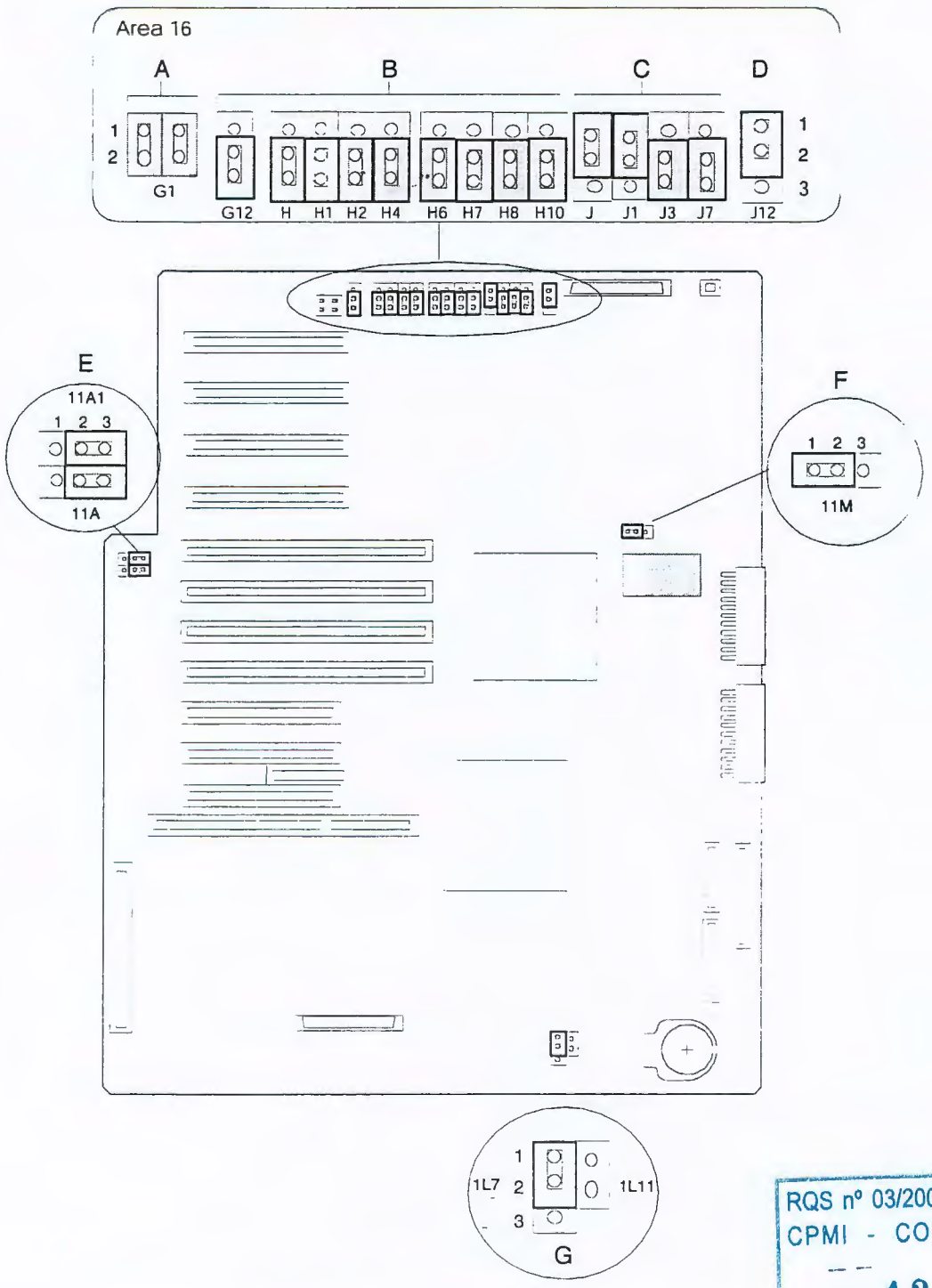


Figure 3-3. System I/O Board Switches and Jumpers

Table 3-4. System I/O Board Jumper Configurations

Figure 3-3 Callout	Description	Option	Jumper	Setting	Factory Default	Your Setting
A	Reserved	Required on factory default (1-2)	16G1	1-2	1-2	1-2
B	Reserved	Required on factory default (2-3)	16G12, 16H, 16H1, 16H2, 16H4, 16H6, 16H7, 16H8, 16H10	2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3	2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3	2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3 2-3
C	Processor Speed	500MHz	16J 16J1 16J3 16J7	1-2 1-2 2-3 2-3	1-2 1-2 2-3 2-3	1-2 1-2 2-3 2-3
D	TEST Mode	Required on factory default (1-2)	16J12	1-2	1-2	1-2
E	CMOS Clear	**Disable** Enable	11A	2-3 1-2	2-3	
E	Password Clear	**Disable** Enable	11A1	2-3 1-2	2-3	
F	CMOS Erase/Write	Required on factory default (1-2)	11M	1-2	1-2	1-2
G	RTC Power Supply	Required on factory defaults	1L7 1L11*	1-2 OFF	1-2 OFF	1-2 OFF

*Used on system I/O Board G7BNF; not used on G7BZJ/G7CEQ.

⚠ CAUTION

Before doing the procedures in this section, make sure that your system is powered off. Unplug the AC power cords from the back of the chassis. Failure to disconnect power before moving the jumpers can result in personal injury and equipment damage.

Note: Observe static precautions. Use an antistatic wrist strap.

Change the setting of any of the configuration switches or jumpers on the system boards as follows.

1. Power off the system and remove the covers as described in Chapter 4, "Upgrades and Options."
2. Check to ensure the system power cords are removed from the back of the system.
3. Locate the switch or jumper you are changing.
4. To change a switch setting, use a pen or your finger to move the switch to the desired setting. To change a jumper setting, use a pair of needle-nose pliers or your fingers to remove the jumper from its current location. Position the jumper over the two pins for the desired setting and press it onto the pins. Be careful not to bend the pins. Record changes to the board settings.
5. Install the system covers and power up the system.

BIOS

The following contains procedures for updating your BIOS .

Updating the BIOS

You should use this procedure when you receive a BIOS FLASH diskette from your service representative. Update the system BIOS as follows.

> **Note:** This procedure clears the event log contents. If you want to save the event log contents, run the Event Log Reader Utility.

1. Insert a bootable DOS diskette into Drive A and power up the system.
2. Remove the MS-DOS diskette and insert the BIOS FLASH diskette into Drive A.
3. Enter PHLASH and press **Enter**.
4. After the system reboots, load the default values by pressing **F2** to enter setup. At the Exit Menu, select *GET DEFAULT VALUES*.
5. Clear the event log by selecting *CLEAR EVENT LOG* at the Server Menu. Press space bar to change NO to YES and press **Esc**. Select *SAVE CHANGES & EXIT* and press **Enter** to continue. The system reboots.

Resetting the CMOS NVRAM

Reset the CMOS NVRAM as follows.

1. Power off the system and remove the panels as described in chapter 5 of this guide.
2. Move the CMOS Clear jumper 11A to ENABLE (1-2). See Figure 3-3 and Table 3-4).
3. Turn the system on and wait for the POST to complete. This automatically reprograms the CMOS NVRAM to the default settings.
4. Power off the system.
5. Move the CMOS Clear jumper 11A back to DISABLE (2-3).
6. Replace the panels and power on the system.
7. Run the Setup Utility to configure your system.

Clearing and Changing the Password

Clear and change the password as follows.

1. Power off the system and remove the panels as described in the Upgrades and Options chapter.
2. Move the Password Clear jumper 11A1 to ENABLE (1-2). See Figure 3-3 and Table 3-4.
3. Power on the system and wait for POST to complete. This automatically clears the old password.
4. Power off the system.
5. Move the Password Clear jumper 11A1 back to DISABLE (2-3).
6. Replace the panels and power on the system.
7. To specify a new password run the Setup Utility.

4

Upgrading Your System

- Precautions
- Preparing Your System for Upgrade
- Modifying the System I/O Board
- DIMMs
- Processors
- Option Boards
- Power Supply
- Removable Media Devices
- Hard Disk Drives

This section contains step-by-step instructions for removal and installation of all the major system components. When you disassemble the server, note the orientation and placement of any cables or shielding that you remove.

⚠ WARNING

The DC push button on/off switch on the front panel does not turn off system AC power. Also, +5vdc is present on the system board whenever the AC power cord is connected between the system and an AC outlet. Before performing any procedures, first power off the DC push button switch located on the front panel. Make sure your system is powered off and the AC power cord is unplugged from the system. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

⚠ CAUTION

The server management logic on the system board monitors system voltage changes. When powering down your system, you may experience a 1- to 5-second delay from the time you press the push button power on/off switch and your system powering down. This is normal system operation and is required by the server management logic.

⚠ CAUTION

Operating your system with the access cover removed can damage system components. For proper cooling and airflow, always replace the access cover before powering on.

Precautions

The following warnings and cautions apply throughout this chapter. Only a technically qualified person should integrate and configure the system.

The only procedure that can safely be done with the system power on is installing (or hot-swapping) an SCA drive/carrier assembly in one of the SCSI hot-swap drive cages or hot-swapping a failed power supply. For any other procedures inside the system, turn off system power and disconnect the AC power cord s.

⚠ WARNING

Before doing the procedures in this chapter, make sure that your system is powered off and unplug all AC power cords. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

System power on/off. The DC push-button on/off switch (a convex button) on the front panel DOES NOT turn off the system AC power. To remove power from system, you must unplug the AC power cords (from wall outlets or power supply).

Hazardous conditions, power supply. Hazardous voltage, current, and energy levels are present inside the power supply. There are no user serviceable parts inside it; servicing should be done by technically qualified personnel.

Hazardous conditions, devices & cables. Hazardous electrical conditions may be present on power, telephone, and communication cables. Turn off the system and disconnect the power cords, telecommunications systems, networks, and modems attached to the system before opening it. Otherwise, personal injury or equipment damage can result.

⚠ CAUTION

Electrostatic discharge (ESD) and ESD protection. ESD can damage disk drives, boards, and other parts. This system can withstand normal levels of environmental ESD while you are hot-swapping SCSI hard drives or hot-swapping a failed fan module or power supply. However, we recommend that you do all procedures in this chapter only at an ESD workstation. If one is not available, provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground (any unpainted metal surface) on your system when handling parts.

ESD and handling boards. Always handle boards carefully. They can be extremely sensitive to ESD. Hold boards only by their edges. After removing a board from its protective wrapper or from the system, place it component-side up on a grounded, static-free surface. Use a conductive foam pad if available but not the board wrapper. Do not slide board over any surface.

Chassis covers, proper cooling and airflow. For proper cooling and airflow, always install the chassis side and top covers before turning on the system. Operating it without these covers in place can damage system parts.

Contact your sales representative or dealer for a list of approved optional peripheral devices.

Removing the Front Doors

You must remove the front doors to remove the side panels on your system. To remove the front doors.

1. Open the front doors and power off the system. Ensure the power cords are unplugged from the AC wall outlet.
2. Lift one of the front doors and pull it towards you (see Figure 4-1). The mounting pins of the front door are disengaged from their mounting holes on the front of the system.
3. Remove the other front door in the same manner.

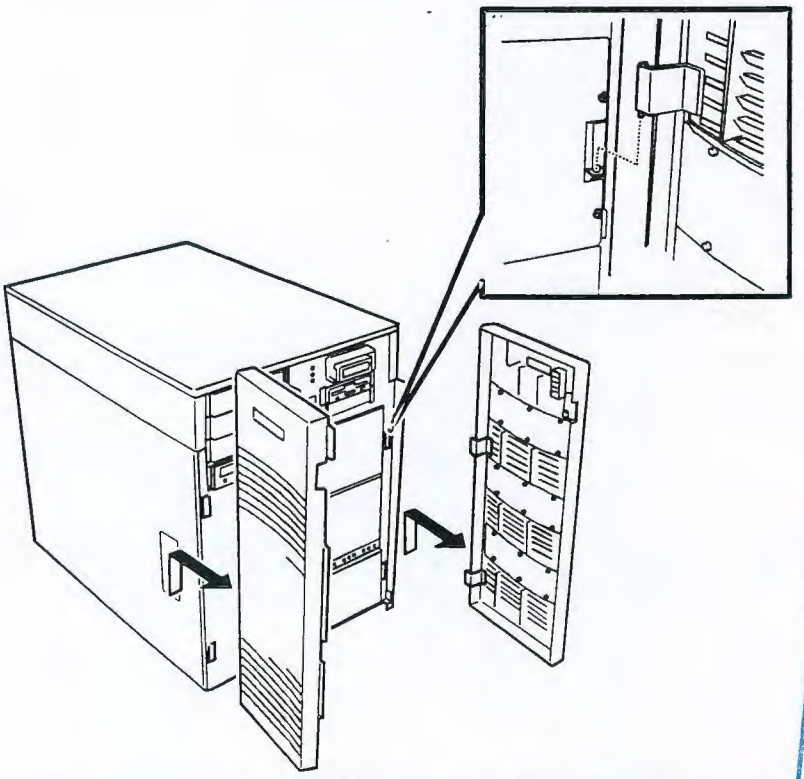


Figure 4-1. System Front Doors

Installing the Front Doors

Install the front doors as follows.

1. Position one of the front doors so the mounting pins of the front door are aligned with their mounting holes on the front of the system. Slide the lower mounting pin into its mounting hole and then slide in the upper pin.
2. Install the other front door in the same manner.

Removing the Top Cover and Side Panels

To install options in your system, you should do the following.

- To modify the system I/O board, add an option board, or add a removable media device, remove the top cover

- To add memory or a processor, remove the left side panel
- To install a hard disk cage, remove the top cover and right side panel.

⚠ CAUTION

For proper cooling and airflow, do not operate the system with the top cover or side panels removed. Always replace them before powering on the system.

Do not damage or bend the EMI fingers that are located along the edges of the top cover and side panels, as you remove and install them, or your system may not meet EMI requirements.

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⚠ WARNING

If you are removing the top cover or side panels after the system is set up, you must first power off the system and all external devices. **Unplug** the system power cords.

Remove the top cover or a side panel as follows.

1. Power off the system and ensure the power cords are unplugged from their AC wall outlet.
2. Observe the safety and ESD precautions listed at the beginning of this chapter.
3. The top cover and side panels are secured from the front edge with two thumb lock screws. Loosen the thumbscrews (see Figure 4-2).

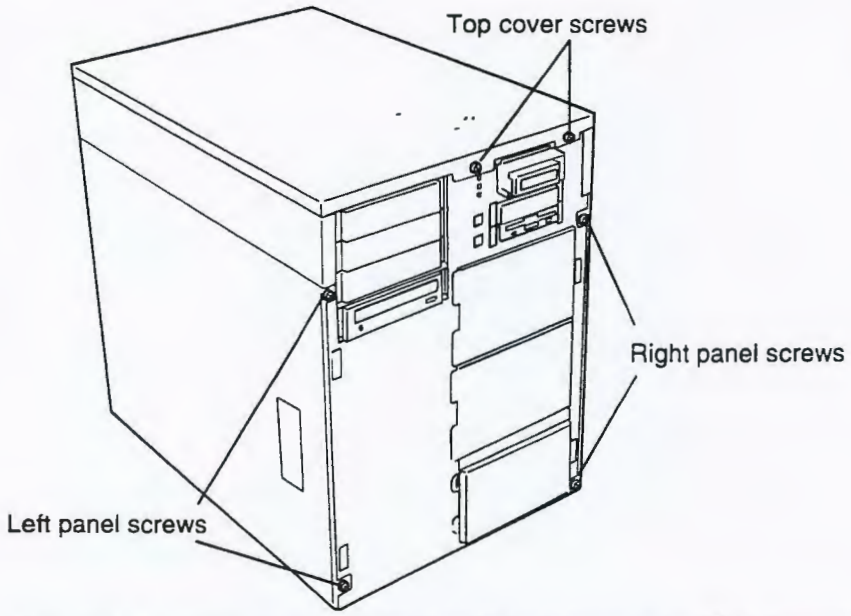


Figure 4-2. Mounting Screws for Top Cover and Side Panels

4. Slide the top cover or side panel toward the front of the chassis about an inch until it stops (see Figure 4-3).
5. Pull the top cover or side panel out and away from the chassis.
6. Set the cover or panel aside for reattaching later.

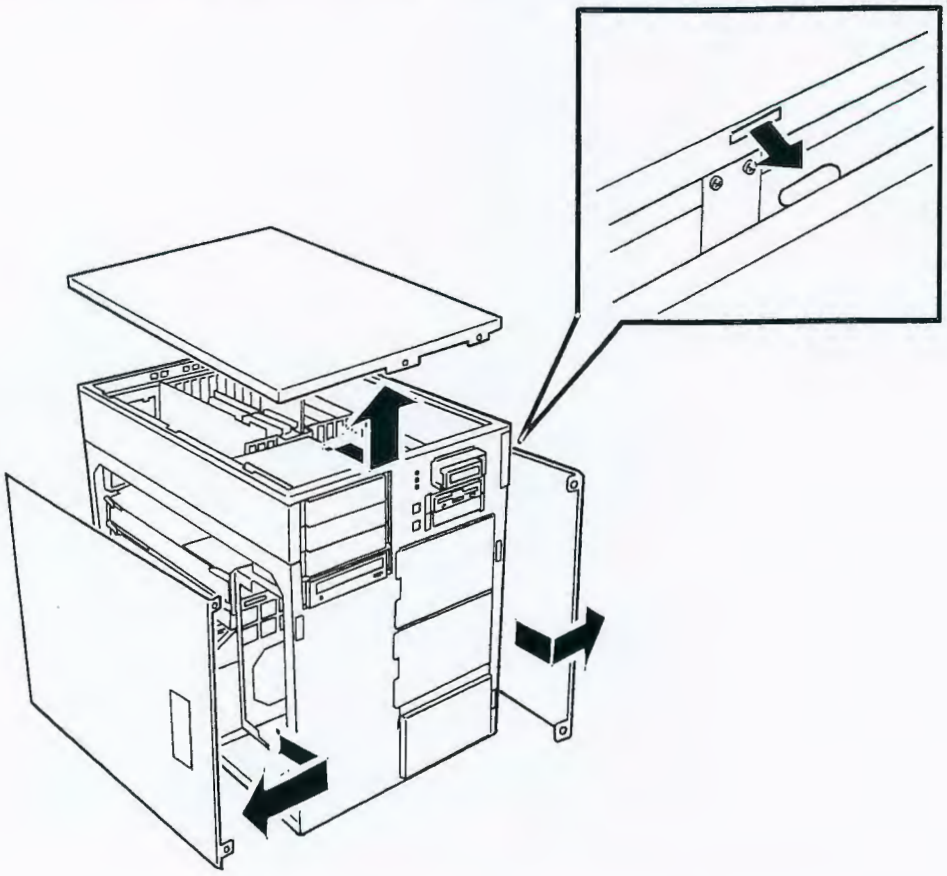


Figure 4-3. Top Cover and Side Panels Removal

Installing the Top Cover and Side Panels

Install the top cover and side panels as follows.

1. Before replacing the top cover or side panel, make sure no tools or loose parts have been left inside the system chassis.
2. Make sure all option boards are firmly seated in their respective slots and that all interior cables are properly connected.
3. The top cover and side panels have tabs that align with the slots in the chassis (see Figure 4-3). Align the tabs with the slots in the chassis and carefully push inward.
4. Slide the cover or panel toward the rear of the chassis so the tabs firmly engage in the slots.
5. Attach the cover or panel to the chassis by firmly tightening the two thumbscrews.

Note: If your system is already set up, plug the system back in, reconnect the peripherals, and power on the peripherals and system.

Modifying the System I/O Board

The following provides procedures for upgrading and configuring the system I/O board in your system. Topics covered include:

- Replacing the non-volatile memory
- Replacing the real-time clock battery.

Note: Electrostatic discharge (ESD) can damage add-in boards and other components; place them on an antistatic surface. Wear an antistatic wrist strap attached to chassis ground.

Replacing the Non-Volatile Memory (NVRAM)

You may need to replace the non-volatile memory because of its internal integral lithium battery life span. Contact your sales representative or dealer for a list of approved devices. The NVRAM is located on your system I/O board (see Figure 4-4). Notice the dot on the chip. Use the dot to correctly position the chip on the system board.

⚠ CAUTION

Danger of explosion if the battery is incorrectly replaced. Replace only with same or equivalent type recommended by manufacturer. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists. Do not expose the component to excessive heat or fire. Keep all batteries away from children.

Replace the non-volatile memory as follows.

Note: Observe static precautions. Use an antistatic wrist strap.

1. Power off the system and remove the top cover as described earlier.
2. If the non-volatile memory is secured by a tie-wrap, remove the tie-wrap. Note the position of the dot on the NVRAM in relation to its socket. Using a IC removal tool or a small pointed tool, gently pry up each end of the non-volatile memory and pull it straight up out of its socket (see Figure 4-4).
3. Position the new chip over its socket so the dot is properly oriented. Carefully insert the chip into its socket connectors.
4. Press down on the chip until it is firmly seated in its socket.
5. Replace the side panel and turn on the system.
6. Run the BIOS Setup to restore proper configuration settings.

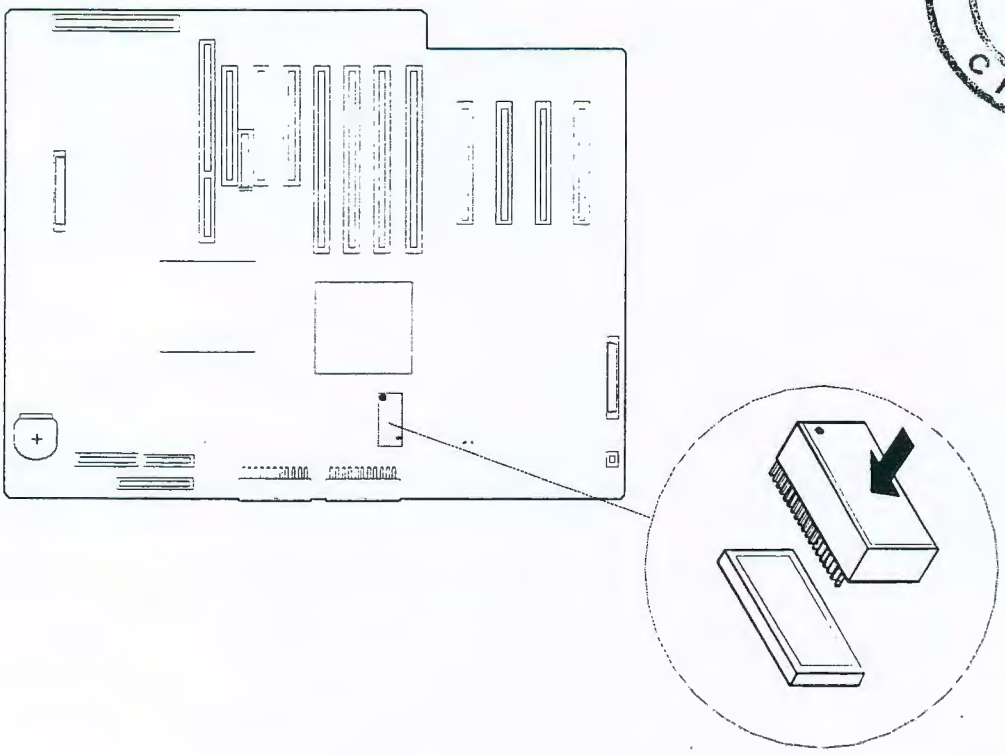


Figure 4-4. Non-Volatile Memory Location

Replacing the Real-time Clock Battery

You may need to replace the real-time clock (RTC) battery because of its battery life span. The battery powers the clock in the absence of power. When the battery starts to weaken, it loses voltage, and the system settings stored in CMOS RAM (for example, the date and time) may be wrong.

The battery (Vendor Part No. CR2450) is available through many vendors. It is located on your system I/O board (see Figure 4-5). Notice the plus (+) sign on the battery. The sign assists in correctly positioning the battery on the system board. Contact your sales representative or dealer for a list of approved devices.

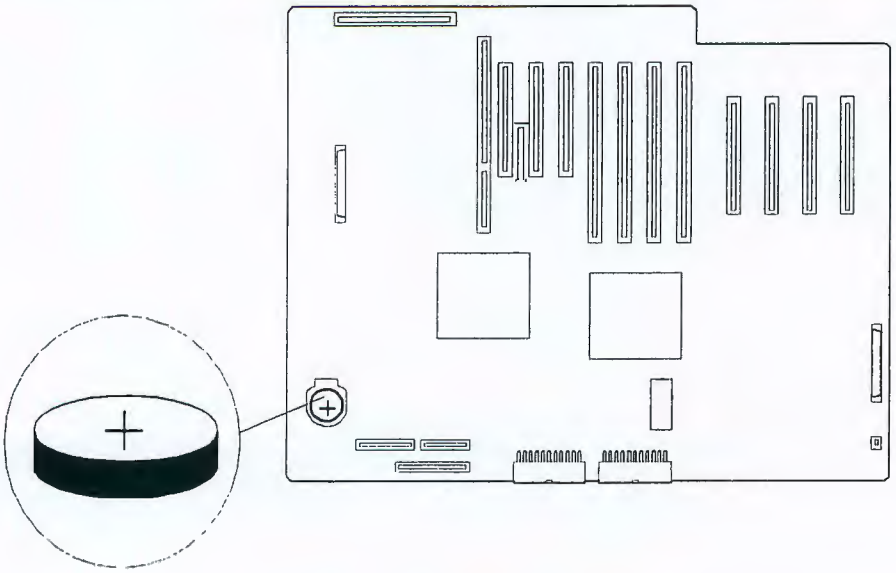


Figure 4-5. Location of the Real-Time Clock Battery

⚠ CAUTION

Danger of explosion if the battery is incorrectly replaced. Replace only with same or equivalent type recommended by manufacturer. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists. Do not expose the component to excessive heat or fire. Keep all batteries away from children.

Replace the battery as follows.

Note: Observe static precautions. Use an antistatic wrist strap.

1. Power off the system and remove the top cover as described earlier.
2. If the battery has a protective plastic cover, remove the cover by lifting it away from the battery. Use your finger nail or a small pointed tool to gently push up the bottom edge of the battery. See Figure 4-5 for socket location.
3. Position the new battery over its socket with the plus (+) sign on the battery facing up.
4. Carefully insert the top of the battery into the socket connectors and gently push the battery into the socket until it is firmly seated in the socket.
5. Replace the top cover and turn on the system.
6. Run the BIOS Setup to restore configuration settings to the real-time-clock.

DIMMs

The memory board contains sixteen DIMM sockets arranged in four banks (see Figure 4-6). Each 168-pin socket can hold a single 72-bit DIMM module with 32MB, 64MB, 128MB, or 256MB of memory. When all sixteen sockets are populated, the memory board supports a maximum of 4GB of memory with 256MB DIMMs. Your system supports a second memory board for a maximum system memory of 8GB. DIMMs must be identical within a bank on each board.

The first bank of DIMMs should be installed in Bank A sockets P02, P03, P04 and P05 (see Figure 4-6). When you install additional DIMMs, you must start with Bank B and continue to Bank D. When you remove DIMMs, you must start with the highest populated bank of DIMMs.

The following provides procedures for adding memory DIMMs to your system.

⚠ WARNING

If the system was running, any processor and heat sink installed is hot. To avoid the possibility of a burn while configuring memory, let the components cool for 10 minutes before continuing with the procedures described here.

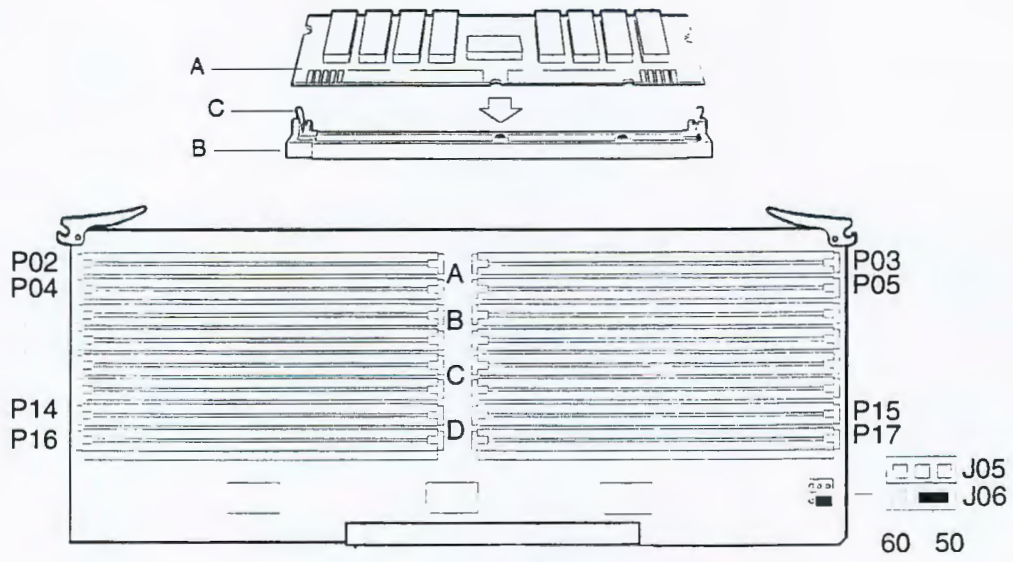


Figure 4-6. Inserting Memory DIMMs

Installing DIMMs

When properly installed, the DIMM module is oriented at an angle of 90 degrees relative to the memory board.

1. Power off the system and remove the left side panel as described earlier.
2. Remove the metal panel supporting the memory board. The support panel is secured to the chassis by a black fastener. Release the fastener by slowly pulling it towards you (listen for two clicks). Grasp the left side of the support panel and swing it away from the chassis to remove it. Set the support panel aside for later installation.

> ***Note:*** Observe static precautions. Use an antistatic wrist strap. Hold DIMMs only by their edges.

3. Open the ejectors on both sides of the memory board (see Figure 4-7). Holding the memory board by its edges, carefully pull it out until the edge connectors are free. Place the memory board on an antistatic surface.

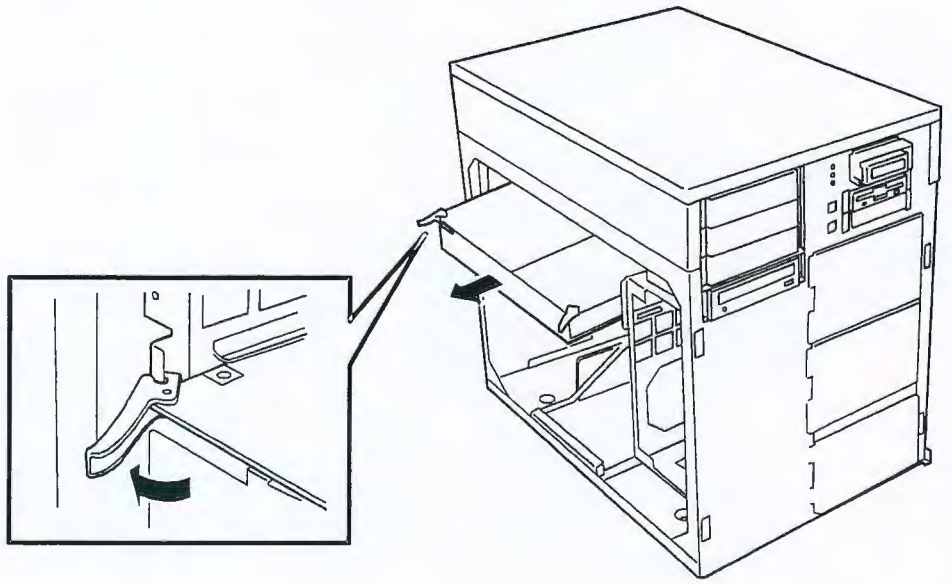


Figure 4-7. Memory Board Ejectors

4. Holding the DIMM module only by the edges, remove it from its antistatic package.
5. DIMMs are keyed so they can only be inserted one way. Position the DIMM over the socket on the board (see Figure 4-6, A and B). The notches in the bottom edge of the DIMM mate with the raised bumps in the DIMM socket.
6. Press down evenly on the DIMM until it seats correctly. The white levers on the sockets are not "tools" to aid in the insertion, only to keep the DIMMs in place and to aid in extraction. The levers should click in place once the DIMM is fully inserted.
7. Repeat the above steps to install any remaining DIMMs.

8. Ensure the memory board jumper is positioned on J06 as shown in Figure 4-6 (50ns).
9. Hold the memory board by its edges and start to insert it into the slot guides. On the CPU baseboard, locate the memory board connector. Do not press in on the board yet! Ease board into the slot guides until it is just touching the connector on the CPU baseboard.
10. Be sure the ejector levers are extended so they can engage the chassis frame. Press the board carefully but firmly into the CPU baseboard connector to seat the board. Close the ejectors on both sides of the memory board. Be sure the ejector is firmly hooked in the chassis frame before closing the ejector.
11. Hook the right side of the support panel into the chassis frame and swing the support panel into position so that the rear edge of the memory boards fits snug against the panel. The support panel is secured to the chassis by a black fastener. Push in on the support panel fastener until it clicks in the locked position.
12. Replace the left side panel and turn on the system.
13. Run the BIOS Setup to confirm the DIMMs are installed correctly.

Removing DIMMs

Remove DIMMs from their sockets as follows.

1. Power off the system and remove the left side panel as described earlier in this chapter.
2. Remove the metal panel supporting the memory board. The support panel is secured to the chassis by a pin. Release the support panel by pulling the black fastener towards you (listen for two clicks). Grasp the left side of the support panel and swing it away from the chassis to remove it. Set the support panel aside for later installation.
3. Open the ejectors on both sides of the memory board (see Figure 4-7). Holding the memory board by its edges, carefully pull it out until the edge connectors are free. Place the memory board on an antistatic surface.

> ***Note:*** Use extreme care when removing a DIMM. Hold DIMMs only by their edges. Place them on an antistatic surface; do not slide them across any surface. Applying too much pressure can break the retaining clips or damage the socket slot. Apply only enough pressure on the retaining clips to release the DIMM.

4. Remove the DIMM modules one at a time starting from the highest numbered sockets.
5. To remove each DIMM, gently spread the retaining clips (see Figure 4-6, 2) just enough so that you can pull the top edge of the DIMM away from the clips.
6. Carefully lift the DIMM away from the socket and store it in an antistatic package.
7. Repeat the above steps to remove the remaining DIMMs.

8. Hold the memory board by its edges and start to insert it into the slot guides. On the CPU baseboard, locate the memory board connector. Do not press in on the board yet! Ease board into the slot guides until it is just touching the connector on the CPU baseboard.
9. Be sure the ejector levers are extended so they can engage the chassis frame. Press the board carefully but firmly into the CPU baseboard connector to seat the board. Close the ejectors on both sides of the memory board. Be sure the ejector is firmly hooked in the chassis frame before closing the ejector.
10. Hook the right side of the support panel into the chassis frame and swing the support panel into position so that the rear edge of the memory boards fits snug against the panel. The support panel is secured to the chassis by a black fastener. Push in on the support panel fastener until it clicks in the locked position.
11. Replace the left side panel and turn on the system.

Processors

The following sections provide procedures for installing and removing the Pentium III Xeon Processor Single Edge Contact (S.E.C.) cartridge. Use these procedures when upgrading or replacing your processor(s). Each processor is packaged in a S.E.C. cartridge. The cartridge includes the processor core with an integrated 16 KB primary (L1) cache, secondary (L2) cache, heat sink, and a back cover. The processors are supported by one or more voltage regulator modules (VRM) on the CPU baseboard, depending on the number of installed processors.

Each S.E.C. cartridge installs in a Slot 2 connector on the CPU baseboard. Each slot must contain either a processor cartridge or a termination board (if there are less than four processors installed). The VRM modules are installed in a bank of VRM sockets adjacent to the processors.

Note: Your system may have up to four processors. All installed processors must be matched for speed. If replacing a processor, the replacement processor must match the speed and cache size of all installed processors. If upgrading a processor, all processors must be upgraded to match.

⚠ CAUTION

Electrostatic discharge (ESD) can damage components; place them on an antistatic surface. Update the CPU baseboard using an antistatic wrist strap attached to chassis ground.

⚠ WARNING

If the system was running, any processor and heat sink installed is hot. To avoid the possibility of a burn, let the components cool for 10 minutes before continuing with these procedures.

Installing a Processor Cartridge

Use the following procedure to install a processor cartridge.

Note: All systems ship with a processor cartridge installed in the bottom slot and termination boards in the remaining slots. Some systems may have more processors, depending on configuration. All processors must be matched in speed and cache size.

1. Power off the system and remove the left side panel as described earlier.

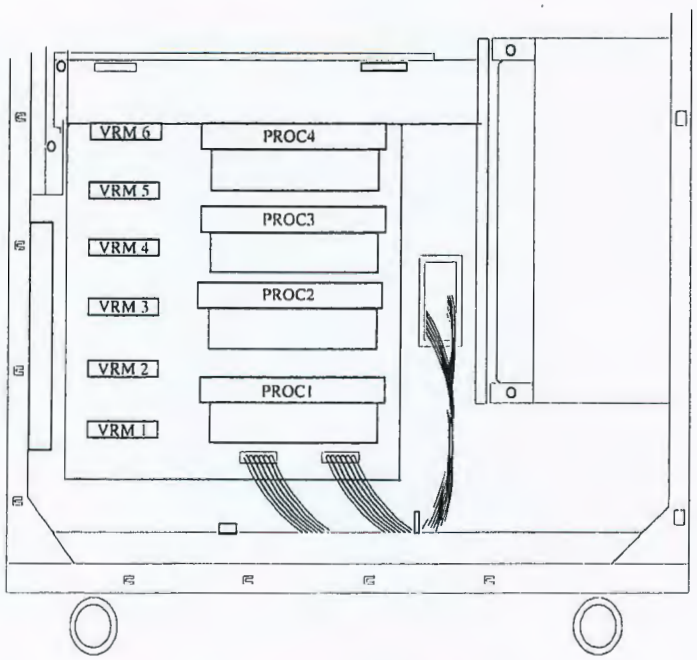


Figure 4-8. Processor and VRM Loacations

Note: Observe static precautions. Use an antistatic wrist strap. Hold processors only by their edges.

2. Remove the termination card from the slot above the installed processor cartridge(s).

   - Remove the retention arm locking the termination card in place by pressing in on the right side of the bar to release the arm.
   - Pull the retention arm towards you to release the arm from the module (see Figure 4-9, 1 and 2).

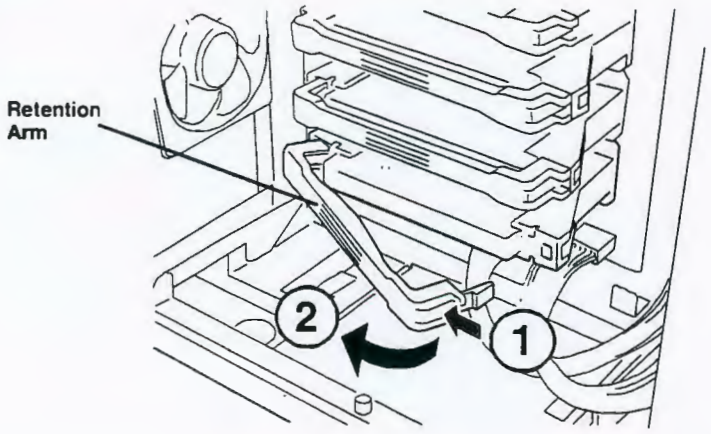


Figure 4-9. Removing the Retention Arm

   - Open the two card ejectors (one on each side) and pull the card out of the system (see Figure 4-10).

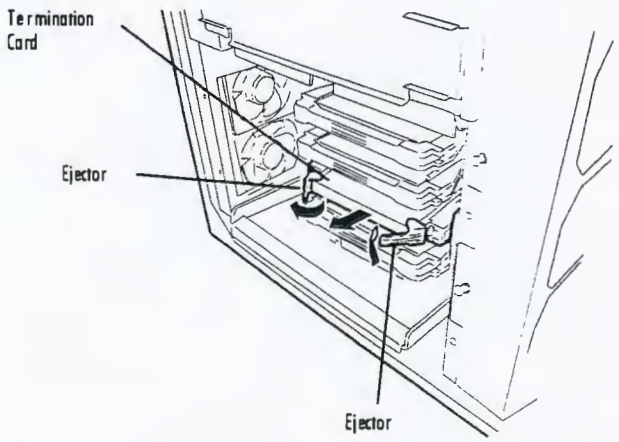


Figure 4-10. Removing the Termination Card

3. Remove a new processor cartridge from its antistatic package and place it on a grounded static-free surface or conductive foam pad.

   If tabs are not attached to the cartridge, remove them from the termination card and install on the cartridge.

   - Slightly spread open each tab so that the two pegs on the tab fit into two holes at the corner of the cartridge. Use care in opening the tab to prevent breakage.

4. Open the tabs on the cartridge and align the cartridge with the slot so that the heat-sink faces down.

   If installing a termination card, align the card so that the embossed logo on the card faces up.

5. Insert the cartridge into the guide rails of the retention module (see Figure 4-11) and carefully push it into the module until resistance is felt. Three distinct clicks should be heard as the processor module seats in the retention module. Check that it is firmly seated (tabs should be closed).

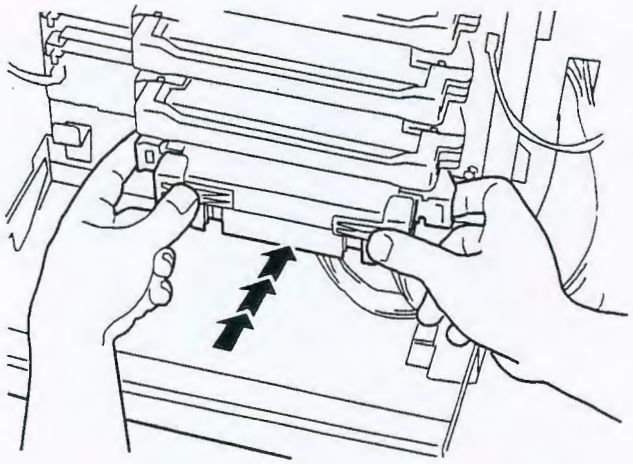


Figure 4-11. Installing the Processor

6. Reattach the retention arm as follows.

   - Align the end of the retention arm with a single alignment dot to the left and the end with the two dots to the right. The dots should match corresponding dots on the cartridge or terminator board.
   - Push the left end of the retention arm into its slot on the on the left side of the retention module.
   - Turn the retention arm to the right and snap it into place on the right side of the retention module.

7. Install the required VRM modules (single processor systems come with two VRM modules installed in VRM sockets 1 and 2). As you add processors, you need to install additional VRM modules.

   - For a second processor, install a VRM module in sockets 3 and 4 (for a total of four VRM modules for two processors).
   - For a third processor, install a VRM module in sockets 5 and 6 (for a total of six VRM modules for three processors).
   - For a fourth processor, no additional VRM modules are required.

8. Replace the left side panel and turn on the system.
9. After you have installed a new processor, run the BIOS Setup Utility to configure its speed.

Removing a Processor Cartridge or Termination Board

Use the following procedure to remove a processor cartridge or termination board.

1. Power off the system and remove the left side panel as described earlier.

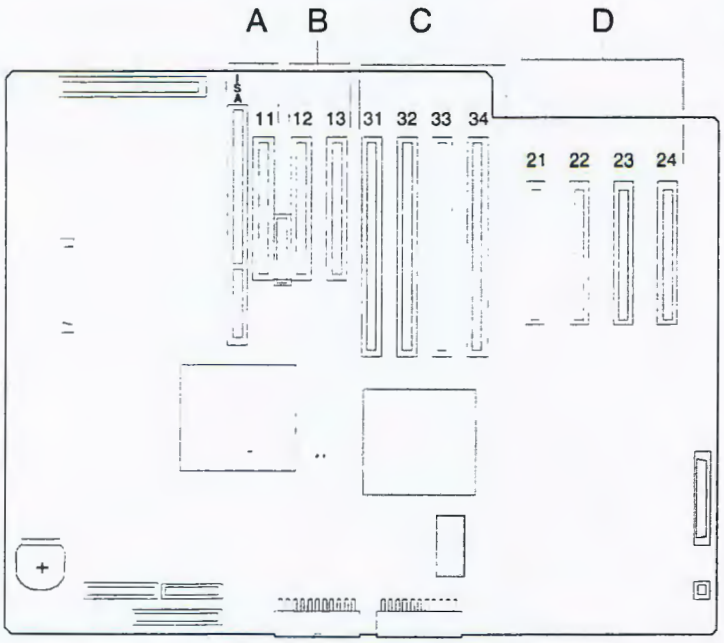
> ***Note:*** Observe static precautions. Use an antistatic wrist strap. Hold processors only by their edges.

2. On the processor or termination card being removed, push in the right end of the retention arm to unlock the arm.
3. Pull the retention arm toward you and remove the arm (see Figure 4-9).
4. Pull the two tabs on the cartridge or termination board straight out to disengage the cartridge or board from the CPU baseboard (see Figure 4-10).
5. Pull the cartridge or termination board straight out of the retention module. Place on a grounded, static-free surface or conductive foam pad.
6. Put the old cartridge in conductive foam and store in an antistatic package.
7. Install a new processor cartridge or termination card (see "Installing a Processor Cartridge or Termination Card"). If not installing a processor, install a termination card the same way as a cartridge and remove the appropriate VRM module(s).
8. Replace the left side panel and turn on the system.

Option Boards

The following sections describe how to install and remove ISA and PCI option boards. The system I/O board has four dedicated 64-bit PCI bus expansion slots, six dedicated 32-bit PCI expansion slots and one combination expansion slot that may be used as an ISA expansion slot or a 32-bit PCI expansion slot. (see Figure 4-12).

The high-performance PCI local bus allows the adoption of newer networking technology, such as 100 Mega-bit/second Ethernet NICs, with a minimum of effort and without concern for I/O bottlenecks. The PCI local bus offers up to 266 Mega-byte/second bandwidth (64-bit slots).



A Combination ISA/PCI #11Board Slot

B First PCI Bus Board Slots (32-bit) (PCI PCI #12 and PCI#13 from the left).

C Third PCI Bus Slots (64-bit) (PCI #31, PCI #32, PCI #33 and PCI #34 from the left).

D Second PCI Bus Board Slots (32-bit) (PCI #21, PCI #22, PCI #23 and PCI#24 from the left).

Figure 4-12. PCI and ISA Slot Locations

Installation Considerations

Newer adapters, designed for Plug-and-Play systems, are automatically configured by the system without any user intervention. Older ISA adapters must be manually configured as detailed below. Once the manual configuration is complete, the Plug-and-Play adapters are configured around the manually configured adapters without causing any resource conflicts.

ISA adapters can be Plug-and-Play. ISA adapters that are not Plug-and-Play must be manually configured following the instructions supplied with the board. The configuration is defined to the system in BIOS Setup. If you are adding a non-Plug-and-Play ISA option board, run the BIOS Setup Utility before installing the board. For details on running the BIOS Setup Utility, see Chapter 3, "Configuring Your System".

On system power-up and reboot, BIOS initiates a scan sequence looking for Plug-and-Play option boards installed since the last power up or reboot. The Plug-and-Play scan sequence is as follows.

- First - BIOS scans for any Plug-and-Play ISA option board installed in the ISA slot.

- Second - BIOS scans for any Plug-and-Play PCI option board installed in slots PCI #11 through #13, PCI #21 through #24 and PCI #31 through #34.

Always install option boards in the first available slot in the scan sequence. For example, if there are PCI option boards installed in slots PCI #11 and PCI #12 of your system, install your Plug-and-Play option board into slot PCI #13.

The SecuRAID 530 (Mylex 1100) is a 64-bit PCI controller and should be installed in PCI #31 slot. See Figure 4-12. Additional SecuRAID 530 PCI controllers should be installed in slots PCI #32 through PCI #34.

Controller/Adapter Hardware Configurations

Table 4-1 lists the option boards you may add to your system and provides information on slot location.

Table 4-1. Option Board Hardware Configurations

Option Board	IRQ[2]	Memory Address	I/O Address
Intel 10/100 (1st)[3]	Set by BIOS	Set by BIOS	Set by BIOS
Intel 10/100 (2nd)[3]	Set by BIOS	Set by BIOS	Set by BIOS
3COM 3c905B (1st)[3]	Set by BIOS	Set by BIOS	Set by BIOS
3COM 3c905B (2nd)[3]	Set by BIOS	Set by BIOS	Set by BIOS
Adaptec 3940UW[1, 4]	Set by BIOS	Set by BIOS	Set by BIOS
SecuRAID 530 (Mylex 1100)[1, 4]	Set by BIOS	Set by BIOS	Set by BIOS
Onboard SCSI	Set by BIOS	Set by BIOS	Set by BIOS

1 For disk controllers plugged into slots and the onboard disk controllers, the sequence for BIOS scanning to determine the primary (Boot) disk controller is:

ISA slots P11 and P12
PCI slot P2 and P3 (first PCI bus)
Onboard 7895 SCSI (first PCI bus)
PCI slot P4 through P6 (second PCI bus)
PCI slot P7 through P10 (third PCI bus).

It's recommended that the BIOS be disabled on all SCSI controllers except for the controller with the boot disk drive attached (seeSymbios Configuration Utility in Chapter 3, " Configuring Your System". This saves memory address resources and provides control over the boot device independent of board slot locations.

2. Additional IRQs can be made available as follows:

Disabling Comm Port 1 = IRQ4 is available
Disabling Comm Port 2 = IRQ3 is available
Disabling Parallel Port = IRQ7 is available.

3. A maximum of five LAN channels consisting of any combination of single or dual channel. Install PCI LAN card in the first available PCI slot from the top.

4. A maximum of four SCSI controllers may be installed. Install the first controller card in PCI slot #31 and the second controller in PCI slot #32.

Installing an Option Board

Install an option board as follows.

1. Power off the system and remove the top cover as described earlier in this chapter.

   Note: Observe static precautions. Use an antistatic wrist strap.

2. Remove the option board from its protective wrapper, holding the board only by the edges. Do not touch the board components or the gold connectors.
3. Record the option board serial number in the equipment log.
4. Set any board jumpers or switches as described in the documentation that comes with the option board.

   Note: Refer to the documentation accompanying the option board for information on whether the board is to be installed in a PCI or ISA expansion slot.

5. If the PCI board has a handle attached to one end, remove the handle (see Figure 4-13).

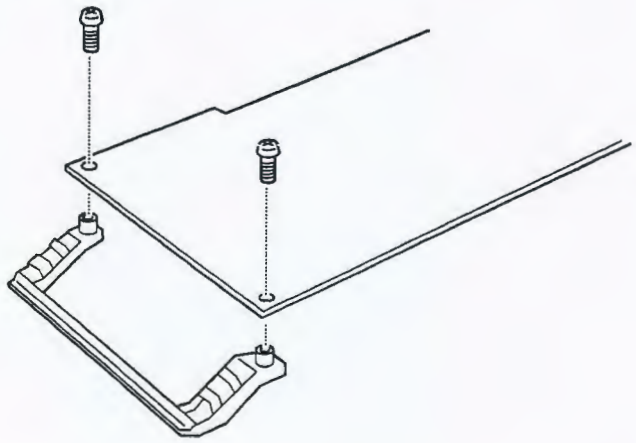


Figure 4-13. Removing the Board Handle

6. See Table 4-1 to determine the recommended option board slot assignment and configuration parameters. See Figure 4-12 to determine system board slot locations.
7. Determine the expansion slot cover that corresponds to the desired expansion slot. Release the cover lock by pressing on the cover tab and remove the expansion slot cover (see Figure 4-14).

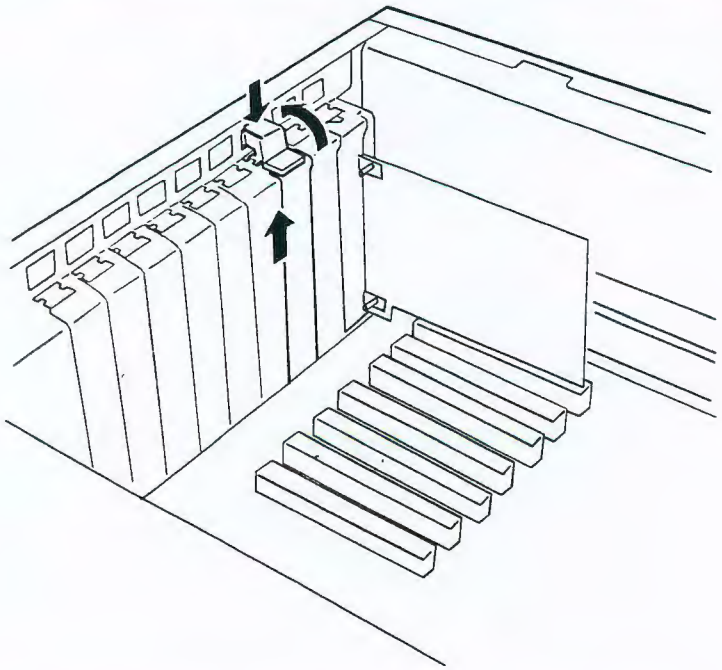


Figure 4-14. Removing the Expansion Slot Cover

8. Holding the board by its top edge or upper corners, firmly press the board into an expansion slot on the system I/O board. The tapered foot of the option board retaining bracket must fit into the mating slot in the expansion slot frame.
9. The retaining bracket fits into the space that was occupied by the expansion slot cover. Secure the expansion board by pushing down on the cover tab (see Figure 4-15).
10. If you have installed a SCSI host adapter board, go to Appendix A, "Cabling," for procedures on cabling these boards into the system. For all other boards, continue with step 11.

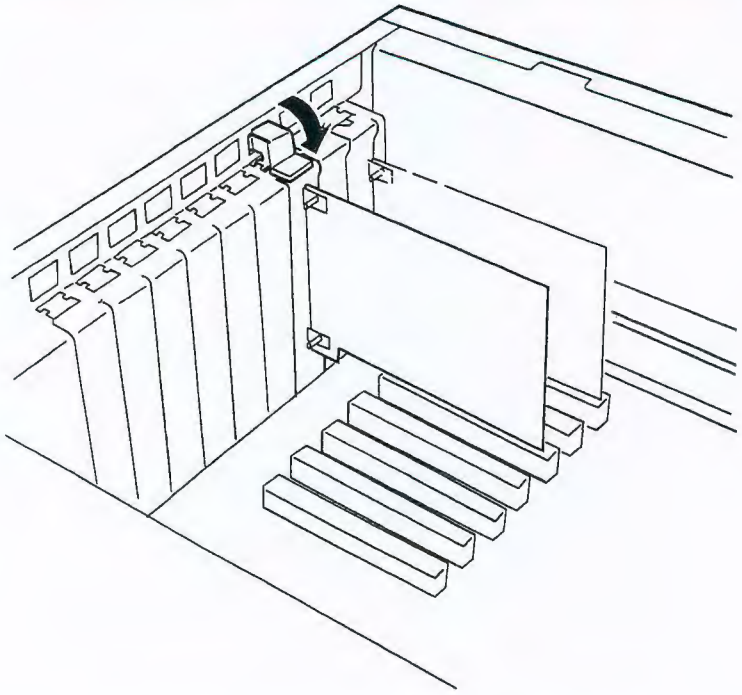


Figure 4-15. Installing an Option Board

11. Connect any external cables (if they are needed) to the installed option board.
12. Replace the top cover and power on the system.

Removing an Option Board

> ***Note:*** Expansion slot covers must be installed on all vacant slots to maintain the electromagnetic emissions characteristics of the system and to assure proper cooling of the system components.

1. Power off the system and remove the top cover as described earlier.
2. Unplug any cables attached to the option board you are removing.
3. Determine the expansion slot retaining bracket that corresponds to desired expansion slot and release the cover lock by pressing on the cover tab (see Figure 4-14).
4. Hold the board at each end, and carefully rock it back and forth until the edge connectors pull free. Make sure that you do not scrape the board against other components.
5. Remove the board from the expansion slot and place it in an antistatic wrapper.
6. If you are replacing a board, go to "Installing an Option Board," otherwise continue.
7. Install an expansion slot cover over the vacant slot. Secure the cover by pushing down on the cover tab (see Figure 4-15).
8. Replace the top cover and power on the system.

9. If you removed an non-Plug-and-Play ISA option board, run the BIOS Setup Utility to remove the ISA board configuration.

Power Supply

The following sections provide procedures for installing an additional power supply, removing a power supply, or swapping out a faulty power supply.

Installing a Power Supply

Use this procedure to add the optional power supply to your system.

1. Power off the system.
2. The empty power supply expansion bay has a blank cover. If you are installing the optional power supply, remove the two screws securing the blank cover (see Figure 4-17, B).
3. Slide the new power supply into the chassis and tighten the thumbscrews (see Figure 4-16. A) that secures the power supply.
4. Connect the power cord to the AC wall outlet and to the input receptacle on the rear of the new power supply.
5. Power on the system.

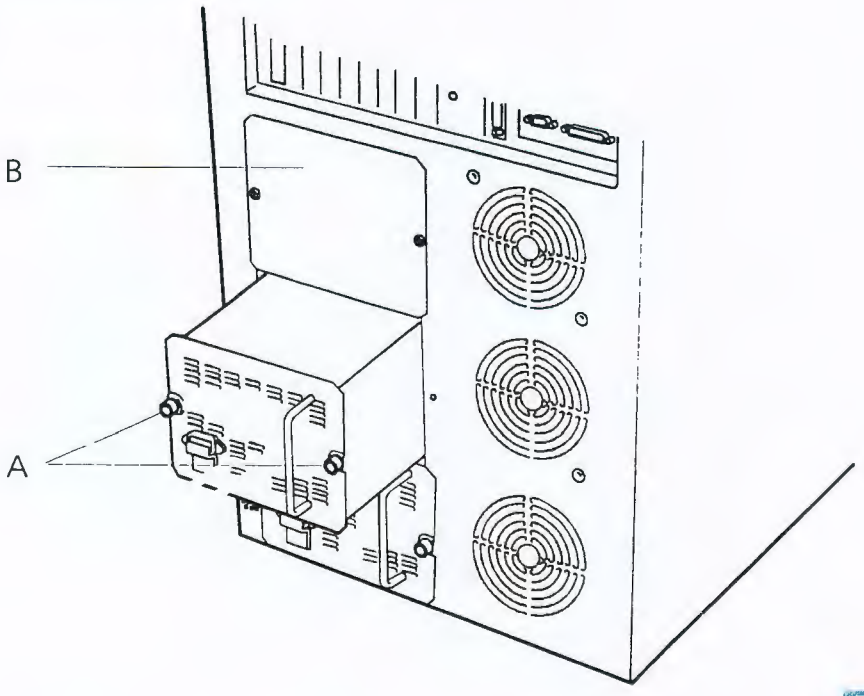


Figure 4-16. Power Supply

Removing a Power Supply

If both LED indicators on a power supply are lit, it's recommended that power to the system be turned off before removing the power supply. To remove a power supply, perform the following steps.

1. Power off the system.
2. Unplug the power cord from the AC wall outlet and from the input receptacle on the rear of the power supply you are removing.
3. Loosen the thumb lock screws (see Figure 4-16, A) that secure the power supply.
4. Hold the handle on the power supply and pull the power supply out of the system.
5. If you are replacing a power supply, go to "Installing a Power Supply," otherwise power on the system.

Hot-Swapping a Power Supply

If you are swapping out a faulty power supply, you can pinpoint which one to remove by checking the status LED indicators on each supply. If either or both of the LED indicators are off, the power supply can be hot-swapped.

If both LED indicators on a power supply are lit, it's recommended that power to the system be turned off before removing the power supply. To remove a power supply, perform the following steps.

1. Unplug the power cord from the AC wall outlet and from the input receptacle on the rear of the power supply.
2. Loosen the thumb lock screws (see Figure 4-16, A) that secure the power supply you want to replace.
3. Hold the handle on the power supply and pull the power supply out of the system.
4. Slide the replacement power supply into the chassis and tighten the thumbscrews (see Figure 4-16, A) that secure the power supply.
5. Connect the power cord to the AC wall outlet and to the input receptacle on the rear of the new power supply.

Removable Media Devices

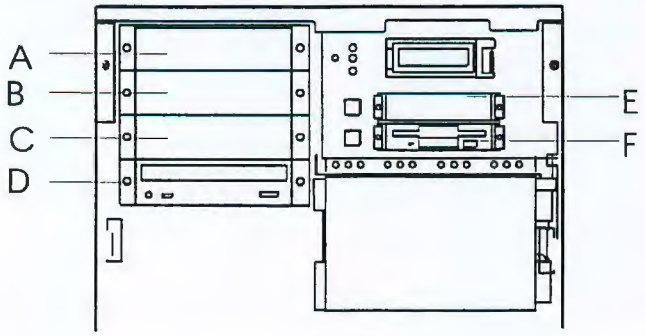
A CD-ROM drive is always mounted in bay D. Any SCSI removable media devices can be installed in peripheral bays A, B, and C. The SCSI devices should be installed in the first available bay from the bottom (bay D).

Figure 4-17 illustrates the recommended removable media configuration. The bays are intended to hold tape, CD-ROM, or other removable media drives. Narrow SCSI drives in the 5 1/4-inch bays receive control signals from channel 1 of the SCSI-3 controller on the system I/O board.

> **Note:** The SCSI termination resistors must be installed in the last SCSI drive of the daisy chain cabling (bottom media bay D). All other devices must have terminators removed.

Hard disk drives cannot be installed in a 5 1/4-inch external bay because the drive generates EMI, is more susceptible to ESD, and does not have sufficient cooling.

A 1.44 MB diskette drive is always mounted in bay F. A second 3 1/2-inch device can be installed in bay E.



Removable Media Device Bays

A. 5 1/4-inch expansion bay
B. 5 1/4-inch expansion bay
C. 5 1/4-inch expansion bay
D. CD-ROM drive
E. 3 1/2-inch expansion bay
F. 1.44 MB diskette

Bay A Removable media narrow SCSI device. Device must have the internal SCSI terminators **removed.**
BAY B Removable media narrow SCSI device. Device must have the internal SCSI terminators **removed.**
Bay C Removable media narrow SCSI device. Device must have the internal SCSI terminators **removed.**
Bay D SCSI CD-ROM (always installed). Device must have the internal SCSI terminators **installed.**
Bay E Second 3 1/2-inch device.
Bay F 1.44 MB diskette drive (always installed).

Figure 4-17. Removable Media Device Bays

Installing a 5 1/4-Inch Device or 3 1/2-Inch Diskette Drive

Install a 5 1/4-inch device or 3 1/2-inch diskette drive as follows.

⚠ CAUTION

CD-ROM devices contain a laser system and are classified as CLASS 1 LASER PRODUCTS. In case of any trouble with a CD-ROM, please contact your nearest service representative. To prevent direct exposure to the laser beam, do not try to open the enclosure.

Use of controls or adjustments or performance of procedures other than those recommended by the manufacturer may result in hazardous radiation exposure.

Note: If you are replacing a diskette drive in Bay F or installing a diskette drive in bay E, use the internal diskette drive cables provided with the system. If you are installing a SCSI device in bays A, B, or C, you must use the internal SCSI cables. Contact your sales representative or dealer for a list of approved optional peripheral devices.

1. Power off the system. Remove the left front door and the top cover as described earlier.
2. Each empty media or diskette drive bay has a blank panel tray. From the bay where you want to install a drive, remove the two screws securing the blank panel tray to the chassis (see Figure 4-18).

   Note: When installing a full height 5 1/4-inch device, remove two blank panels.

3. Grasp the blank panel tray and slide it out of the bay.
4. Remove the two screws securing each side rail to the blank panel tray (see Figure 4-19).
5. Save the blank panel tray and screws to reuse if you remove a drive from a bay later and do not reinstall one.

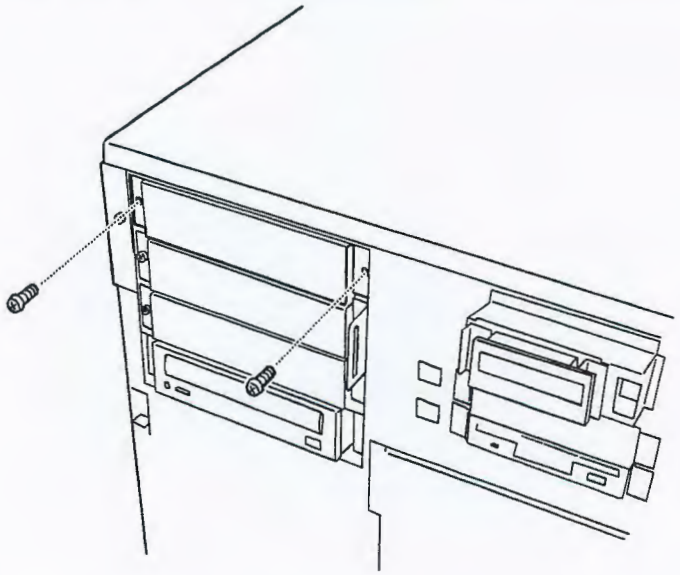


Figure 4-18. Removing Blank Panel Tray

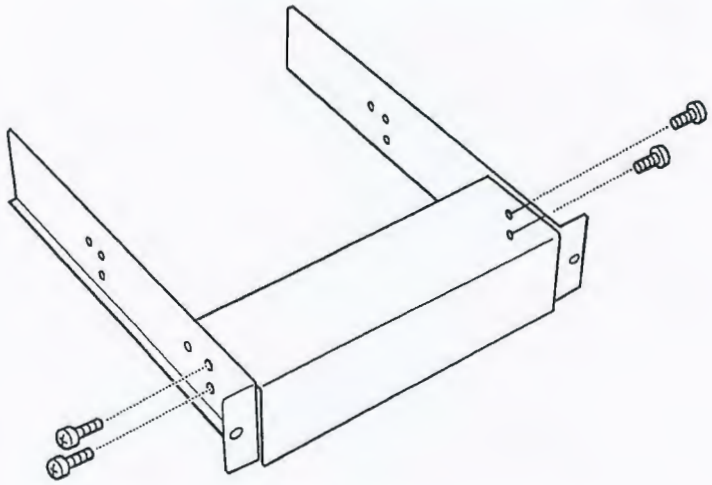


Figure 4-19. Removing Side Rails

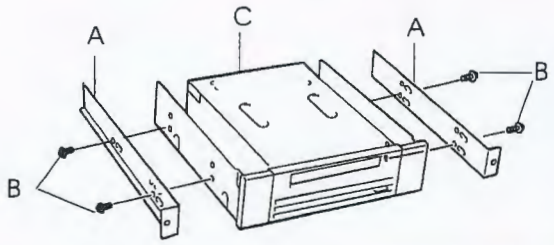
6. Remove the device from its protective wrapper and place it on an antistatic surface. Record the drive model and serial number in the equipment log.

7. Set any device jumpers or switches on the device. Refer to the installation procedures that come with the device.

> ***Note:*** SCSI termination resistors for the 5 1/4-inch devices must be installed in the last SCSI device of the daisy chain cabling (bottom media bay D). All other 5 1/4-inch devices must have terminators removed.

8. Using the four screws supplied with the drive, reinstall the side rails just removed from the blank panel tray (see Figure 4-20, A).

Note: Do not use the screws used to secure the blank panel tray.



Attaching side rails to removable media drive

A Side rails

B Four drive mounting screws

C Drive

Figure 4-20. Attaching Side Rails to a Device

9. Engage the device side rails into the bay guide rails (see Figure 4-21). Ensure that the device side rails (see Figure 4-22, A) are inside the bay guide rails exactly as shown in Figure 4-22, B.

10. Push the drive into the bay until the screw holes of the side rails are directly in front of the chassis screw holes and secure with the screws previously removed.

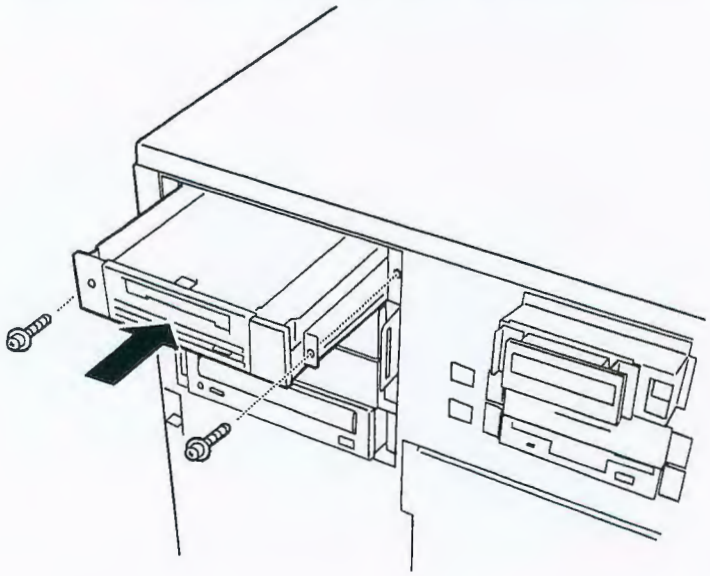


Figure 4-21. Installing a Device

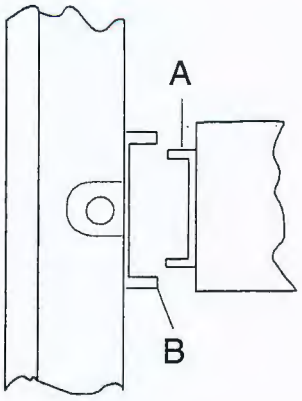


Figure 4-22. Engaging the Device Side Rails to the Bay Guide Rails

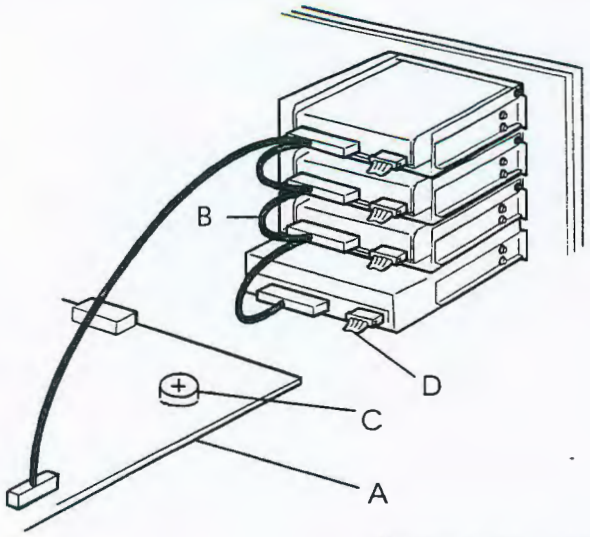
11. Connect a power cable to the back of the drive (see Figure 4-23).

> ***Note:*** For 5 1/4-inch devices, power cables are provided in the chassis for removable 5 1/4-inch media drives (including the CD-ROM that is factory-installed). These power cables are interchangeable for 5 1/4-inch devices only; you can connect any one of them to any device you install in the 5 1/4-inch media bays. The connectors are keyed and can be inserted in only one way.
>
> For 3 1/2-inch diskette drives power cables are provided in the chassis (including the diskette drive that is factory-installed). The connectors are keyed and can be inserted in only one way.

12. Connect the data cable (see Figure 4-23) to the device; the SCSI connector is keyed and can be inserted only one way.

> ***Note:*** For the 5 1/4-inch devices, be certain that you are using the 50-pin SCSI data cable. This cable comes from the system I/O board to the removable media bays and ends at the CD-ROM drive in bay D. Do not confuse this cable with the 34-pin diskette drive cable which begins on the system I/O board and ends at the diskette drive in bay F.

13. Reinstall the top cover and the left front door. Power on the system.



A System I/O board
B Signal cable
C Battery
D Power cable

Figure 4-23. Installing Device Cables

Removing a 5 1/4-Inch Device or 3 1/2-Inch Diskette Drive

Remove a 5 1/4-inch device or a 3 1/2-inch diskette drive as follows.

1. Power off the system. Remove the left front door and the top cover as described earlier in this chapter.
2. Disconnect the signal and power cables from the back of the drive (see Figure 4-23).
3. Remove the two screws securing the device to the front of the chassis (see Figure 4-21).
4. Slide the drive out the front of the bay, and place on an antistatic surface.
5. Remove and save the side rails and screws (see Figure 4-20).
6. Place the drive in an antistatic wrapper.
7. Cover an empty bay by installing a blank panel tray in the bay (see Figure 4-18 and 4-19).
8. Reinstall the top cover and the left front door. Power on the system.
9. Remove the drive serial number from the equipment log.

Hard Disk Drives

The following sections provide procedures for installing an additional disk drive, removing a disk drive, or swapping out a faulty disk drive from one of the three hot-swap drive cages. The 3 1/2-inch SCSI drives must use the industry standard 80-pin Single Connector Attachment (SCA) connector. Each drive must be installed in a carrier.

> ***Note:*** To order a carrier, contact your sales representative or dealer.

- If installing new drives, follow an installation scheme starting with the bottom left drive. Fill the cages in the sequence shown in Figure 4-24.
- If an individual SCSI drive fault LED (yellow light) is on steadily, this indicates that the drive below it has been flagged as faulty. Follow the procedure described in this section to remove the faulty drive and swap in a good one.

> ***Note:*** **Swap SCSI drives without turning off power.** This is one of the few system procedures that is safe to do with the system power left on. This is true only if a Redundant Array of Independent Disks (RAID) controller module is installed and only for the drive/carrier assemblies in the hot-swap cages, *not for drives in any other bays.*

> ***Note:*** ESD can damage disk drives, boards, and other parts. This system can withstand normal levels of environmental ESD while you are hot-swapping SCSI hard drives. However, we recommend that you do all procedures in this chapter only at an ESD workstation or provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground (any unpainted metal surface) on your system when handling parts.

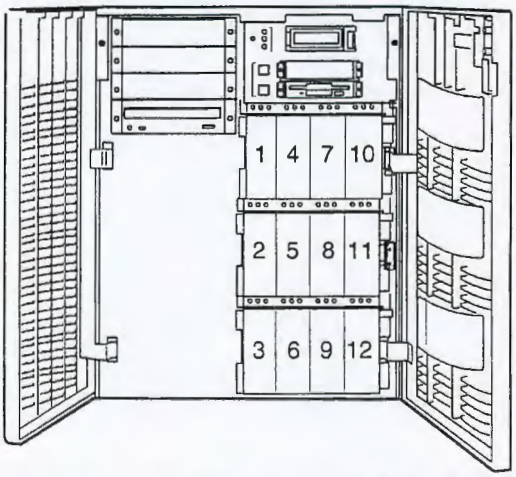
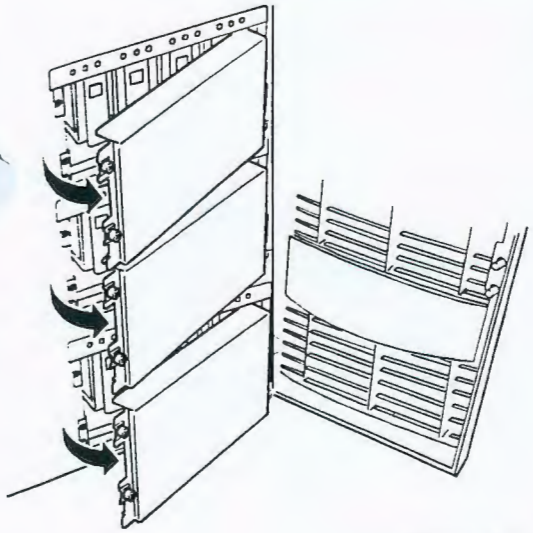


Figure 4-24. Hard Drive Installation Sequence

Installing a Hard Drive

Use this procedure to add an optional hard drive to your system.

1. Power off the system. If locked, unlock and open the right front door.
2. Referring to Figure 4-24, determine which hard drive cage will contain the new hard drive. Open the EMI metal panel in front of the hard drive cage by turning its two thumb lock screws counter clockwise (see Figure 4-25).
3. The hard drive cage has four slots for mounting the hard drives. Confirm which slot of the hard drive cage the hard drive will be mounted. The SCSI ID (0 through 3) is determined by the slot number from left to right.



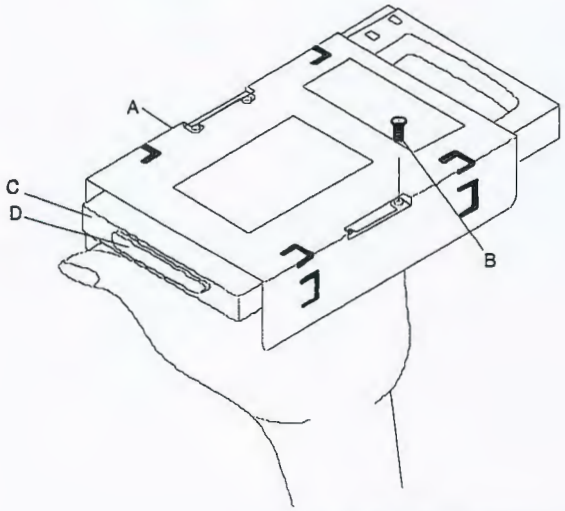
Three hard drive cages

(EMI panel and exterior door shown open)

Figure 4-25. Hard Disk Drive Cages

Note: Observe static precautions. Use an antistatic wrist strap.

4. The drive carrier is shipped with the add-on drive. Remove the new drive from its protective wrapper and place it on an antistatic surface. Record the drive model and serial numbers in the equipment log.
5. Position the drive so its SCA connector is near the top surface of the drive. Place the drive on the antistatic surface again. Slide the drive into the carrier with its SCA connector facing toward the front of the carrier (open end).
6. While holding the drive in the carrier with your left hand, align the drive's screw holes with the carrier's screw holes and insert the four screws of appropriate size and length (see Figure 4-26).
7. Pressing the lock button on the carrier handle, open the handle. Align the drive/carrier assembly so it engages the guide rails in the hard drive cage (see Figure 4-27).



Installing 3 1/2inch hard disk drive in carrier for hot-swap bays

A Carrier

B Four screws

C Hard disk drive

D SCA connector

Figure 4-26. Installing Hard Disk in Carrier

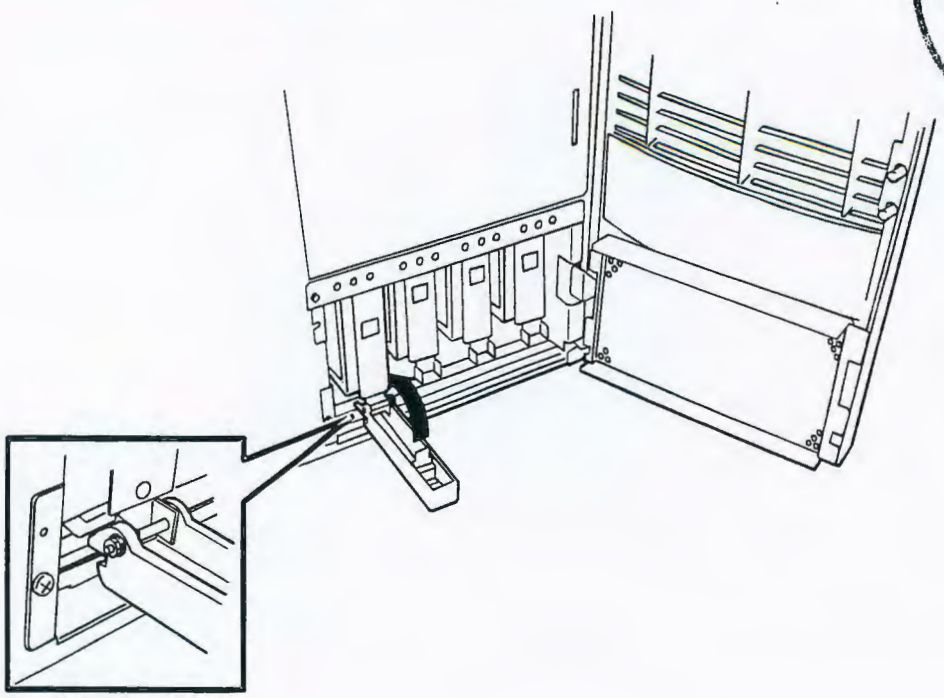


Figure 4-27. Installing Carrier in the System

8. Gently push the assembly into the bay until the drive docks with the backplane connector. Be sure the hook on the bottom of the handle engages the chassis frame and slowly lift the handle. You should hear a click when the handle locks in place.
9. Close the EMI metal panel, and secure with the two thumbscrews.
10. Power on the system and close the front door.

Removing a Hard Drive

Use this procedure to remove a hard drive from your system.

1. Power off the system. If locked, unlock and open the right front door.
2. Determine which hard drive cage contains the hard drive you want to remove. Open the EMI metal panel in front of the hard drive cage by turning its two thumb lock screws counter clockwise (see Figure 4-25).
3. The hard drive cage has four hard drive slots. Confirm which slot of the hard drive cage contains the hard drive to be removed.
4. Grasp the handle of the hard disk's carrier and press down on its thumb-release button (see Figure 4-28).
5. Remove the hard disk and place it in an antistatic wrapper. Close the EMI metal panel, and secure with the two thumbscrews.
6. Power on the system and close the front door.

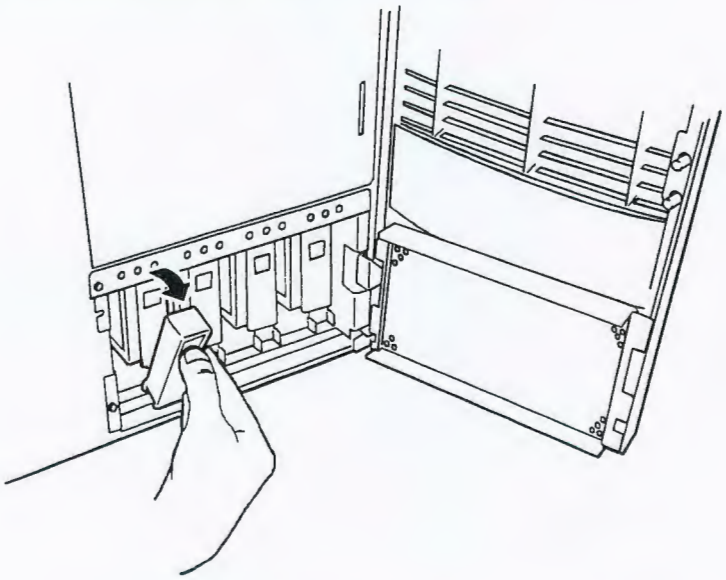


Figure 4-28. Removing the Hard Disk Carrier

Hot-Swapping a Hard Drive

If you are swapping out a faulty hard drive, you can pinpoint which drive to remove by checking the status LEDs that occur in sets of three above each of the four drive bays. See "Status LED Indicator Descriptions" in Chapter 1.

> ***Note:*** When the SCSI drive fault LED indicates a drive fault (steady yellow light), you can remove the drive and swap in a replacement at any time when the drive is not being accessed, without needing to power down the system. However, drive manufacturers caution against moving a drive that is still spinning because of possible damage to the drive.

1. If locked, unlock and open the right front door.
2. Determine which hard drive cage contains the faulty hard drive. Open the EMI metal panel in front of the hard drive cage by turning its two thumb lock screws counter clockwise (see Figure 4-25).
3. The hard drive cage has four hard drive slots. Check all the drive LEDs to confirm which drive to remove. See "Status LED Indicator Descriptions" in Chapter 1.

> ***Note:*** Depending on the drive fault, the drive may be still spinning when you remove it. Follow the next step exactly when removing drives.

4. Grasp the handle of the hard disk's carrier and press down on its thumb-release button (see Figure 4-28). Pull the faulty drive out of the bay far enough to disengage the drive connector from the backplane. Wait 30 seconds until the drive spins down, then remove the drive from the drive bay.

> ***Note:*** Observe static precautions. Use an antistatic wrist strap.

5. Place the removed hard drive on an antistatic surface.
6. Remove the replacement drive from its protective wrapper and place it on an antistatic surface. If a drive carrier was not shipped with the replacement drive, remove the carrier from the removed drive.
7. Place the removed hard drive in an antistatic wrapper.
8. Position the replacement drive so its SCA connector is near the top surface of the drive. Place drive on the antistatic surface again. Slide the drive into the carrier with its SCA connector facing toward the front of the carrier (open end).
9. While holding the drive in the carrier with your left hand, align the drive's screw holes with the carrier's screw holes and insert the four screws of appropriate size and length (see Figure 4-26).
10. Pressing the lock button on the carrier handle, open the handle. Align the drive/carrier assembly so it engages the guide rails in the hard drive cage (see Figure 4-27).

11. Gently push the assembly into the bay until the drive docks with the backplane connector. Be sure the hook on the bottom of the handle engages the chassis frame and slowly lift the handle. You will hear a click when the handle locks in place.

12. Close the EMI metal panel, and secure with the two thumbscrews.

13. Close the front door.

5

Problem Solving

- Resetting the System
- Troubleshooting Checklists
- Diagnostic Testing
- Specific Problems and Corrective Actions
- Error Messages
- Error Code Hardware Reference
- Status LED

This chapter helps you identify and solve problems that may occur during system installation or while using your system. The first section of this chapter tells you how to reset your system in the event of problems. The next few sections provide troubleshooting checklists and procedural steps that help you isolate specific system problems. The last sections include error message and status LED information.

⚠ WARNING

The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, 5 VDC is present on the system board whenever AC power cords are connected to the system. Before doing the following procedures, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

Resetting the System

There are two ways to reset the system.

Reset button

Pushing the reset button located on the rear panel (see Figure 3-1) clears the system memory, restarts the POST, and reloads the operating system.

Power off/on

Turning the power off and then on with the push-button switch on the front panel has the same effect as pushing the reset button, except that power is halted to all peripherals.

Troubleshooting Checklists

The following paragraphs provide troubleshooting checklists for problems that occur at initial system startup, when you run new application software, and after the system hardware and software were running correctly.

Initial System Startup

Problems that occur at initial system startup are usually caused by incorrect installation or configuration. Hardware failure is a less frequent cause. If you have problems during initial system startup, check the following.

- Are the system power cords properly connected to the system and plugged into NEMA 5-15R outlets (100-120 VAC) or NEMA 6-15R outlets (200-240 VAC)?
- Is AC available at the wall outlets?

- Is the power on/off push-button switch on the front panel in the ON position (power on LED should be lit)?
- Are all cables correctly connected and secured?
- Are all the PCI/ISA option boards fully seated in their connector slots on the system board?
- Are all jumper settings on the system I/O board correct? For jumper information, see Chapter 3, "Configuring Your System."
- Are all jumper and switch settings on option boards and peripheral devices correct? If applicable, ensure that there are no conflicts; for example, two option boards sharing the same interrupt, memory or I/O addresses.
- Are the processor(s) and VRMs fully seated in their slots on the system board? See Chapter 4, "Upgrading Your System," for installation procedures.
- Are all DIMMs fully seated and installed correctly? See Chapter 4, "Upgrading Your System," for installation instructions.
- Are all removable media drives and disk drives installed correctly? See Chapter 4, "Upgrading Your System."
- Is the system's hard drive properly formatted or defined?
- Is the operating system properly loaded? Refer to the operating system documentation.
- Are all drivers properly installed? For information about installing drivers, refer to your network operating system configuration guide.
- Are the configuration settings in BIOS Setup correct? For information about running these utilities, see Chapter 3, "Configuring Your System."

If the above items are all correct, but the problem reoccurs, refer to *Diagnostic Testing* in this chapter.

Running New Application Software

Problems that occur when you run new application software are usually related to the software. Faulty equipment is much less likely, especially if other software runs correctly. If you have problems while running new application software, check the following.

- Does the system meet the minimum hardware requirements for the software? Refer to the software documentation.
- Is the software an authorized copy? Unauthorized copies often do not work. Obtain an authorized copy of the software.
- If you are running the software from a floppy disk, is it a good copy?

- If you are running the software from a hard disk drive, is the software correctly installed? Were all necessary procedures followed and files installed?
- Are the correct device drivers installed?
- Is the software correctly configured for the system?
- Are you using the software correctly?
- Try a different copy of the software to see if the problem is with the copy you are using.
- If other software runs correctly on the system, contact your vendor about the failing software.

If the problems persist with the software, contact the software vendor's customer service representative.

After System Has Been Running Correctly

Problems that occur after the system hardware and software have been running correctly often indicate equipment failure. However, many situations that are easy to correct can also cause such problems. If you have problems after the system has been running correctly, check the following.

- If you are running the software from a floppy disk, try a new copy of the software.
- If you are running the software from a hard disk drive, try running it from a floppy. If the software runs correctly, there may be a problem with the copy on the hard disk. Reinstall the software on the hard disk drive and try running it again. Make sure all the necessary files are installed.
- If the problem recurs, you may need to reformat the hard disk drive. The drive, drive controller, or system boards may be defective.
- If the problems are intermittent, there may be a loose cable, dirt in the keyboard (if keyboard input is incorrect), a marginal power supply, or other marginal component failures.
- If you suspect that a transient voltage spike, power outage, or brownout might have occurred, reload the software and try running it again. Symptoms of voltage spikes include a flickering video display, unexpected system reboots, and the system not responding to user commands.

> ***Note:*** Voltage spikes can corrupt or destroy data files on the drive. If you are experiencing voltage spikes on the power line, install a surge suppresser between the power outlet and the system power cords.

If the problem recurs after you have checked and corrected all of the above items, refer to *Diagnostic Testing* in this chapter.

Preparing Your System for Upgrade

Have the following tools available:

- Phillips screwdriver (#1 bit and #2 bit)
- flat-head screwdriver
- small needle nose pliers
- pen or pencil
- utility knife
- ESD workstation or antistatic wrist strap (recommended)
- IC removal tool.

Equipment Log

Use the equipment log form located at the end of this guide to record the model and serial number of your system, all installed options, and any other pertinent information specific to your system. You need this information when configuring your system.

Diagnostic Testing

This section provides a more detailed approach to identification of a system problem and locating its source.

Error Checking

Each time you turn on the system, POST runs automatically and checks the system boards, processors, memory, keyboard, and most installed peripheral devices.

If POST finds an error, it displays an error message. Refer to the *Error Message* section in this chapter for an explanation of each error message.

Troubleshooting Guide

Use the following troubleshooting procedures to help you identify a problem. These general procedures lead you through the following:

- Preparing the system for diagnostic testing
- Monitoring POST while it is running
- Verifying proper operation of key system LEDs
- Confirming loading of the operating system.

Preparing the System for Diagnostic Testing

To prepare the system for diagnostic testing, perform the following:

> ***Note:*** Before disconnecting any peripheral cables from the system, turn off the system and any external peripheral devices. Failure to do so can cause permanent damage to the system and/or the peripheral devices.

1. Turn off the system and all external peripheral devices. Disconnect all devices from the system except the keyboard and video monitor.
2. Make sure the system power cords are plugged into a properly grounded AC outlets.
3. Make sure your video display monitor and keyboard are correctly connected to the system. Turn on the video monitor. Set its brightness and contrast controls to at least two-thirds of their maximum ranges (refer to the documentation supplied with your video display monitor).
4. If the operating system normally loads from the hard disk drive, make sure there is no diskette in drive A. Otherwise, place a diskette containing the operating system files in drive A.
5. Turn on the system. If the power indicator LED does not light, refer to *Power Light Does Not Light* found later in this chapter.

Monitoring POST While Running

Each time you turn on the system, POST runs automatically and checks the system board, CPU, memory, keyboard, and most installed peripheral devices.

During the memory test, POST displays the amount of memory that it is able to access and test. Depending on the amount of memory, it may take several minutes to complete the memory test. When the memory test completes. the following is displayed:

```
Press <F2> to enter SETUP
```

Press **<F2>** if you want to run BIOS Setup. When the utility appears, follow the instructions on your monitor to configure BIOS. See Chapter 3, "Configuring Your System." If you do not press **<F2>**, the above message remains for a few seconds and the boot process continues.

When this message appears:

```
Press Ctrl-C to start the Symbios Configuration Utility
```

Press **<Ctrl+C>** if you want to configure SCSI devices in your system. When the utility appears, follow the instructions on your monitor to configure the SCSI host adapter settings and run the SCSI disk utilities. See Chapter 3. "Configuring Your System." If you choose not to run the Symbios Configuration Utility, the boot process continues.

If POST finds an error, it displays an error message. This information is useful to your service representative. Refer to the *Error Message* section in this chapter for an explanation of each error code.

The BIOS indicates errors by writing an error code to the PS/2-standard logging area in the Extended BIOS Data Area, and by displaying a message on the screen, which is sometimes preceded by the POST Error Code. The error code will also be logged to the Event Logging area.

Verifying Proper Operation of Key System Indicators

As POST determines the system configuration, it tests for the presence of each mass storage device installed in the system. As each device is checked, its activity indicator should turn on briefly. Check for the following.

- Does the diskette drive activity indicator turn on briefly. If not, refer to Diskette *Drive Activity Indicator Does Not Light* in this chapter.
- If a second diskette drive is installed, does its activity indicator turn on briefly. If not, refer to *Diskette Drive Activity Indicator Does Not Light* in this chapter.
- If there is a hard disk drive or SCSI devices installed in the system, does the hard disk drive activity indicator turn on briefly. If not, refer to *Hard Disk Drive Activity Indicator Does Not Light* in this chapter.

Confirming Loading of the Operating System

Once the system boots up, the operating system prompt appears on the screen. The prompt varies according to the operating system. If the operating system prompt does not appear, refer to *Running New Application Software* in this chapter.

Specific Problems and Corrective Actions

This section provides possible solutions for the following specific problems:

- Power LED does not light
- System cooling fans do not rotate
- No characters appear on screen
- Characters on the screen appear distorted or incorrect
- Floppy disk drive access LED does not light
- Hard disk drive access LED does not light
- Problems with application software.

Try the solutions in the order given. If you cannot correct the problem, contact your service representative for assistance.

Power LED Does Not Light

Check the following.

- Is the system operating normally? If so, the power LED is probably defective.
- Are there other problems with the system? If so, check the items listed under *System Cooling Fans Do Not Rotate*.

System Cooling Fans Do Not Rotate

> ***Note:*** In addition to the cooling fans that are an integral part of each power supply, the system has six internal fans. The six fans are redundant in configuration. This means if one fan fails, its associated fan changes its rotating speed to high. There are no serviceable components inside the power supply. If the power supply is opened, the manufacturer's warranty is voided.

Check the following.

- Is AC power available at the wall outlet?
- Are the system power cords properly connected to the system and the AC wall outlets?

- Are the power supply LED status lamps on each supply lit? If either LED on a supply is off, the power supply is defective and must be replaced.
- Is the power connector for the cooling fan connected to the system I/O board (option board fan) and the CPU base board (CPU fans)?
- Is the front panel power on indicator lit? If this LED is amber, a defective power supply is indicated.

If the switches and connections are correct and the power outlet is functioning, a power supply has probably failed. Contact your service representative for assistance.

No Characters Appear On Screen

Check the following.

- Is the riser card fully seated in the system I/O board connector? The riser card is the small card that the mouse and keyboard plug into.
- Is the video display plugged in and turned on?
- Are the brightness and contrast controls properly adjusted?
- Are the video display switch settings correct?
- If you are using an option video controller board, verify that the video controller board is fully seated in the system board connector.
- Is the video display signal cable properly installed?

If there are still no characters on the screen after you check the above, contact your service representative or authorized dealer for assistance.

Characters are Distorted or Incorrect

Check the following.

- Are the brightness and contrast controls properly adjusted on the video display? Refer to the documentation supplied with your video display.
- Are the video display signal and power cables properly installed?
- If the problem persists, the video display may be faulty or it may be the incorrect type. Contact your service representative for assistance.

Floppy Disk Drive Activity LED Does Not Light

Check the following.

- Are the floppy disk drive power and signal cables properly installed?
- Are all relevant switches and jumpers on the floppy disk drive set correctly?
- Is the floppy disk drive properly configured in BIOS Setup?

If you are using the onboard floppy disk controller, use BIOS Setup to make sure that Onboard Floppy is set to Enabled. Conversely, to use an optional fixed/floppy disk controller, make sure that Onboard Floppy is set to Disabled. For information about running BIOS Setup, see Chapter 3, Configuring Your System."

If the problem persists, there may be a problem with the floppy disk drive, system I/O board, or drive signal cable. Contact your service representative for assistance.

Hard Disk Drive Activity LED Does Not Light

If you have installed one or more hard disk drives in your system. check the following.

- Is the optional disk controller board fully seated in the system I/O board connector?
- Is the disk drive seated properly?
- Are the jumpers on the system I/O board set correctly?

If you received error messages, refer to the *Error Message* section for information about error messages.

If the problem persists, there may be a problem with the hard disk drive, the optional controller board, system I/O board, drive signal cable, or LED

Error Messages

The server status is displayed in 16 digits of alphanumeric characters on the liquid crystal display (LCD) on the front of the server. Use this indication together with the status LED indications to solve problems that may occur while using your system.

> ***Note:*** Record the indication of LCD before contacting your service representative. An alarm indication is useful when maintaining the server.

Alarm Indication during POST

Each time you turn on the system, POST runs automatically. During POST, the test that is being executed is displayed on the LCD. If the same code has been displayed for more than 5 minutes, an occurrence of fatal error is assumed. Record the code displayed on LCD, then contact your service representative.

When an alarm that restricts operation (such as degradation function) or that can be recovered by re-setup has occurred, an error code is displayed on the LCD. (An error message is also displayed on the display unit and the error is recorded in the Event Log.)

Table 5-1 lists the error codes and messages you may see during POST.

Table 5-1. POST Error Codes and Messages

Error Code and Message		Explanation	Action
0200	Failure Fixed Disk	Hard disk failure	Replace the hard disk.
0210	Stuck Key	The key is kept on pressed.	Stop pressing the key.
0211	Keyboard error	Keyboard error	Replace the keyboard.
0212	Keyboard Controller Failed	Keyboard controller failed.	Replace the keyboard.
0213	Keyboard locked – Unlock key switch	Keyboard is locked.	Start BIOS Setup to set up the keyboard correctly.
0220	Monitor type does not match CMOS – Run SETUP	The display unit is incorrectly setup.	Start BIOS Setup to set up the monitor correctly.
0230	System RAM Failed at offset	System RAM error. Offset address	Ask you customer service representative to replace memory module.
0231	Shadow RAM Failed at offset	Shadow RAM error. Offset address	Ask you customer service representative to replace memory module.
0232	Extended RAM Failed at address line	Extended RAM error. Offset address	Contact your customer service representative.
0233	Memory type mixing detected	Memory devices of different types are installed.	Install correct memory devices.
0234	Single-bit ECC error	A 1-bit memory error occurred.	Contact your customer service representative.

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0235	Multiple-bit ECC error occurred	A multi-bit memory error occurred.	Contact your customer service representative.
0250	System battery is dead – Replace and run SETUP	No system battery is installed.	Install the battery. (After restarting the computer, start the BIOS Setup Utility to set required values again.)
0251	System CMOS checksum bad – Default configuration used	Checksum of system CMOS is not correct.	The default values were set. Start the BIOS Setup Utility to set required values again.
0260	System timer error	System timer error	Contact your customer service representative.
0270	Real time clock error	Realtime lock error	Contact your customer service representative.
0271	Check date and time setting	Realtime clock is set incorrectly.	Start the BIOS Setup Utility to set the time again. If the same error occurs still, contact your customer service representative.
0280	Previous boot incomplete – Default configuration used	The previous activation has not been terminated normally.	Correct the setup values by using the BIOS Setup Utility and start the system again.
02B0	Diskette drive A error	Error in floppy disk A	Contact your customer service representative.
02B1	Diskette drive B error	Error in floppy disk B	Contact your customer service representative.
02B2	Incorrect Drive A type – run SETUP	The type of drive A is incorrect.	Start the BIOS Setup Utility to set required values again.
02B3	Incorrect Drive B type – run SETUP	The type of drive B is incorrect.	Start the BIOS Setup Utility to set required values again.
02D0	System cache error – Cache disabled	System cache error	No cache can be used. Contact your customer service representative.
0B1B	PCI System Error on Bus/Device/Function	A PCI system error occurred in bus/device/function.	Contact your customer service representative.
0B1C	PCI Parity Error on Bus/Device/Function	A PCI parity error occurred in bus/device/function.	Contact your customer service representative.
0B22	CPUs are installed out of order	CPUs are installed in incorrect order.	This does not indicate an error. However, change the slot in which the CPU is installed.
0B30	Fan 1 Alarm occurred.	Memory cooling fan error	Check whether the fan is clogged. Clean it if the fan is covered with dust. If no error is found or the failure is cleared in spite of cleaning, contact your customer service representative.
0B31	Fan 2 Alarm occurred.	Memory cooling fan error	Follow 0B30 "Action."

0B32	Fan 3 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."
0B33	Fan 4 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."
0B34	Fan 5 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."
0B35	Fan 6 Alarm occurred.	CPU cooling fan error	Follow 0B30 "Action."

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0B36	Fan 7 Alarm occurred.	Optional board cooling fan error	Check whether the fan is clogged. Clean it if the fan is covered with dust. If no error is found or the failure is cleared in spite of cleaning, contact your customer service representative.
0B40	Invalid System Configuration Data	System configuration data is damaged.	Start the BIOS Setup Utility to set the time again. If the same error reoccurs, contact your customer service representative.
0B41	System Configuration Data Read error	Read error on the data configuring the system	Ask your customer service representative for System I/O board replacement.
0B42	Resource Conflict	The PCI board resource is not properly mapped.	Start the BIOS Setup Utility for reset. If the same error reoccurs, contact your customer service representative.
0B43	WARNING: IRQ not configured	The PCI board interrupt is not properly set.	Follow OB42 "Action."
0B44	Expansion Rom not initialized	The expansion ROM on the PCI board is not initialized.	Check PCI board installation. If the same error reoccurs, ask your customer service representative for System I/O board replacement.
0B45	System Configuration Data Write Error	Write error on the data configuring the system.	Ask you customer service representative for System I/O board replacement.
0B50	CPU#1 with error taken off line.	Because an error was detected in CPU #1, it was disabled.	The CPU is disabled. Contact your customer service representative.
0B51	CPU#2 with error taken off line.	Because an error was detected in CPU #2, it was disabled.	Follow 0B50 "Action."
0B52	CPU#3 with error taken off line.	Because an error was detected in CPU #3, it was disabled.	Follow 0B50 "Action."
0B53	CPU#4 with error taken off line.	Because an error was detected in CPU #4, it was disabled.	Follow 0B50 "Action."
0B58	Forced to use CPU#1 with error	An error was detected in CPU#1.	The system is started forcibly though an error is detected in the CPU displayed. Contact your customer service representative.
0B59	Forced to use CPU#2 with error	An error was detected in CPU#2.	Follow 0B58 "Action."
0B5A	Forced to use CPU#3 with error	An error was detected in CPU#3.	Follow 0B58 "Action."
0B5B	Forced to use CPU#4 with error	An error was detected in CPU#4.	Follow 0B58 "Action."

0B60	DIMM group #1 has been disabled	A memory error was detected in memory board #1, bank A, . Memory is disabled. See Figure 5-3.	Contact your customer service representative.

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0B61	DIMM group #2 has been disabled	A memory error was detected in memory board #1, bank B. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B62	DIMM group #3 has been disabled	A memory error was detected in memory board #1, bank C. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B63	DIMM group #4 has been disabled	A memory error was detected in memory board #1, bank D. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B64	DIMM group #5 has been disabled	A memory error was detected in memory board #2, bank A,. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B65	DIMM group #6 has been disabled	A memory error was detected in memory board #2, bank B. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B66	DIMM group #7 has been disabled	A memory error was detected in memory board #2, bank C Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B67	DIMM group #8 has been disabled	A memory error was detected in memory board #2, bank D. Memory is disabled. See Figure 5-3.	Contact your customer service representative.
0B6F	DIMM group with error is enabled	Memory error was detected.	Errors are detected in all memory devices. Contact your customer service representative.
0B70	The error occurred during temperature sensor reading	An error was detected in the middle of detection of abnormal temperature.	Contact your customer service representative.
0B71	System Temperature out of the range	Abnormal temperature was detected.	Turn off the power once. Then check whether the fan is clogged. Clean it if the fan is covered with dust. If no error is found or the failure is cleared in spite of cleaning, contact your customer service representative.
0B74	The error occurred during voltage sensor reading	An error occurred during detection of voltage.	Contact your customer service representative.
0B75	System Voltage out of the range	Abnormal system voltage was detected.	Contact your customer service representative.
0B78	The error occurred during fan sensor reading	An error was detected during read of FAN sensor.	Contact your customer service representative.

Table 5-1. POST Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
0B7C	The error occurred during the redundant power module confirmation	An error occurred while redundant power supply was configured.	Contact your customer service representative.
0B80	IBF or OBF Check Error occurred by the access via System Management Controller	No response was issued for access to System Management Controller.	Contact your customer service representative.
0B81	System Management Controller Firmware CRC check error occurred	An error occurred in firmware of System Management Controller.	Contact your customer service representative.
0B82	Hardware error of System Management Controller occurred	A hardware error was detected in System Management Controller.	Contact your customer service representative.
0B83	All Device of 1st System Management Bus became not able to accessed	SMBus could not be accessed via System Management Controller.	Contact your customer service representative.
0B84	Some Device of 1st System Management Bus became not able to accessed	No device could not be accessed through SMBus access via System Management Controller.	Contact your customer service representative.
0BB0	SMBIOS – SROM data read error	Reading SROM data failed.	Contact your customer service representative.
0BB1	SMBIOS – SROM data checksum bad	SROM data checksum was incorrect.	Contact your customer service representative.
0C00	RomPilot reports error number xx	RomPilot initialization error	Perform the configuration again. If the error occurs, a hardware failure may occur. Contact your customer service representative.

Alarm Indication During System Operation

Table 5-2 lists the alarm indications displayed on LCD during server operation.

Table 5-2. Operational Error Codes and Messages

Error Code and Message		Explanation	Action
15FF	CPU Bus Err	CPU bus error	Check CPU installation or termination board installation. If the same error reoccurs, contact your customer service representative.
0B01	CPU Error 1	CPU#1 error	Follow 15FF "Action."
0B02	CPU Error 2	CPU#2 error	Follow 15FF "Action."
0B03	CPU Error 3	CPU#3 error	Follow 15FF "Action."
0B04	CPU Error 4	CPU#4 error	Follow 15FF "Action."
0B11	CPU Thermal	CPU#1 temperature error	Clean the cooling fan. If the same error reoccurs, contact your customer service representative.
0B12	CPU Thermal	CPU#2 temperature error	Follow 0B11 "Action."
0B13	CPU Thermal	CPU#3 temperature error	Follow 0B11 "Action."
0B14	CPU Thermal	CPU#4 temperature error	Follow 0B11 "Action."
1052	Fan Alarm	Memory cooling fan error	Follow 0B11 "Action."
1053	Fan Alarm	Memory cooling fan error	Follow 0B11 "Action."
1054	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1055	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1056	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1057	Fan Alarm	CPU cooling fan error	Follow 0B11 "Action."
1058	Fan Alarm	Optional board cooling fan error	Follow 0B11 "Action."
2101	Memory Err	A memory error was detected in a DIMM located on memory board #1.	See Figure 5-5 to determine which DIMM caused the memory error on memory board #1. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2102	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2103	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2104	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2105	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."

2106	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2107	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2108	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2109	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210A	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210B	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210C	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210D	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
210E	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."

Table 5-2. Operational Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
210F	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2110	Memory Err	See 2101 "Explanation."	Follow 2101 "Action."
2111	Memory Err	A memory error was detected in a DIMM located on memory board #2.	See Figure 5-5 to determine which DIMM caused the memory error on memory board #2. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2112	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2113	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2114	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2115	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2116	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2117	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2118	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2119	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211A	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211B	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211C	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211D	Memory Err	See 2111 "Explanation."	Follow 2101 "Action."
211E	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
211F	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."
2120	Memory Err	See 2111 "Explanation."	Follow 2111 "Action."

2201	Memory Err	A memory error was detected in a DIMM pair located on memory board #1.	See Figure 5-4 to determine which DIMM pair caused the memory error on memory board #1. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2203	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
2205	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
2207	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
2209	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
220B	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
220D	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."
220F	Memory Err	See 2201 "Explanation."	Follow 2201 "Action."

Table 5-2. Operational Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
1028	Power L2 #1	CPU L2 cache power failure. See Figure 5-1.	Check CPU VRM installation. If the same error reoccurs, contact your customer service representative.
1029	Power L2 #2	CPU L2 cache power failure. See Figure 5-1.	Check CPU VRM installation. If the same error reoccurs, contact your customer service representative.
10F0	Pow Major B	Power major alarm	Contact your customer service representative.
105F	SCSI Open	The front door is open.	This is a Warning, not an error.
105E	HPC Open	The PCI slot door on the top cover is open.	This is a warning, not an error
DUMP		The DUMP switch is pressed.	This is not an error.
Sleep:x		The system is running in the power save mode. ("x" indicates the power save mode level (1 through 4).)	This is not an error. Pressing the SLEEP switch restores the original state. Level setup and definitions depend on the OS.
SMI Timeout		The system is stalled due to a hardware failure.	A critical error occurred. Contact your customer service representative.
SMBus Err xxyy		SMBus device error. (xx: channel, yy: status)	Contact your customer service representative.
ISA Error		ISA I/O check error	Check ISA board installation. If the same error reoccurs, contact your customer service representative.
1017	Thermal Hi	PCI (unknown location) high temperature error	Shut down the server to check if fans and other components are covered with dust. When a low temperature error occurred, raise the room temperature to warm up the server for operations. If there appears to be no cause of a malfunction, contact your customer service representative.
1061	Thermal Hi	Front panel high temperature error	Follow 1017 "Action."
1062	Thermal Hi	HDD cage #1 (botom) high temperature error	Follow 1017 "Action."
1063	Thermal Hi	Baseboard high temperature error	Follow 1017 "Action."

1064	Thermal Hi	HDD cage #2 (middle) high temperature error	Follow 1017 "Action."
1065	Thermal Hi	HDD cage #2 (top) high temperature error	Follow 1017 "Action."
1068	Thermal Hi	CPU#1 high temperature error	Follow 1017 "Action."
1069	Thermal Hi	CPU#2 high temperature error	Follow 1017 "Action."
106A	Thermal Hi	CPU#3 high temperature error	Follow 1017 "Action."
106B	Thermal Hi	CPU#4 high temperature error	Shut down the server to check if fans and other components are covered with dust. When a low temperature error occurred, raise the room temperature to warm up the server for operations. If there appears to be no cause of a malfunction, contact your customer service representative.
1017	Thermal Lo	PCI (unknown location) low temperature error	Follow 106B "Action."
1061	Thermal Lo	Front panel low temperature error	Follow 106B "Action."
1062	Thermal Lo	HDD cage #1 (bottom) low temperature error	Follow 106B "Action."
1063	Thermal Lo	Baseboard low temperature error	Shut down the server to check if fans and other components are covered with dust. When a low temperature error occurred, raise the room temperature to warm up the server for operations. If there appears to be no cause of a malfunction, contact your customer service representative.
1064	Thermal Lo	HDD cage #2 (middle) low temperature error	Follow 1063 "Action."
1065	Thermal Lo	HDD cage #2 (top) low temperature error	Follow 1063 "Action."
1068	Thermal Lo	CPU#1 low temperature error	Follow 1063 "Action."
1069	Thermal Lo	CPU#2 low temperature error	Follow 1063 "Action."
106A	Thermal Lo	CPU#3 low temperature error	Follow 1063 "Action."
106B	Thermal Lo	CPU#4 low temperature error	Follow 1063 "Action."

1017	Thermal Wrn	PCI (unknown location) temperature warning	Follow 1063 "Action."
1061	Thermal Wrn	Front panel temperature warning	Follow 1063 "Action."
1063	Thermal Wrn	Baseboard temperature warning	Follow 1063 "Action."
1068	Thermal Wrn	CPU#1 temperature warning	Follow 1063 "Action."
1069	Thermal Wrn	CPU#2 temperature warning	Follow 1063 "Action."
106A	Thermal Wrn	CPU#3 temperature warning	Follow 1063 "Action."
106B	Thermal Wrn	CPU#4 temperature warning	Follow 1063 "Action."
0C00	WDT Timeout	Watch-dog timer time-out	Contact your customer service representative.

Error Code Hardware Reference

The following hardware illustrations show the probable locations of hardware failures as defined by specific error codes listed in Tables 5-1 and 5-2.

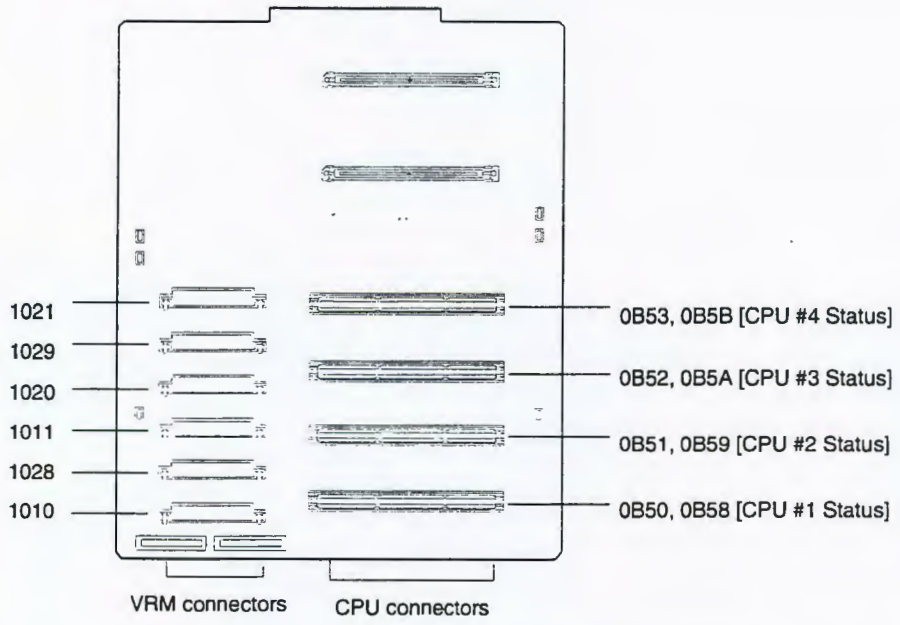


Figure 5-1. CPU/VRM Error Code Locations

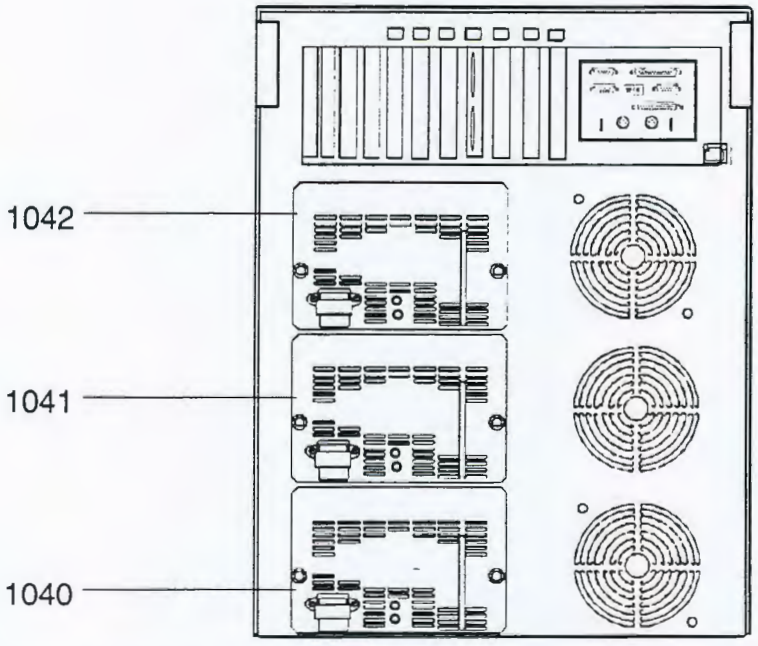
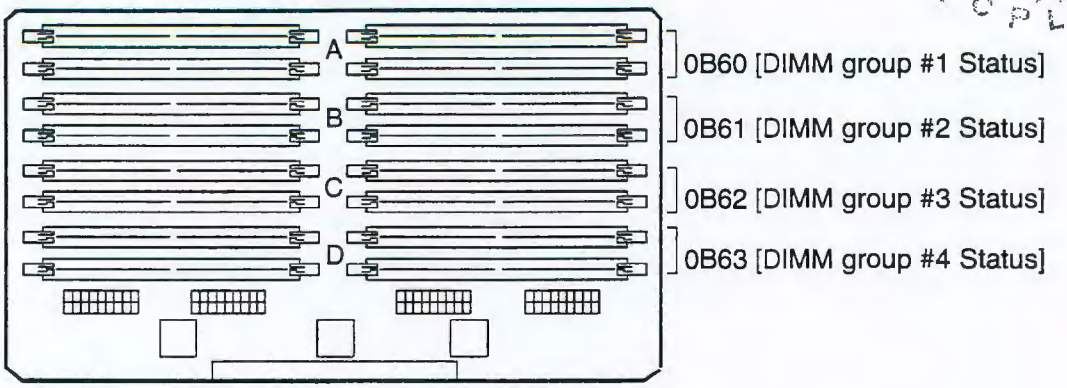
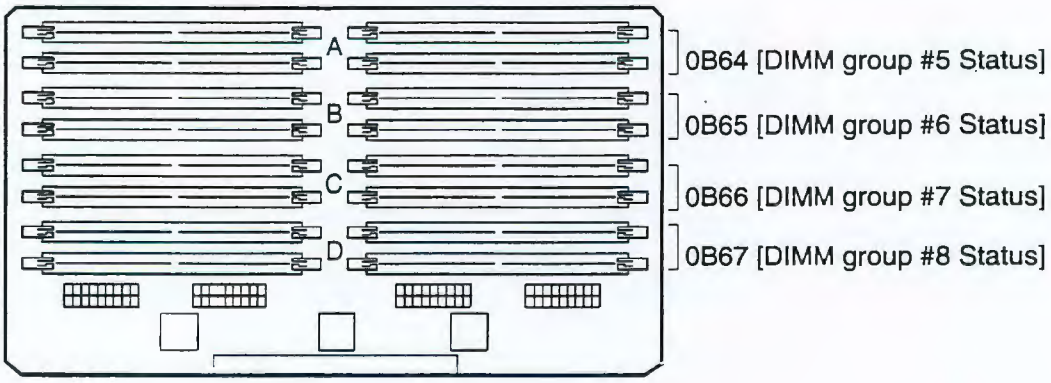


Figure 5-2. Power Supply Error Code Locations



Error Indications by Memory Bank

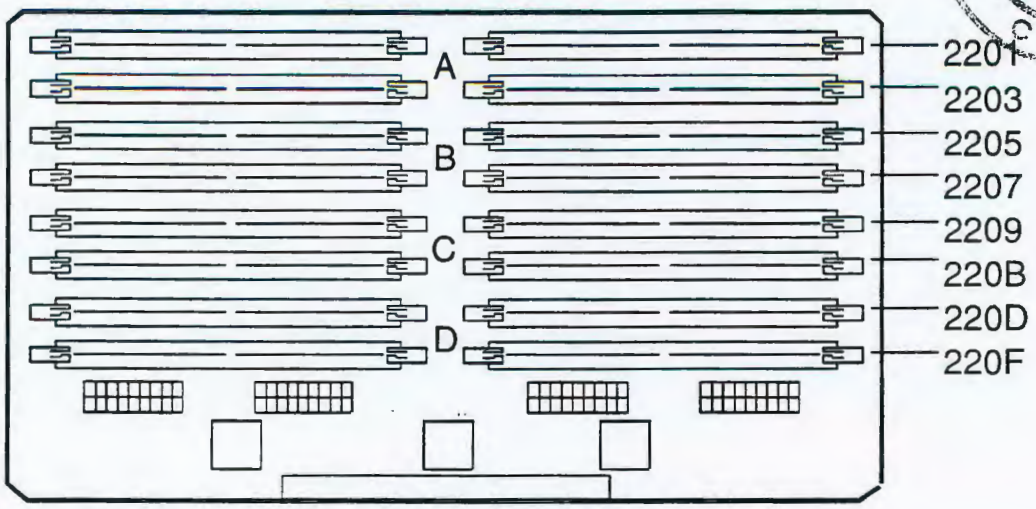
Memory Board 1



Error Indications by Memory Bank

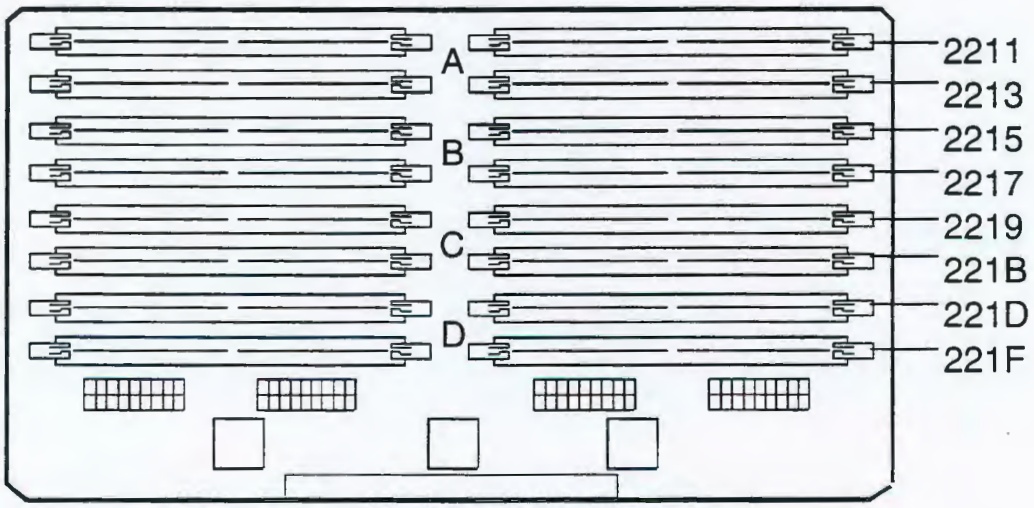
Memory Board 2

Figure 5-3. Memory Error Code Bank Locations



Error Indications by DIMM Pair

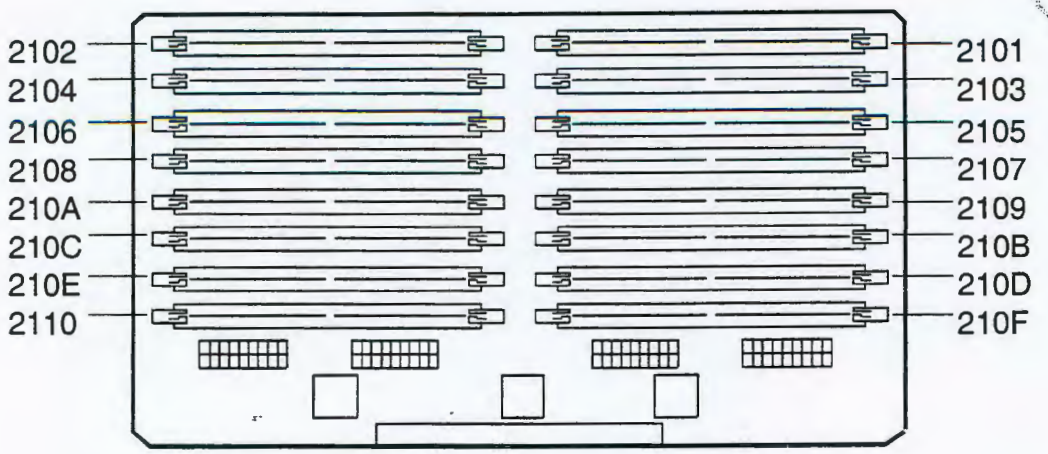
Memory Board 1



Error Indications by DIMM Pair

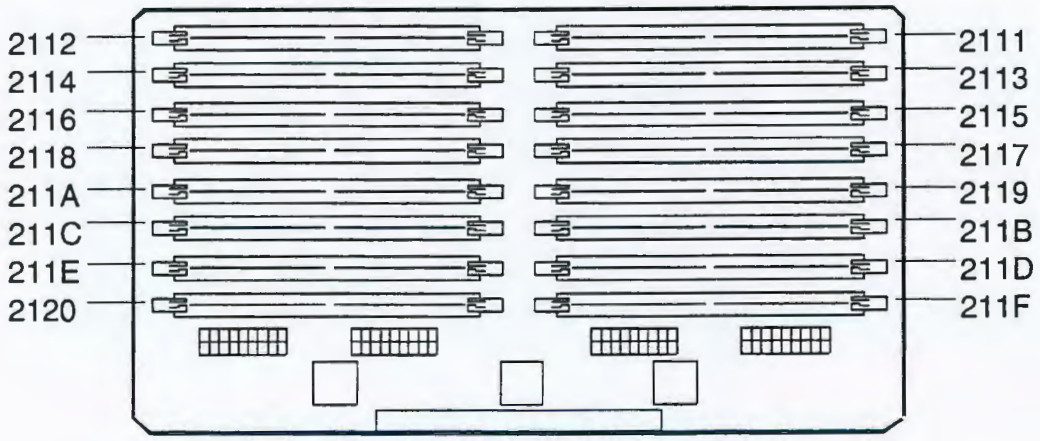
Memory Board 2

Figure 5-4. Memory Error Code DIMM Bank Locations



Error Indications by DIMM Slot

Memory Board 1



Error Indications by DIMM Slot

Memory Board 2

Figure 5-5. Memory Error Code DIMM Locations

Status LEDs

The following paragraphs list and describe the various system and disk status LED indicators and provides a user response for the various status conditions. Once your server is up and running, you can monitor server operation through the system status LED panel indicators and the SCSI device status LED panel indicators. See Table 5-3 and Table 5-4 for a list and description of the LED indicators and Table 5-5 for a list of the system status abnormal conditions.

If any problems persist, contact your service representative for assistance.

Table 5-3. System Status LED Indicators

LED	Status	Description	Response
Power	Off	Power OFF	None required (normal)
	Off	Power ON	Check: power cord outlet circuit breaker power switch is ON AC Link Mode (BIOS Setup) covers securely mounted
	Green	Power ON	None required (normal)
	Amber	System power supply failure	Replace failed power supply module.
Status	Off	Power OFF	None required (normal)
	Green	No alarms	None required (normal)
	Amber	Abnormal condition (see Table 5-5).	Check condition.
Disk	Off	Not accessing disk drives	None required (normal)
	Amber	Internal disk drive failure	Check disk drive status LEDs
	Green	Accessing disk drives	None required (normal)

Table 5-4. Disk Drive Status LED Panel Indicators

LED	Status	Description	Response
Disk Drive Present	Off	Disk drive not present	None required (normal)
	Green	Disk drive present	None required (normal)
Disk Drive Activity	Off	Not accessing disk drive	None required (normal)
	On	Accessing disk drive	None required (normal
Disk Drive Status	Off	No alarms	None required (normal)
	Amber	Disk drive failure	Replace disk drive.

Table 5-5. System Status Abnormal Conditions

LED (Amber)	Conditions
System Status	Chassis intrusion (front cover) Unit fan alarm Memory multi-bit error (SERR) Temperature Voltage CPU thermal trip CPU, memory or option board error or failure Power supply failure

A

System Cabling

- Before You Begin
- Static Precautions
- RAID Configuration

This appendix contains information and procedures on cabling configurations used in your system. The configurations include the RAID controller.

Before You Begin

⚠ WARNING

The DC push button on/off switch on the front panel does not turn off system AC power. Also, +5vdc is present on the system board whenever the AC power cord is connected between the system and an AC outlet. Before performing any procedures, first power off the DC push button switch located on the front panel. Make sure your system is powered off and the AC power cord is unplugged from the system. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

Static Precautions

An electrostatic discharge (ESD) can damage disk drives, option boards, and other components. You can provide ESD protection by wearing an antistatic wrist strap attached to chassis ground when handling system components.

Electronic devices can be easily damaged by static electricity. To prevent damage, keep them in their protective packaging when they are not installed in your system.

RAID Configuration

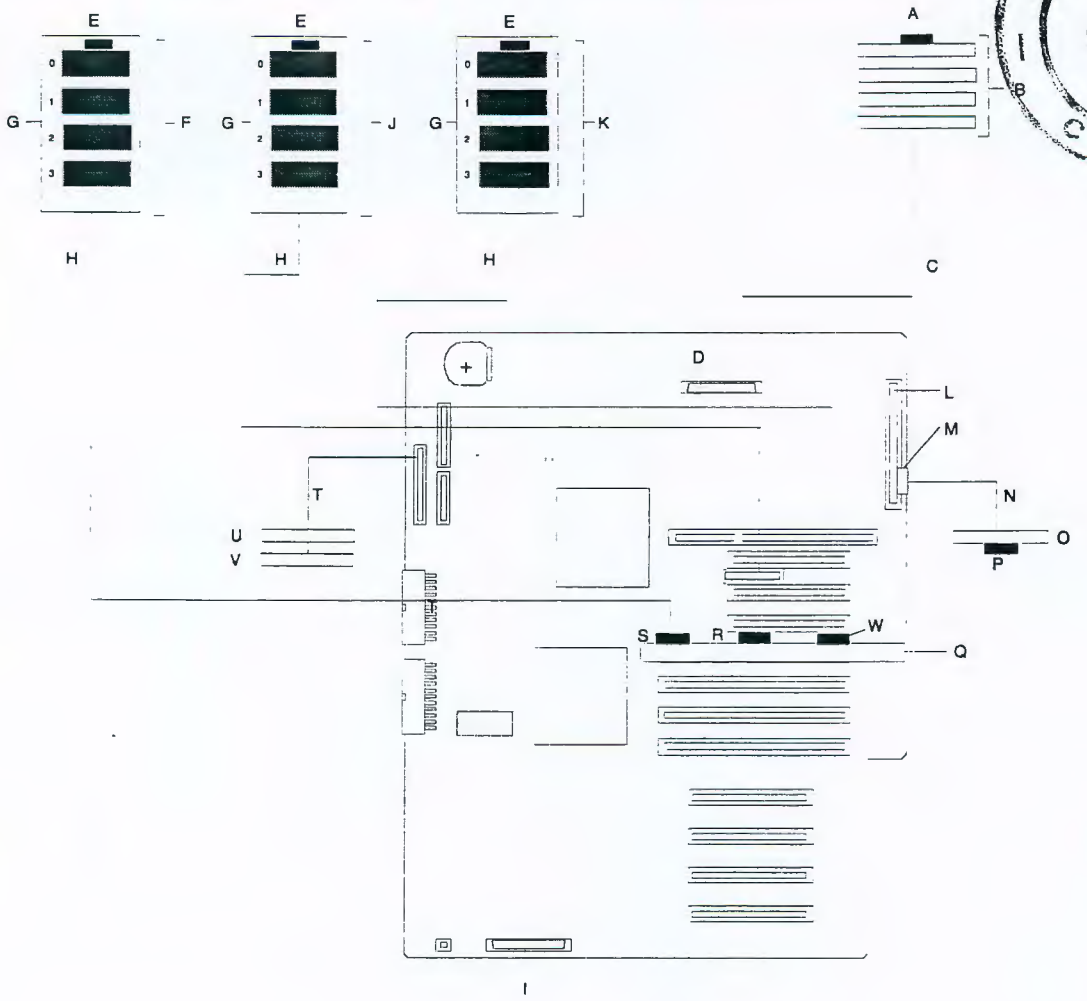
One of the standard features of your system is the three channel SecuRAID 530 (Mylex 1100) controller board, which gives your system the added security of fault tolerance. Your system has RAID pre-cabled at the factory. The RAID controller is installed in PCI slot #31 and is used to control the hard disk drives in the hot-swap hard drive cages. Channel 1 of the dual Ultra2 wide SCSI-3 controller on the system I/O board is used to control up to four peripherals (CD-ROM and tape drives) in the removable media drive bays. A 3 1/2-inch diskette drive is installed in all systems and interfaces separately to the system I/O board. Figure A-1 is a diagram of the SCSI cabling.

The narrow SCSI interface cable is connected to the SCSI connector on the system I/O board (Figure A-1, D). This cable connects to the rear of the SCSI removable media peripherals (if present). The last drive on the daisy chain cable must have its internal SCSI terminators installed (Figure A-1, A).

The Ultra2 wide SCSI-3 interface cables are connected to the RAID board (Figure A-1, Q). Termination for the hard disk drives is provided on the SCSI distribution panel (Figure A-1, E).

The onboard narrow SCSI controller also includes a connector located at the rear of the system for connecting external SCSI devices (Figure A-1, M). Three important rules must be followed if you connect external narrow SCSI devices:

- A maximum of seven narrow SCSI devices may be connected to the onboard SCSI controller. For example if three SCSI devices in the system cabinet are connected to the SCSI bus, only four external narrow SCSI devices can be connected.
- The maximum cable length for all narrow devices connected to the controller is 1 meter (39 inches).
- The last external narrow SCSI device must be terminated. Active termination is recommended.



A.	Device internal SCSI termination resister	**B.**	Narrow SCSI devices in upper peripheral bays
C.	Narrow SCSI interface cable	**D.**	SCSI channel 1 connector
E.	SCSI back plane terminator	**F.**	Ultra2 wide SCSI-3 disks in lower cage
G.	Distribution back plane	**H.**	Wide SCSI interface cable
I.	SCSI channel 2 connector (not used)	**J.**	Ultra2 wide SCSI-3 disks in middle cage
K.	Ultra2 wide SCSI-3 disks in upper cage	**L.**	I/O riser board
M.	Narrow SCSI connector (50 pin)	**N.**	External narrow SCSI cable
O.	External narrow SCSI device	**P.**	SCSI terminator
Q.	RAID controller in PCI slot #31	**R.**	Channel 1 cable connector
S.	Channel 2 cable connector	**T.**	Diskette interface cable
U.	2nd 3 1/2-inch device (optional)	**V.**	3 1/2-inch diskette drive
W	Channel 0 cable connector		

Figure A-1. RAID Cable Configuration

B

Memory Configurations

- Memory DIMM Configurations

Memory DIMM Configurations

The memory board contains sixteen 168-pin DIMM sockets for a total of up to 4 GB of system memory, using 256MB DIMMs. See Figure B-1. DIMM sockets on the board are organized as four 144-bit wide (128-bit wide data path with 16 parity bits) banks. ECC generation/checking is provided for each bank. DIMM sockets accept 168-pin single- or double-sided DIMMs. A bank must be populated using identical DIMMs. DIMMs may vary in size from one bank to the other, but all DIMMs must be the same speed. Timing requires 50ns fast page devices.

A memory DIMM upgrade kit consists of 4 identical (of the same size and type) DIMMs defined as:

4 x 32MB DIMMS = 128MB

4 x 64MB DIMMs = 256MB

4 x 128MB DIMMs = 512MB

4 x 256MB DIMMs = 1GB.

The first bank of DIMMs should be installed in sockets P02, P03, P04 and P05. When you install additional DIMMs, you must start with bank 2 and continue to bank 4. When you remove DIMMs, you must start with the highest populated bank of DIMMs. Table B-1 lists the distribution of DIMMs for system memory configurations that maximize socket availability, other combinations are possible.

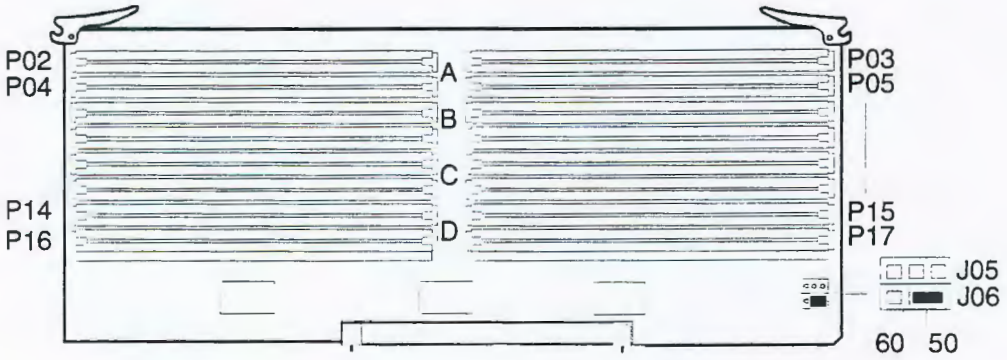


Figure B-1. CPU Base Board DIMM Sockets

Table B-1. Memory Configurations

Total Memory	Bank #A	Bank #B	Bank #C	Bank #D
128MB	4 x 32MB			
256MB	4 x 64MB			
384MB	4 x 64MB	4 x 32MB		
512MB	4 x 128MB			
640MB	4 x 128MB	4 x 32MB		
768MB	4 x 128MB	4 x 64MB		
896MB	4 x 128MB	4 x 64MB	4 x 32MB	
1024MB	4 x 256MB			
1152MB	4 x 256MB	4 x 32MB		
1280MB	4 x 256MB	4 x 64MB		
1408MB	4 x 256MB	4 x 64MB	4 x 32MB	
1536MB	4 x 256MB	4 x 128MB		
1664MB	4 x 256MB	4 x 128MB	4 x 32MB	
1792MB	4 x 256MB	4 x 128MB	4 x 64MB	
1920MB	4 x 256MB	4 x 128MB	4 x 64MB	4 x 32MB
2048MB	4 x 256MB	4 x 256MB		
2176MB	4 x 256MB	4 x 256MB	4 x 32MB	
2304MB	4 x 256MB	4 x 256MB	4 x 64MB	
2432MB	4 x 256MB	4 x 256MB	4 x 64MB	4 x 32MB
2560MB	4 x 256MB	4 x 256MB	4 x 128MB	
2688MB	4 x 256MB	4 x 256MB	4 x 128MB	4 x 32MB
2816MB	4 x 256MB	4 x 256MB	4 x 128MB	4 x 64MB
3200MB	4 x 256MB	4 x 256MB	4 x 256MB	
3328MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 32MB
3456MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 64MB
3584MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 128MB
4096MB	4 x 256MB	4 x 256MB	4 x 256MB	4 x 256MB

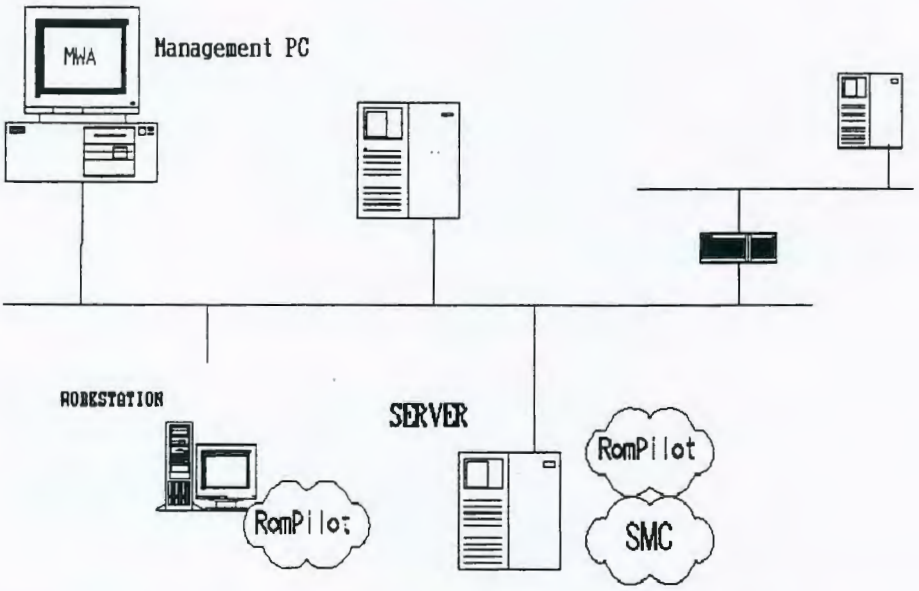
C

Management Workstation Application

- Overview
- MWA System Requirements
- Installing MWA
- MWA Main Window
- Using MWA
- Dialog Boxes
- Troubleshooting

Overview

Management Workstation Application (MWA) is an application used for remote server management in a network environment. The managed server may be remotely accessed from a management PC (the computer in which ESMPRO™ operates). MWA is a pre-boot management application in that the managed server is accessed prior to loading the server operating system.



The following server operations are available from a management PC running MWA software:

- **Remote console control -** This function enables you to see the screen of a server from the console of the management PC and to key in data to the server from the keyboard of the management PC
- **Remote drive access -** This function enables a server to access a floppy disk drive on the management PC. A server can also be booted from the floppy disk on the management PC.
- **SOS recovery** - If an SOS message is received from a server, MWA receives the fault information and sends the necessary instructions to the server for recovery.
- **Alert to ESMPRO™** - If MWA receives an alert message from a server, it sends this message to ESMPRO™ AlertManager.
- **Power cycling** - This function enables powering the server OFF and ON.
- **Reset control** - This function enables reset of the server.
- **Event Log retrieval** - All event log data recorded in the server is retrieved by the management PC.

Remote Console

Remote console enables the user to view the screen of a server or key in data to the server from the keyboard of the management PC as if operating the keyboard of the server. When a server is connected to MWA, the remote console function allows the server screen to display in the server window.

Remote Drive

Remote drive allows a server to access the diskette drive on the management PC or an FD image file as if it were the drive on the server.

> **Note:** An FD image file is copied and saved from a floppy disk. This file can be used instead of a floppy disk as a remote drive for a server.

A server can also be booted from a floppy disk on the management PC. When the remote drive function is in use, [RD] is displayed at the title bar of the server window. In this case diskette drive A on a server is allocated as a remote drive. Therefore, the floppy disk drive of the server itself cannot be used while the remote drive function is in use.

MWA System Requirements

This section outlines the management PC requirements necessary for using MWA.

Operating Systems:

- Windows 95 / Windows 98 / Windows NT 4.0 or later
- More than 3MB of free RAM
- More than 5MB of disk space
- ESMPRO Version 3.22 or later.
- TCP/IP Network.

Managed Server:

- Servers managed by MWA must support the RomPilot extended BIOS.

Installing MWA

To use MWA several procedures must be performed to configure the managed server and the management PC. For ease of installation these procedures should be performed in the order presented in the following sections. Installation procedures include procedures to be performed at the server and at the management PC.

Server Procedures

- Create a server system generation diskette (SG) containing essential server networking information.
- Run the BIOS Setup Utility making the changes to BIOS necessary for server acceptance of MWA support.

Management PC Procedures

- Install MWA software on the management PC.
- Configure and register SG information within MWA at the management PC.

Creating a Server System Generation Diskette (SG)

For the management PC to connect with a server, server system generation (SG) information must be configured and registered on MWA software running on the management PC.

In this procedure you will create a diskette containing your server's SG information. In the following section, you will register the SG information with MWA.

1. Prepare a floppy disk. formatted with MS-DOS.
2. Insert the EXPRESSBUILDER CD in the server's CD-ROM drive, and boot the server from the CD. The EXPRESSBUILDER menu displays.
3. Select: **Custom Setup**.
4. Select: **System Management**.
5. Select: **Network Setup**. The Network setup program starts.
6. Insert the floppy disk prepared in step 1 into the server's diskette drive and press the **ESC** key.

7. Set the SG information as follows. (The items with * marks must be entered.)

   — Computer Name*
   Enter the server name.

   — IP Address*
   Enter the IP address of the server.

   — Subnet Mask*
   Enter the subnet mask of the server.

   — Default Gateway*
   Enter the IP address of the default gateway on the network.

   — Management PC (1)(3)'s IP*
   Enter the IP address of the management PC with MWA installed. (1)(3) shows priority.

   — Pass-phrase*
   Enter the pass-phrase that is used for communication between server - RomPilot and management PC - MWA.

   — Community Name (SMC supported servers)
   Enter a key for authentication used between server SMC and management PC - MWA (community name for SNMP trap). Default value is public.

   — Magic Number (SMC supported servers)
   Enter code key that is used between server - SMC and management PC - MWA.

   — Recovery Mode (SMC supported servers)
   Select automatic or manual.
   If automatic is selected, SMC automatically executes recovery processing when a fault occurs. It will be accepted as an instruction from MWA.

   — SOS Alert (SMC supported servers)
   Select SOS Alert enabled or disabled.
   If disabled is selected, SMC will not send an SOS message to MWA when a fault occurs.

8. Select: **Save Setting**. SG information is saved on the floppy disk. You will need this floppy disk (called the SG information FD) to register the server on the management PC MWA.

Note: For details on Network setup, see EXPRESSBUILDER online help.

Configuring Server BIOS Setup

To use MWA, you must configure the server's BIOS with three specific settings enabled. These settings take place in Advanced Menu and the Hardware Menu of the BIOS Setup. (Refer to Chapter 3, "Configuring Your System," for BIOS Setup information.) The following table shows the settings that must be enabled to use MWA.

Menu Parameter Name	Required Setting for MWA
ADVANCED MENU	
Advanced Press **Enter** for menu.	
ROMPilot Support	Enabled
Peripheral Configuration Press **Enter** for menu.	
LAN controller	Enabled
SYSTEM HARDWARE MENU	
Wake On LAN	Enabled

Installing MWA on the Management PC

To Install MWA on the management PC perform the following procedure.

1. Start Windows95 / Windows 98 / or Windows NT on the management PC.
2. Insert the EXPRESSBUILDER CD into the PC CD-ROM drive.
3. Using Explorer, execute "setup.exe" in MWA folder of the CD-ROM. MWA installer will start.
4. Follow MWA installer instructions.

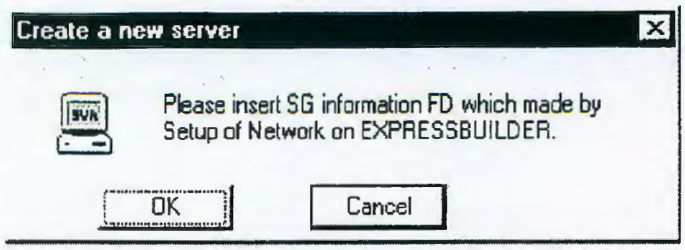
> ***Note:*** MWA will be registered in the Startup folder after installation, and started automatically when an OS start (Log in) is initiated.

Registering SG Information on MWA

In order for MWA to connect with a server, the server system generation information (SG) must be set and registered on MWA.

In this procedure SG information is registered on MWA from the server System Generation diskette (SG) created in the section *Creating a Server System Generation diskette (SG).*

1. Run MWA on the management PC and select the New SG command from File menu. The *Create a New Server* dialog box displays.



2. Insert the SG Information floppy disk into the management PC diskette drive.
3. Select OK. Server SG information is registered on MWA.

MWA Main Window

The MWA main window provides a graphical user interface (GUI) to access server control operations and to launch the management plug-ins. At the top of the GUI is the menu and tool bar. These provide the options to initiate plug-ins and other support features. A status bar at the bottom displays connection information like server name, line status, and mode.

Toolbar

The tool bar buttons of MWA main window combine server control and management plug-in options available from the Connect and Action menus as follows.

Open - The Open command opens a server window for a specified server.

Connect - The Connect command connects a current server.

Disconnect - The Disconnect command disconnects a current server.

Pause POST - The "Pause POST" command will pause to the server in the middle of POST if selected when the current server is executing POST.

To resume POST, select the Go to End of POST command, the Go (MWA mode) command, or the Go (No MWA mode) command.

Go to End of POST - The "Go to End of POST" command will pause the server at the end of POST if selected when the current server is executing POST.

To resume booting, select MWA mode command or the No MWA mode command.

MWA mode - When MWA mode command is selected when POST is paused, the server resumes POST and executes booting in MWA mode.

No MWA mode - If the No MWA mode command is selected when POST is paused, the server resumes POST and executes booting in No MWA mode.

Main Menu

MWA Main menu has the following menus.

- **File**

  — **New SG...**registers server system generation (SG) information. This command requires the SG information floppy disk described in *Registering SG Information on MWA*. When this command is selected, the Create a new server dialog box displays. Insert the floppy disk and click the OK button. If the IP address in a new server SG information exists in an old server SG information, the old information is updated. Once the registration has been completed, the server SG information is saved as (IP address).rp file. MWA can be connected only to servers registered using the New SG command.

  — **Open...**opens a server window for a specified server. The Open a Server dialog box lists SG-registered servers on MWA. Select a server to operate.

  — **Close...**closes the active server window and disconnects the server.

  — **Delete...**deletes the SG information for the selected server.

  — **Write back SG...**saves server SG information on a floppy disk. The SG information can be set again using the floppy disk. When this command is selected, the Write back a server dialog box displays. Insert a formatted floppy disk and select the OK button. Then, select a server from the server list. SG information for only one server can be saved on a floppy disk because the server SG information for all files are saved under the same name.

  — **Properties...**displays or set properties for the current server. If no servers are in operation, the Select a Server dialog box opens. Select a server to change its properties. In the Server Properties dialog box, view or set necessary information.

  — **Defaults...**allows you to view and set basic properties for all servers in the Default Server Properties dialog box. If [Use Default Settings] is checked in the Server Properties dialog box, server properties are set to the values specified in the Default Server Properties dialog box.

  — **Configure...**changes MWA configuration in the Configure dialog box. Timer counts for no response detected. After connecting to a server. MWA sometimes cannot receive any response from the server because the server is busy. If the server responds within specified timer count, MWA does not close communication. Increase the timer count if you expect the server to be busy for a long time. The default is 300 seconds.

— **Server Monitor...**enables or disables the monitor for servers. The server monitor continually monitors server status using PING or RPC even when MWA is not connected to the servers. The status of the current server is displayed in the status bar. When the server monitor is enabled, a check mark appears next to the menu item.

— **Exit...**terminates MWA and closes the connections to all servers.

- **View**

— **Toolbar...**displays or hides the toolbar. The toolbar includes buttons for some of the most common commands in MWA, such as the Open command. When the toolbar is displayed, a check mark appears next to the menu item.

— **Status Bar...**displays or hides the status bar. The status bar describes the action to be executed by the selected menu item or depressed toolbar button, and information on the current server. When the status bar is displayed, a check mark appears next to the menu item.

— **Summary...**opens or closes the Server Summary dialog box. The Server Summary dialog box displays the IP addresses, server names, and current statuses of all the SG-registered servers on MWA. When the Server Summary dialog box is open, a check mark appears next to the menu item.

— **History Log...**opens or closes the History Log dialog box. The History Log dialog box displays server communications, operator commands, and other events in chronological order. When the Delete button is selected, the Delete Logged Messages dialog box displays. The operator can delete all or part of the log. When the History Log dialog box is open, a check mark appears next to the menu item.

- **Reset/Reboot**

— **Cold Reset...**executes a cold reset on a current server.

— **Warm Reset...**command executes a warm reset on a current server. Some types of servers have been set such that a cold reset is executed by the Warm Reset command. For details, refer to the users guide for the managed machine.

— **Wake-up...**activates a server whose power is off. The Wake-Up command is executed normally under the following conditions. MWA knows the server MAC address as the server has been connected with MWA more than once. OS was terminated normally the last time server was active.

— **Pause at Next Connect...**specifies whether to pause POST when a current server is connected the next time. When pause is set, a check mark appears next to the menu item. Note that this setting is valid only when the server is connected the next time and not for later connections.

- **Data**

— **CMOS...**displays the CMOS data of a current server in the Data dialog box. The data can be read only when the server is paused at the end of POST.

— **ESCD...**displays the ESCD data of a current server in the Data dialog box.

— **DMI...**displays the DMI data of a current server in the Data dialog box. The data can be read only when the server is paused at the end of POST.

— **PCI...**When the Read button is selected in the PCI Information dialog box, the PCI information of a current server is displayed. The information includes a bus number, a device number and a function number of each device name and so on.

- **Window**

— **Cascade...**command arranges the opened windows in an overlapping fashion.

— **Tile...**arranges the opened windows in an non-overlapping fashion.

— **Arrange Icons...**arranges icons for minimized windows at the bottom of the main window. If there is an open window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this window.

— **Server Window Names 1,2...**MWA displays a list of currently opened server windows at the bottom of the Window menu. A check mark appears in front of the current server window name. Select a server window to activate.

Pop-Up Menus

Clicking the right mouse button in a server window displays a Pop-up menu. From this menu, you can execute main commands on the current server.

— **Connect command...**connects the current server to the management PC. Once the server has been connected, [Connected] is displayed in the title bar and the server screen displays in the server window.

— **Disconnect command...**closes the connection to a current server. Once the server has been disconnected, [Not Connected] is displayed in the title bar.

— **Change Remote Drive command...**temporarily changes the remote drive of a current server. This command can be executed only when a remote drive is in use. Set the necessary information in the Temporary Change to Remote Drive dialog box. This command does not update the server properties. The setting becomes invalid when the server is disconnected.

— **Pause POST command...**pauses the server in the middle of POST when the current server is executing POST. To resume POST, select the Go to End of POST command, then select Go (MWA mode) command, or the Go (No MWA mode) command.

— **Go to End of POST command...**pauses the server at the end of POST when the current server is executing POST. To resume booting, select the Go (MWA mode) command or the Go (No MWA mode) command.

— **Go (MWA mode) command...**When the Go (MWA mode) command is selected when POST is paused, the server resumes POST and executes booting in MWA mode.

— **Go (No MWA mode) command...**If the Go (No MWA mode) command is selected when POST is paused, the server resumes POST and executes booting in No MWA mode.

— **Restore Final Screen command...**displays the remote console screen as it appeared immediately before the server was disconnected. This command becomes valid after the server is disconnected.

— **Clear Screen command...**clears the remote console display. This command becomes valid after the server is disconnected.

— **Server Summary Pop-up menu...**Position the cursor on a server record in the Server Summary dialog box and click the right button to display the Server Summary Pop-up menu. From this menu, can execute main commands on the server.

Using MWA

Opening a Server Window

To remotely access a managed server from the management PC using MWA, you must open a server management window for the server. You can then issue commands to the server and make various settings though this window.

There are two ways to open a server window:

- **Using a command** - Select **Open** from the File menu. The **Select a Server** dialog box displays. Select the server you want to remotely access.
- **Automatic connection** - If a server is set for automatic connection, MWA opens a server window and connects to the server when a notification is received from the server. Refer to *Connection and Disconnection* in the next section.

Connecting and Disconnecting the Server

MWA is a pre-boot management application. MWA can be connected to a server only from the time the server is powered on or reset until the operating system is booted in the server. Once a server is connected, the remote control function displays the server screen in the server window at the management PC. Most MWA functions can be executed only when a server is connected.

Connect to a server as follows:

- **Connect command** - Select Connect from the Pop-up menu in the server window.
- **Setting automatic connection** - Select Properties from the Pop-up menu in the server window. The Server Properties dialog box displays. Check [Activate] for RESET or POST Error alert on the Alert page. After this setting is made, MWA will automatically connect to the server each time a specified alert is reported from the server.

Disconnect a server from the management PC using one of the following commands:

- **Disconnect command** - Select Disconnect from the Pop-up menu in the server window.
- **Close command** - Close from the File menu closes the active server window and closes the connection to the server.
- **Exit command** - Exit from the File menu terminates MWA and closes the connections to all servers.
- **Server reset or reboot** - When a server is reset, its connection to MWA is closed. If automatic connection is set for the server, the server is connected again.

Using a Remote Drive

When a remote drive is in use, [RD] displays in the title bar of the server window. To connect to a remote drive, perform the following steps:

1. Select Properties from the Pop-up menu in the server window to open the Server Properties dialog box. Select the Remote Drive page.
2. At the Remote Drive page, select the remote drive to use. Select [Floppy A:] or [FD Image File]. If [FD Image File] is selected, enter the file name of the FD image. The FD image file should be created in advance.

> ***Note:*** If [Read Only] is checked, an FD image file can be used in some servers.

To change the remote drive FD image file:

1. Select the Change Remote Drive command from the Pop-up menu in the server window. The Temporary Change to Remote Drive dialog box opens.
2. Select [Floppy A:] or [FD Image File]. If [FD Image File] is selected, enter a file name.

> ***Note:*** If [Read Only] is checked, an FD image file can be used in some servers.

> ***Note:*** The Server must be reset after a remote drive is used in the server.

Setting and Clearing Server Pause

MWA can pause server processing during or at the end of the server Power On Self Test (POST.)

Set a server pause as follows:

- **Pause command -** During server POST, select Pause POST from the Pop-up menu in the server window. The server pauses immediately. When the Go to End of POST command is executed, the server pauses again after completing the POST.
- **Pause at Next Connect command** - To set pause at the next server connection, select the Pause at Next Connect command from the Pop-up menu in the server window. When pause is set, a check mark appears next to the menu item.
- **Pause at POST error command** - Select Properties from the Pop-up menu in the server window to open the Server Properties dialog box. Check [Activate] for POST error alert on the Alert page. When MWA receives this alert message from the server, MWA will connect to the server and the server POST will be paused

Clear a server pause to resume processing as follows:

- **Go command** - To resume server processing, select the Go (MWA mode) command or the Go (No MWA mode) command from the Pop-up menu in the server window.

A server pause is also cleared in the following ways:

- Time-out reset
- If there is no communication between MWA and a disconnected server for five minutes or longer, the server is automatically reset.

Recovering from an SOS

If a fault is detected, a server that includes a system management controller (SMC), SMC transmits an SOS message to the management PC. When this SOS message is received, MWA opens an SOS Receive dialog box to display the SMC event log and other information.

The server recovery method depends on the recovery mode of each server.

- **Automatic recovery mode** - If an SOS message is received from a server, MWA displays the server information in an SOS Receive dialog box but does not accept a server recovery instruction from the operator. The server automatically executes recovery processing, such as reset.
- **Manual recovery mode** - If an SOS message is received from a server, MWA displays the server information in an SOS Receive dialog box and waits for a server recovery instruction from the user. Make an appropriate instruction in the dialog box.

Note: If SOS Alert is disabled in [Setup of Network] in the server, the server does not send SOS message to MWA.

Alerting ESMPRO™

If MWA receives an alert message from a server, it sends this message to ESMPRO™ AlertManager. Alert types from MWA to ESMPRO are as follows.

- Alerts from the server RomPilot
  - — System Reset
  - — *POST stalled (Reset by POST stalled)
  - — *SMI stalled (Reset by SMI stalled)
  - — *Boot failed (Reset by boot failed)
  - — POST end (Booting)
  - — POST error
  - — Security breach attempted
- Alert from the server System Management Controller (SMC)
  - — Sensor limit alarm
  - — CPU missing
  - — POST stalled
  - — SMI handler alarm
  - — SMI handler stall

* Not supported by some server models.

Dialog Boxes

Select a Server Dialog Box

The Select a server dialog box displays a list of SG-registered servers on MWA.

Server Properties Dialog Box

From the Server Properties dialog box you can view and set properties for the current server. The contents of the server properties are as follows:

- **ID page...**provides server identification information, such as a server name, an IP address, a MAC address, and a UUID.
- **Alert page...**Sets MWA operation for each type of alert which comes from a server.
- **[Sound] is checked...**MWA beeps when an alert is received from a server. The server window of the server becomes active.

- **[Activate] is checked...**When an alert is received from a server, the window of the server becomes active. If [Activate] is checked for RESET or POST Error alert, MWA attempts to connect to the server. If [Use Default Settings] is checked, this property is set to the values set by the Defaults command.
- **Remote Drive page...**A remote drive can be set for a server.
- **[None] is check...**A remote drive is disabled. Server's local drive can be used.
- **[Floppy A:] is checked...**A floppy disk drive on the management PC becomes a remote drive for the server.
- **[FD Image File:] is checked...**A specified FD image file in the management PC becomes a remote drive for the server. If an image file is set as a remote drive, click the Create/Copy Image File button to display the Create/Copy Image File dialog box. From there you can create an image file or copy one to a floppy disk. If [Read Only] is checked, one FD image file can be used by more than one server. If [Use Default Settings] is checked, this property is set to the value set by the Defaults command.

Default Server Properties Dialog Box

From the Default Server Properties dialog box you can view and set basic properties of all servers. If [Use Default Settings] in the Server Properties dialog box is checked, the server property is set to the values set by the Defaults command.

- **Alert page...**Set MWA operation for each type of alert from a server.
- **[Sound] check...**MWA beeps when an alert is received from a server. The server window of the server becomes active.
- **[Activate] check...**When an alert is received from a server, the window of the server becomes active. If [Activate] is checked for RESET or POST Error alert, MWA attempts to connect to the server.
- **Remote Drive page...**A remote drive can be set for servers.
- **[None] check...**A remote drive is disabled. Server's local drive can be used.
- **[Floppy A:] check...**A floppy disk drive on the management PC becomes a remote drive for the server.
- **[FD Image File:] check...**A specified FD image file in the management PC becomes a remote drive for the server. If a FD image file is set as a remote drive, click the Create/Copy FD Image File button to display the Create/Copy FD Image File dialog box where you can create an FD image file or copy one to a floppy disk. If [Read Only] is checked, one FD image file can be used on multi servers.

Create/Copy FD Image File Dialog Box

The Create/Copy FD Image File dialog box is used to create a FD image file as a remote drive or to copy the contents of a FD image file onto a floppy disk. Select an operation to execute.

Server Summary Dialog Box

The Server Summary dialog box lists IP addresses, server names, and current status of all the SG-registered servers on MWA. This dialog box also allows the following operations:

- **Activating a server window...**Double-click on a server record to open and activate the server window for the server.
- **Executing a command on the server...**Click the right-mouse button on a server record to display the Server Summary Pop-up menu. From this menu, you can execute main commands, such as Open, Connect, and Properties on the server.

Delete Logged Messages Dialog Box

The Delete Logged Messages Dialog Box sets conditions for deleting logged messages from the history log.

- **Delete history timed at xx/xx/xx xx:xx:xx and earlier...**If a logged message is selected in the History Log dialog box, a condition for deletion can be set for messages of the same date and time and earlier. The condition becomes invalid after deletion.

  If [Server xxx:xxx:xxx:xxx only] is checked, only the messages of the specified server are deleted.

  If [General (Non-server) messages only] is checked, the messages not dependent on the server, such as Started MWA, are deleted.

  If [All messages] is checked, all the messages at the specified date and time and earlier are deleted.

- **Automatically Delete messages...**These conditions of deletion are stored and remain valid.

  If [Keep only messages less than xx days old] is checked, messages within the specified number of days from the current day are kept and other messages are deleted automatically.

  If [Keep only the xx most recent messages] is checked, the specified number of recent messages are kept and other messages are deleted automatically.

  This Automatic Deleting process is executed when the OK button is selected in the dialog box, MWA is started, and MWA is exited.

Data Dialog Box

The Data dialog box displays the CMOS, ESCD, or DMI data of a server. This dialog box also allows the following operations.

- Compare Current Data... - The previously acquired data of the current server is compared with the present data of the server, the previously acquired data of another server, or file data.

  To compare with the data of another server, select a server in the Select a server dialog box. If an error is detected by this comparison, the Data Differences dialog box displays the compared data.

- Read Data from Server... - The present data of the current server is acquired and displayed. The Save As button is used to save the acquired data in a file.

Temporary Change to Remote Drive Dialog Box

The Temporary Change to Remote Drive dialog box changes a remote drive for a server temporarily.

If [Floppy A:] is checked, a floppy disk drive on MWA-active management PC becomes a remote drive for the server.

If [FD Image File:] is checked, a specified FD image file in the management PC becomes a remote drive for the server.

If [Read Only] is checked, one FD image file can be used by more than one server. Since no FD image file can be created or copied in this dialog box, create a file using the Defaults command or the Properties command in advance.

SOS Receive Dialog Box

If a fault is detected, a server that includes the system management controller (SMC) transmits an SOS message to the management PC. When this SOS message is received, MWA opens the SOS Receive dialog box to display the server information. If the server is in Manual Recovery Mode, MWA requests the operator for the server recovery method. When MWA communicates an inquiry to the server, [Connecting] is displayed in the title bar. You can do nothing in the dialog box while the message is displayed. Wait until the message is cleared.

It is only when the OS cannot run normally due to a fault in the server that you can control the server from this dialog box. If the server is already recovered, the server cannot be operated from MWA.

Contents and functions of the dialog box are as follows:

- **Server...**The dialog box displays the name and the IP address of the server that issued the SOS message, as well as the firmware version of the SMC on the server and the recovery mode of the server. If the recovery mode is Automatic, the server is automatically reset for recovery after this dialog box displays. The server cannot be controlled from MWA.
- **Message...**The dialog box displays the SOS message received from a server on the first line. The display box also displays the SMC event log of the server sequentially from the latest data up to when the SOS occurred.
- **Server last status...**The dialog box displays the LCD contents immediately before the SOS message transmission, the POST code of the last boot processing, and the current power status (DC).
- **Server control...**The operator can send recovery instructions to a server. The buttons are explained below. If a button operation causes an error, take the appropriate action on the server that sent the SOS message.

  — Power cycle...Use this button to turn the server off and on again. The dialog box closes after the normal execution of server control is confirmed.

  — Reset...Use this button to reset a server. The dialog box closes after the normal execution of server control is confirmed.

  — Power on... Use this button to turn a server on. The dialog box closes after the normal execution of server control is confirmed.

  — Power off... Use this button to turn a server off.

  — SMI dump... The dump switch of a server is turned on. This function is valid only for a server whose power is on. Some types of servers may not support this function. If this function is not supported, the operation ends in an error.

— Get log all... All the SMC event log data recorded in a server is acquired sequentially from the oldest one and displayed by activating the Windows standard editor WordPad. Since it takes time to make an inquiry to the server, [Connecting] is displayed in the title bar. The operator can do nothing in the dialog box while the message is displayed.

Troubleshooting

This section briefly explains problems and mistakes that may occur during MWA operations.

Problem: The Select a server dialog box does not display server information.

Probable Cause: Server SG information is not registered or the information has been lost. Register the server SG information again.

Problem: MWA cannot be operated after the reset command was executed.

Probable Cause: When some reset commands are issued, MWA waits for a response and cannot perform other operations. Wait for a while.

Problem: The Read button cannot be selected in the Data dialog box.

Probable Cause: Data read from a server is restricted as follows:

The server is connected.

CMOS data and DMI data can be read at the end of POST. Stop server processing at the end of POST by selecting the Pause POST command and the Go to End of POST command from the Pop-up menu in the server window.

Problem: A remote drive cannot be used.

Probable Cause: See *Using a Remote Drive*.

Problem: Booting from a remote drive failed.

Probable Cause: Check the following:

The remote drive is set correctly.

The remote drive is a floppy disk (or a FD image file) from which MS-DOS can be booted.

The priority of the boot device of the server is a floppy disk.

Problem: The server window does not display a server screen.

Probable Cause: A graphic server screen may not be displayed correctly in the server window. The window display becomes normal when the server returns to an MS-DOS screen.

Problem: Characters are corrupted when the server window displays a server screen.

Probable Cause: If MS-DOS is booted in a language other than English, MWA cannot display the messages for this language in the server correctly. Boot MS-DOS in English mode.

Probable Cause: If the server is displaying a graphic screen, MWA may not be able to display the screen correctly.

Problem: When an MS-DOS program is activated in English mode, the server displays corrupted characters.

Probable Cause: If MS-DOS in the server is in English mode, MWA remote console correctly displays messages from the MS-DOS programs in the server. However, the server cannot display messages for other language correctly.

Problem: OS cannot be booted from the server disk.

Probable Cause: When the remote drive is set on MWA, the server is booted from the remote drive. Cancel the remote drive setting and reset the server.

Problem: The floppy disk drive on the server cannot be used.

Probable Cause: When the remote drive is set on MWA, drive A: on the server is assigned remote drive on the management PC. Cancel the remote drive setting and reset the server.

Problem: MWA cannot connect to the server.

Probable Cause: Check each item in Step 7 of *Creating a Server System Generation Diskette.*

D

Hardware Event Log

- Introduction
- Viewing the Hardware Event Log
- Component Locations

Introduction

Sensors are located throughout your system to monitor temperature. fans, voltages and alarms. The sensors report any abnormalities of these functions in the Hardware Event Log. This appendix helps you locate the hardware component in your system that the sensor indicated to the Hardware Event Log as causing an error.

The Hardware Event Log is readable using the Off-line Maintenance Utility. The Off-line Maintenance Utility can be loaded into a maintenance partition on your hard drive using the EXPRESSBUILDER CR-ROM included with your system. Once loaded, you access the Off-line Maintenance Utility by pressing F4 during system bootup. The contents of the Hardware Event Log can also be viewed using ESMPRO in a Windows NT Operating System environment.

Table D-1 lists channel numbers that are recorded in the Hardware Event Log. The sensor that initiated the channel number entry is shown as well as the figure number of the illustration in this appendix that shows the location of the suspected faulty hardware component. Refer to the figure number noted in the Failure Location column to view the component that caused the error.

Viewing the Hardware Event Log

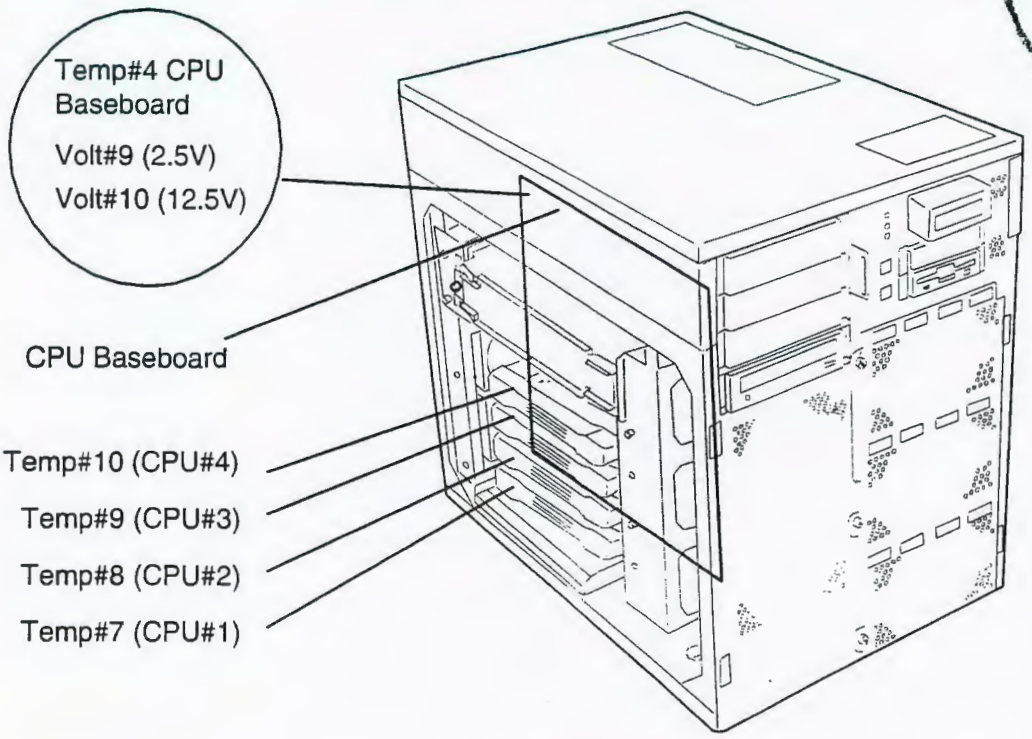
Use the following procedure to view the Hardware Event Log using the Off-line Maintenance Utility:

1. Press F4 (Maintenance Utility) during system bootup. The Off-line Maintenance Utility menu displays.
2. Select *H/W Event Log Viewer.*
   Press **ENTER**. The H/W Event Log Viewer window displays.
3. Select *Display H/W Event Log.*
   Press **ENTER**. The Display H/W Event Log <Select Event Type> window displays.
4. Select *All Event Type* or *System Error Limit Exceeded.*
   Press **ENTER**. The Display H/W Event Log <In Outline> window displays.
5. Select *System Error Limit Exceeded* of each entry listed.
   Press **ENTER**.
6. Note the channel number of the error and using Table D-1, cross-reference the channel number to the system component that caused the error. Channel numbers are listed numerically in Table D-1

Table D-1 Hardware Event Log Channel Numbers

Channel Number	Sensor	Failure Location
10h	Volt#1 (CPU#1)	See Figure D-1
11h	Volt#2 (CPU #2)	See Figure D-1
12h	Volt#3 (3.3V)	See Figure D-2
13h	Volt#4 (5V)	See Figure D-2
14h	Volt#5 (12V)	See Figure D-2
17h	Temp#2 (PCI)	See Figure D-2
20h	Volt#6 (CPU #3)	See Figure D-1
21h	Volt#7 (CPU #4)	See Figure D-1
23h	Volt#8 (5V standby)	See Figure D-2
25h	Volt#9 (2.5V)	See Figure D-1
26h	Volt#10 (1.5V)	See Figure D-1
28h	Volt#11 (CPUL2 voltage#1)	See Figure D-1
29h	Volt#12 (CPUL2 voltage#2)	See Figure D-1
40h	Power Module 1 Alarm	See Figure D-3
41h	Power Module 2 Alarm	See Figure D-3
42h	Power Module 3 Alarm	See Figure D-3
52h	Fan#5 (Memory upper rear)	See Figure D-4
53h	Fan#6 (Memory upper front)	See Figure D-4
54h	Fan#1 (CPU lower rear)	See Figure D-4
55h	Fan#2 (CPU lower front)	See Figure D-4
56h	Fan#3 (CPU middle rear)	See Figure D-4
57h	Fan#4 (CPU middle front)	See Figure D-4
58h	Fan#7 (Option cards)	See Figure D-5
5Dh	Cabinet Covers (Sides, Top)	See Figure D-6
5Eh	PCI Cover	See Figure D-6
5Fh	Front Disk Bay Cover	See Figure D-6
61h	Temp#1 (Front Panel)	See Figure D-2
62h	Temp#3 (LVD #1)	See Figure D-3
63h	Temp#4 (CPU Baseboard)	See Figure D-1
64h	Temp#5 (LVD #2)	See Figure D-3
65h	Temp#6 (LVD #3)	See Figure D-3
68h	Temp#7 (CPU #1)	See Figure D-1
69h	Temp#8 (CPU #2)	See Figure D-1
6Ah	Temp#9 (CPU #3)	See Figure D-1
6Bh	Temp#10 (CPU #4)	See Figure D-1

Component Locations



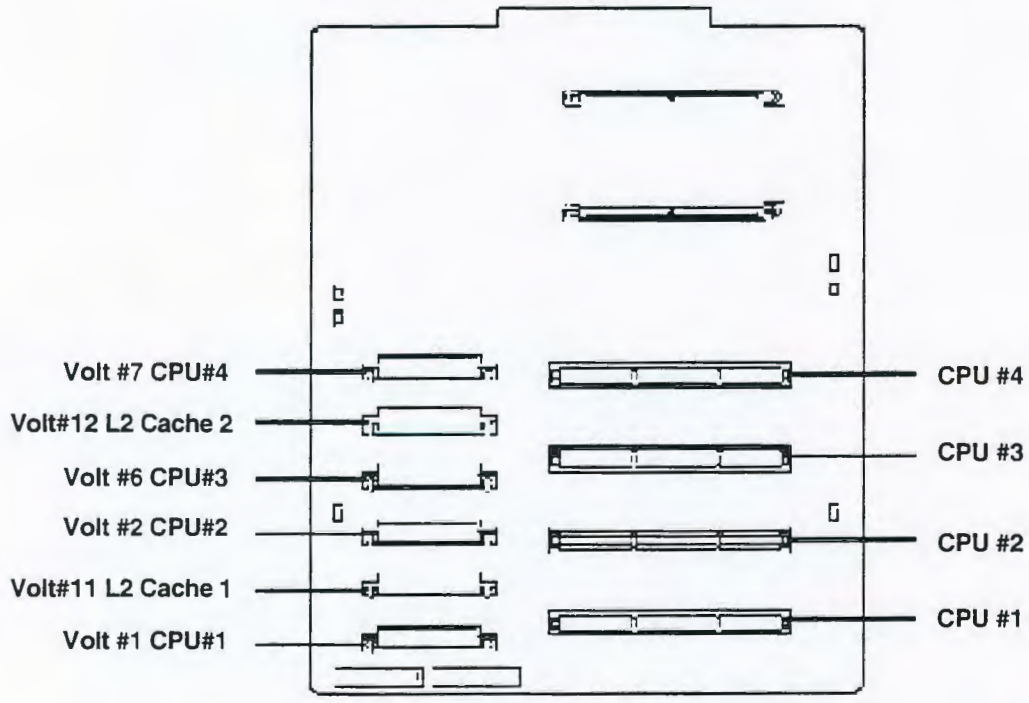


Figure D-1 Component Locations View A

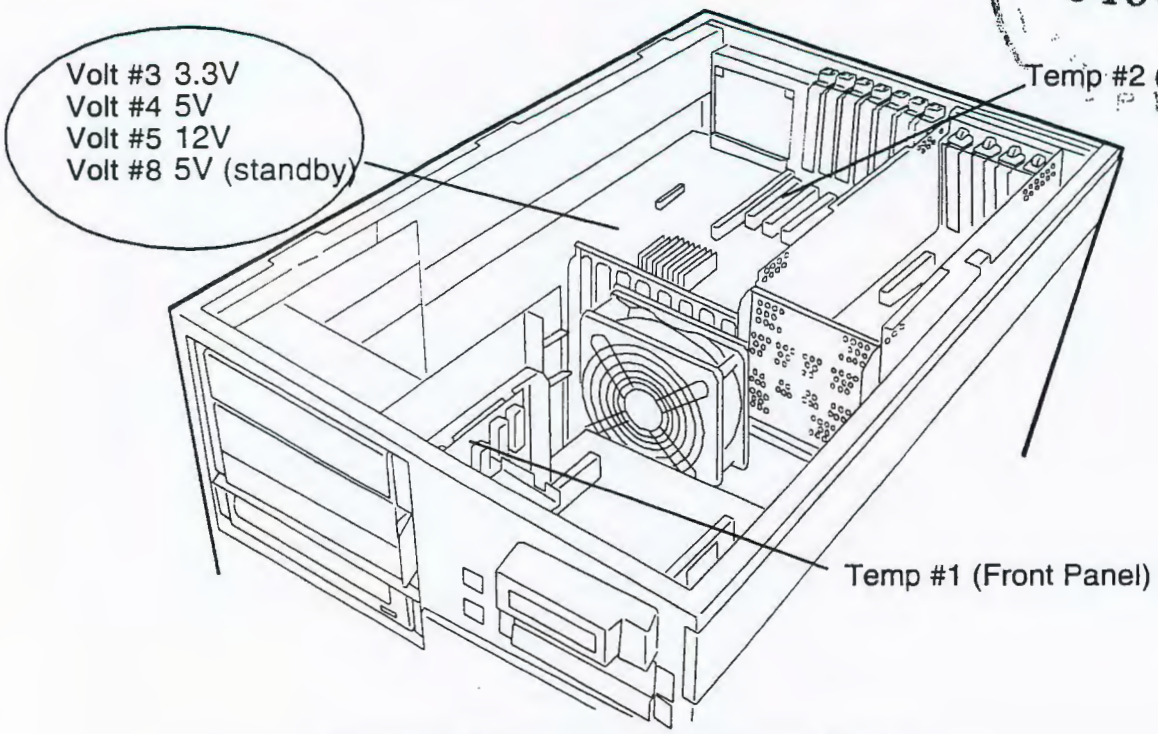


Figure D-2 Component Locations View B

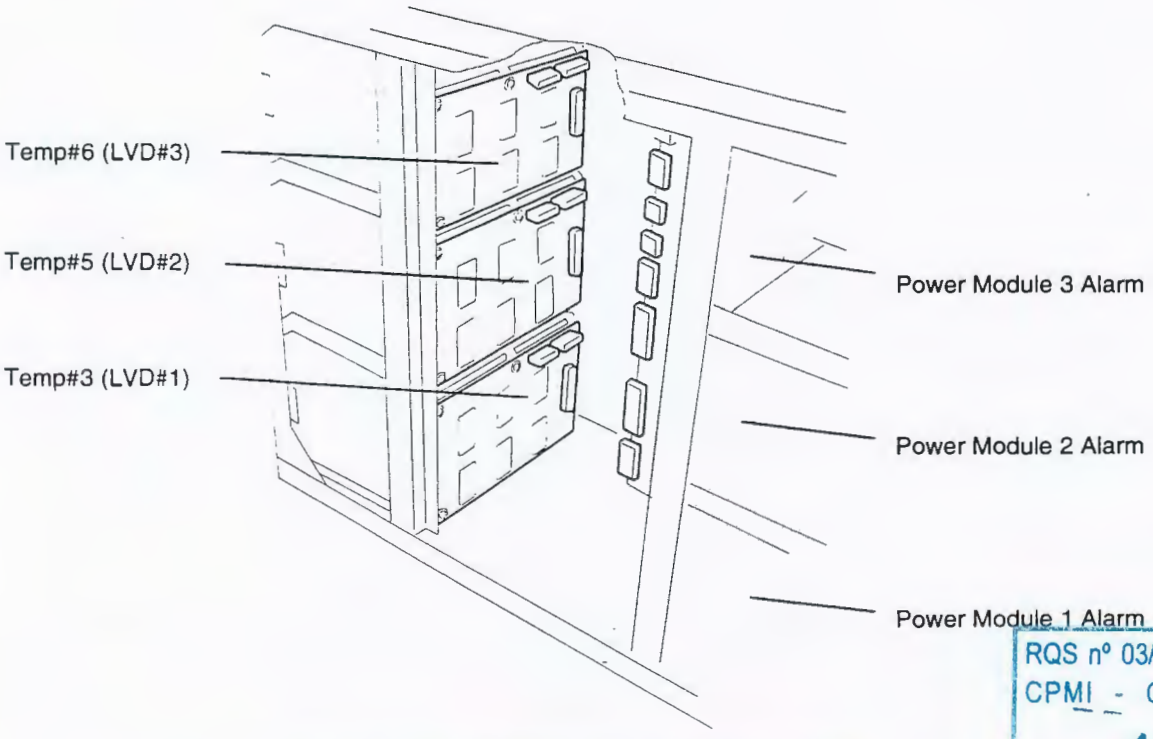


Figure D-3. Component Locations View C

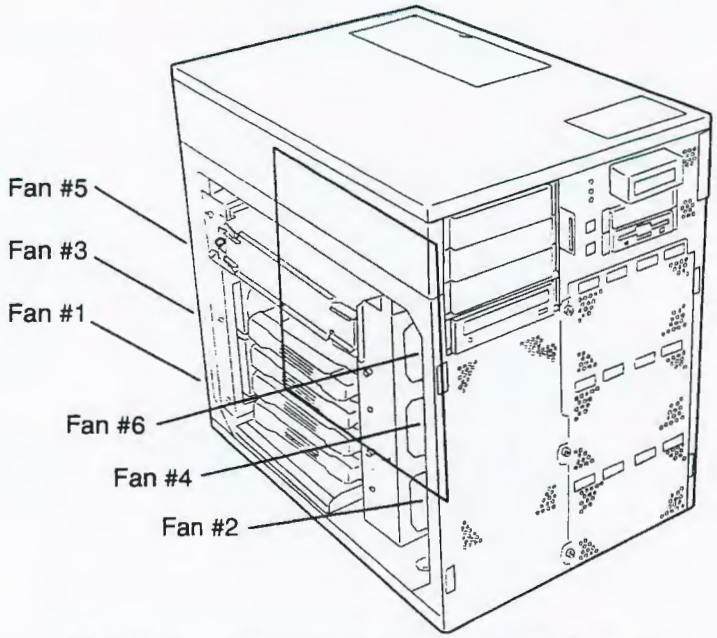


Figure D-4. Component Locations View D

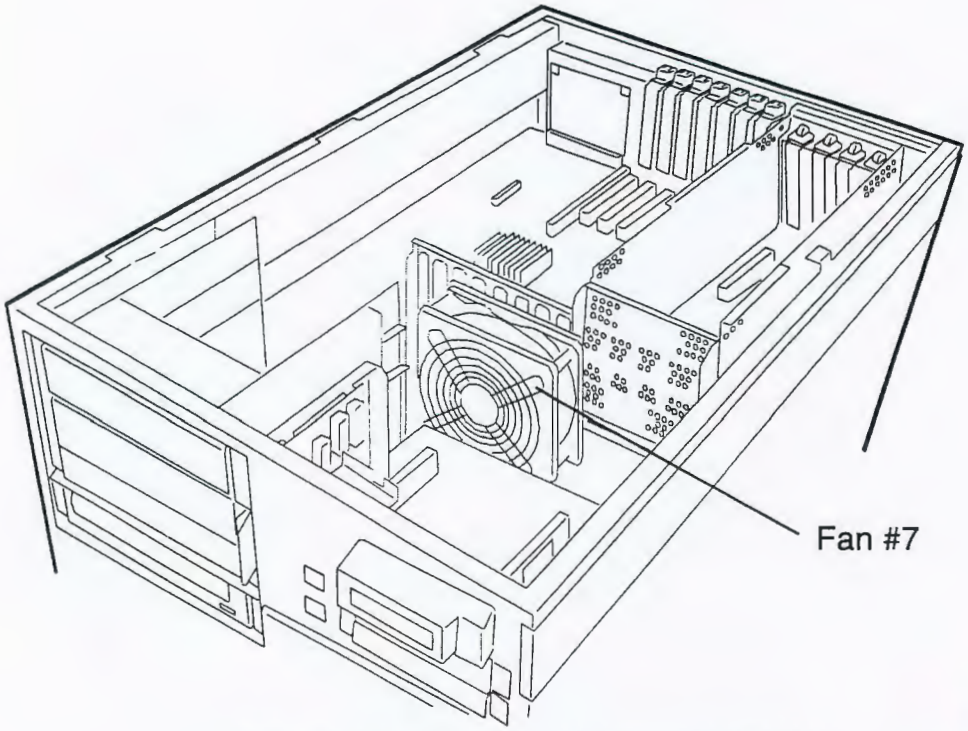


Figure D-5. Component Locations View E

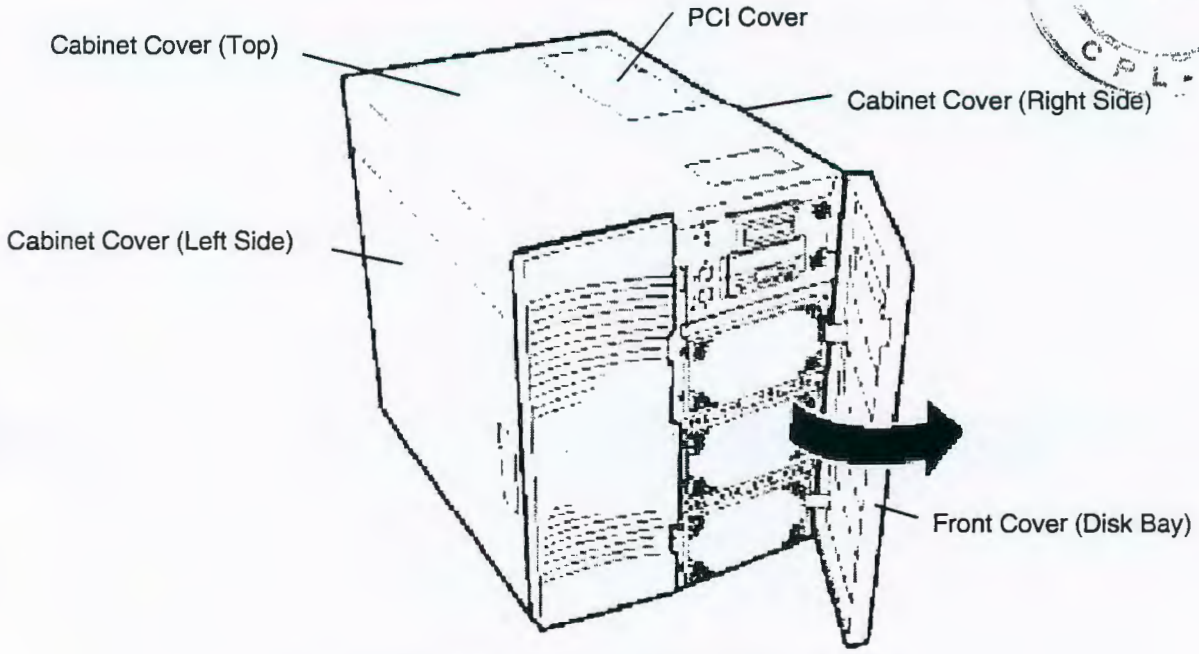


Figure D-6. Component Locations View F

Glossary

A

AC
(Alternating Current) The type of current available in wall outlets. All computers must convert alternating current to direct current to operate. See also DC.

Address
A label, name, or number that identifies a location in computer memory.

ASCII
(American Standard Code for Information Interchange) A standard number assigned to each of the alphanumeric characters and keyboard control code keys to enable the transfer of information between different types of computers and peripherals.

B

backplane slot
A connector on the backplane board in desktop computers and expansion boxes that allows you to install circuit cards.

backup
A copy of data for safe-keeping. The data is copied from computer memory or disk to a floppy disk, magnetic tape, or other media.

backup battery
The battery in your computer that maintains the real-time clock and the configuration information when the computer's power is removed.

base memory
An area of memory between 0 and 640 kilobytes.

baud rate
The speed with which data is transmitted during serial communication. The computer's operating system and software program must be configured for the same baud rate as the communication device, such as a serial printer. See also bps.

BIOS
(Basic Input/Output System) A program stored in flash EPROM or ROM that controls the keyboard, disk drives, video monitor, and other devices. See also flash EPROM, EPROM, and ROM.

bit
Derived from BInary digiT, a bit is the smallest unit of information a computer handles. See also byte.

boot
The process of loading the operating system into memory.

bps
(bits per second) The number of bits transferred in one second during serial communication, such as modem transmission.

byte
A group of eight bits.

C

cache memory
A very fast, limited portion of RAM set aside for temporary storage of data for direct access by the microprocessor.

CD-ROM drive
(Compact Disk ROM drive) A type of mass storage device that reads information from a compact disk.

Centronics port
An industry standard parallel port. See also parallel port.

CGA
(Color Graphics Adapter) A type of video display system that provides low-resolution text and graphics on TTL monochrome and color monitors.

CMOS
(Complimentary Metal-Oxide Semiconductor) A type of low-power integrated circuit used in computers. See also TTL.

COM1 or COM2
The name you can assign a serial port to set or change its address. See also serial port.

command
An instruction that directs the computer to perform a particular operation.

configuration
The way in which a computer is set up to operate. Some configurable options include CPU speed, serial port designation, and memory allocation.

coprocessor
See math coprocessor.

CPU
(Central Processing Unit) See microprocessor.

CRT
(Cathode-Ray Tube) The type of video display used in monitors for desktop computers.

D

DC
(Direct Current) The type of current available in the rechargeable battery packs used in portable computers. See also AC.

default
The factory setting your computer uses unless you instruct it otherwise. For example, when powering up, the computer will boot from the default drive.

density
The capacity of information (bytes) that can be packed onto a storage device, such as a floppy disk.

device driver
A software program that a computer must use to recognize and operate certain hardware, such as a mouse or a video monitor.

disk drive
A device that stores data on a hard or floppy disk. A floppy disk drive requires a floppy disk to be inserted; a hard disk drive has a permanently encased hard disk.

DOS
(Disk Operating System) See operating system.

DRAM
(Dynamic RAM) See RAM.

E

ECC
(Error Checking and Correction) A method of detecting and correcting errors.

EEPROM
(Electrically Erasable Programmable Read-Only Memory) A type of memory device that stores password and configuration information.

EGA
(Enhanced Graphics Adapter) A type of video display system that provides medium-resolution text and graphics on TTL monochrome, color, and enhanced color monitors.

EMS
(Expanded Memory Specification) A method of accessing memory beyond the 640K limit of DOS by exchanging data in and out of main memory at high speeds. Some software requires EMS to operate.

EPROM
(Erasable Programmable Read-Only Memory) A type of memory device that is usually used to store system BIOS code. This code can be erased with ultraviolet light, but is not lost when the computer is powered off. See also flash EPROM and ROM.

expanded memory
See EMS.

expansion slot
See backplane slot.

extended memory
The protected memory above 1M that is directly accessible by the microprocessor through certain utilities and operating systems. This memory is used in computers with 80286, 80386, and 80486 microprocessors.

F

flash EPROM
A type of memory device that is usually used to store system BIOS code. This code can be replaced with updated code from a floppy disk, but is not lost when the computer is powered off. See also EPROM and ROM.

floppy disk drive
See disk drive.

format
The process used to organize a hard or floppy disk into sectors so it can accept data. Formatting destroys all previous data on the disk.

G

(Gigabyte)
1,073,741,824 bytes. See also byte.

H

hard disk drive
See disk drive.

hardware
The physical parts of your computer, including the keyboard, monitor, disk drives, cables, and circuit cards.

I

IC
(Integrated Circuit) An electronic device that contains miniaturized circuitry.

(ISA Configuration Utility)
The program that you use to change the configuration of some ISA desktop computers. This program also contains information about the hardware in the computer.

interface
A connection between the computer and a peripheral device that enables them to exchange data. See also parallel port and serial port.

ISA
(Industry Standard Architecture) An industry standard for computers and circuit cards that transfer 16 bits of data at a time.

J

jumper
A small electrical connector used for configuration on some computer hardware.

K

(Kilobyte)
1,024 bytes. See also byte.

L

LAN
(Local Area Network) A group of computers linked together within a limited area to exchange information.

LCD
(Liquid Crystal Display) The type of video display used in portable computers.

LED
(Light-Emitting Diode) A small electronic device that glows when current flows through it.

LPT1 or LPT2
The name you can assign a parallel port to specify its address. See also parallel port.

LVD
Super-fast Ultra2 SCSI Low Voltage Differential (LVD) Parallel SCSI Interface. A new SCSI interface that provides greater I/O bandwidth, device connectivity, data reliability, and longer cable lengths for Ultra2 SCSI hard disk drives.

M

(Megabyte)
1,048,576 bytes. See also byte.

math coprocessor
An IC that works with the microprocessor to speed up mathematical calculations.

memory
The circuitry in your computer that stores data and programs. See also EMS, extended memory, RAM, and ROM.

microprocessor
The integrated circuit that processes data and controls the basic functions of the computer.

modem
A device used to exchange information with other computers over telephone or data lines.

module
A circuit board that plugs into a dedicated connector on the system board in your computer.

mouse
A small input device that you guide on a flat surface to control the cursor movement and operation of the computer when using certain software programs.

N

NVRAM
(Nonvolatile RAM) A type of RAM that retains its contents even after the computer is powered off. This memory stores EISA configuration information. See also RAM and SRAM.

O

operating system
A set of programs that provides the interface between other software programs and the computer.

P

parallel port
The connector on the back of your computer that allows the transfer of data between the computer and a parallel device, such as a parallel printer.

partition
The process of dividing the storage space on a hard disk into separate areas so that the operating system treats them as separate disk drives.

password
A security feature that prevents an unauthorized user from operating your computer. See also EEPROM.

PCI
Peripheral Component Interconnect. PCI is a high-performance peripherals I/O bus supporting data transfers of up to 132MB per second.

Pentium
A type of microprocessor, with a built-in math coprocessor, cache memory, and memory and bus controllers, that processes and communicates 32 bits of data at a time. This microprocessor also contains power management capabilities.

peripheral
A device connected to and controlled by the computer, such as an external disk drive or a printer.

pixel
The smallest element that is visible on a video display. The resolution of a video display system is measured in pixels.

PnP
(Plug-n-Play) Plug-and-play is the ability to plug a device into a computer and have the computer recognize that the device is there. The user doesn't have to tell the computer.

POST
Power-On-Self-Test.

R

RAM
(Random-Access Memory) A temporary storage area for data and programs. This type of memory must be periodically refreshed to maintain valid data and is lost when the computer is powered off. See also NVRAM and SRAM.

real-time clock
The IC in your computer that maintains the time and date.

RCU
(Resource Configuration Utility) The program that you use to change the configuration of your system. This program also contains information about the hardware in your system.

ROM
(Read-Only Memory) A type of memory device that usually is used to store system BIOS code. This code cannot be altered and is not lost when the computer is powered off. See also BIOS, EPROM, and flash EPROM.

RS-232C port
An industry standard serial port. See also serial port.

S

save
To store information on a floppy disk, hard disk, magnetic tape, or some other permanent storage device.

SCSI
(Small Computer System Interface) An industry standard interface that provides high-speed access to tape drives, hard disk drives, and other peripheral devices.

SEL
(System Event Log) A record of system management events. The information stored includes the name of the event, the date and time the event occurred and data pertinent to the event. Event data may include POST error codes that reflect hardware errors or software conflicts within the system.

serial communication
Information sent sequentially, one bit at a time.

serial port
The connector on the back of your computer that allows the transfer of data between the computer and a serial device, such as a mouse, a modem, or a serial printer.

Setup program
The program that you use to change the configuration of some ISA desktop and notebook computers. This program also contains information about the hardware in the computer.

software
Programs with specific functions, such as word processing, data base management, communications, and operating system.

SRAM
(Static RAM) A temporary storage area for data and programs. This type of memory does not need to be refreshed, but it is lost when the computer is powered off. See also NVRAM and RAM.

SVGA
(Super VGA) A type of video display system that provides very high-resolution text and graphics on analog color monitors.

system board
The main circuit board in your computer. It contains most of the connectors and ports.

T

tape drive
A type of storage device using magnetic tape.

TTL
(Transistor-Transistor Logic) A type of integrated circuit used in computers. See also CMOS.

V

VGA

(Video Graphics Array) A type of video display system that provides high-resolution text and graphics on analog color monitors.

Equipment Log

Use this equipment log form to record pertinent information about your system. You will need some of this information to run the System Setup Utility. Be sure to update the equipment log when you add options.

Record the model and serial numbers of the system components, dates of component removal or replacement, and the name of the vendor from whom the component was purchased. Be sure to record the same information for any components added to the system, such as hard disk drives, add-in boards, or printers.

Record the model and serial numbers of the unit and system baseboard. The model and serial numbers of the system unit are recorded on a label attached to the rear of the unit. The serial number of the system board is located along the left side of the board. near the PCI expansion slot covers.

The location of serial numbers on add-in boards, hard disk drives, and external equipment, such as video displays or printers, varies from one manufacturer to another. Literature accompanying these products should illustrate or describe the location of model and serial numbers.

Component	Manufacturer Name and Model	Serial Number (if available)	Date Installed
Server			
CPU 1			
CPU 2			
CPU 3			
CPU 4			
Memory Board #1			
Memory Board #2			
DIMMs			
DIMMs			
DIMMs			
DIMMs			
DIMMs			
DIMMs			
Modem			
Diskette Drive A			
Diskette Drive B			
Tape Drive 1			
Tape Drive 2			
CD-ROM Drive 1			
CD-ROM Drive 2			
Hard Disk Drive 1			
Hard Disk Drive 2			
Hard Disk Drive 3			
Hard Disk Drive 4			
Hard Disk Drive 5			
Hard Disk Drive 6			
Hard Disk Drive 7			
Hard Disk Drive 8			
Hard Disk Drive 9			
Hard Disk Drive 10			
Hard Disk Drive 11			

Component	Manufacturer Name and Model	Serial Number (if available)	Date Installed
Hard Disk Drive 12			
RAID Controller			
Network Controller 1			
Network Controller 2			
Monitor			
Keyboard			
Mouse			
External Peripherals			

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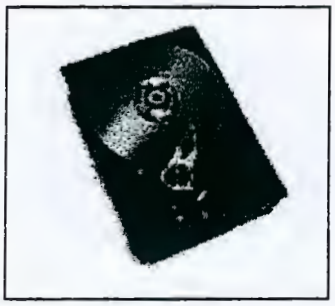
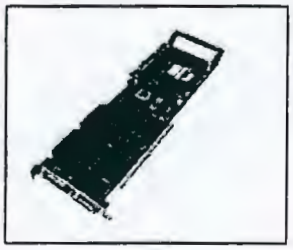
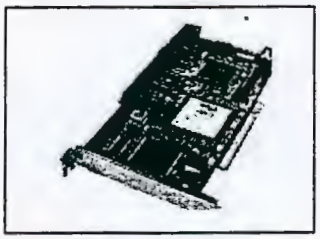
456-01502-001

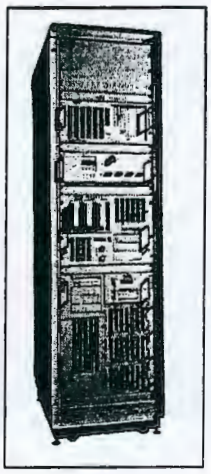
ACCESSORIES GUIDE

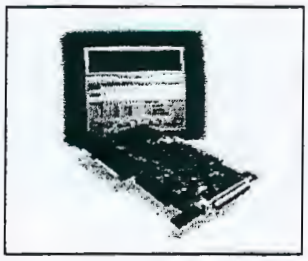
JANUARY 2000

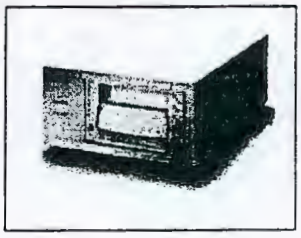


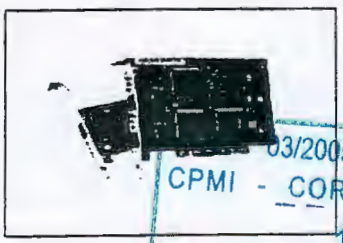












Created by Mark Carr

BULL TECNOLOGIA DA INFORMAÇÃO LTDA.

Table 5-2. Operational Error Codes and Messages (continued)

Error Code and Message		Explanation	Action
2211	Memory Err	A memory error was detected in a DIMM pair located on memory board #2.	See Figure 5-4 to determine which DIMM pair caused the memory error on memory board #2. Check memory DIMM installation and memory board installation. If the same error reoccurs, contact your customer service representative.
2213	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
2215	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
2217	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
2219	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
221B	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
221D	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
221F	Memory Err	See 2211 "Explanation."	Follow 2211 "Action."
	PCI PERR	PCI bus parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0901	PCI PERR	PCI bus#1 parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0902	PCI PERR	PCI bus#2 parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0903	PCI PERR	PCI bus#3 parity error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
	PCI SERR	PCI bus system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0A01	PCI SERR	PCI bus#1 system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
0A02	PCI SERR	PCI bus#2 system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.

0A03	PCI SERR	PCI bus#3 system error	Check PCI board installation. If the same error reoccurs, contact your customer service representative.
1012	Power +3.3V	3.3V power failure	Ask your customer service representative for power unit or board replacement.
1013	Power +5V	5V power failure	Ask your customer service representative for power unit or board replacement.
1014	Power +12V	12V power failure	Ask your customer service representative for power unit or board replacement.
1022	Power +1.5V	1.5V power failure	Ask your customer service representative for power unit or board replacement.
1023	Power +5.0VS	5V power failure	Ask your customer service representative for power unit or board replacement.
1010	Power CPU#1	CPU#1 power failure. See Figure 5-1.	Check CPU VRM installation. If the same error reoccurs, contact your customer service representative.
1011	Power CPU#2	CPU#2 power failure. See Figure 5-1.	Follow 1010 "Action."
1020	Power CPU#3	CPU#3 power failure. See Figure 5-1.	Follow 1010 "Action."
1021	Power CPU#4	CPU#4 power failure. See Figure 5-1.	Follow 1010 "Action."
1040	Power Error 1	Power unit #1 (bottom) failure. See Figure 5-2.	Ask your customer service representative for replacement of the failed power unit.
1041	Power Error 2	Power unit #2 (middle) failure. See Figure 5-2.	Follow 1040 "Action."
1042	Power Error 3	Power unit #3 (top) failure. See Figure 5-2.	Follow 1040 "Action."

Standard warranty	3 year on-site	3 year on-site
Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes NTSL certified
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 1400 (option)

TABLE OF CONTENTS

TECHNOLOGY REFERENCE

MEMORY TECHNOLOGY

WHAT IS SDRAM?

- *Synchronous DRAM - a fast high-bandwidth memory designed to work best with systems employing high-performance chipsets and processors*
- *Can Synchronise itself with the system clock that controls the CPU, eliminating time delays + improving processor efficiency.*
- *Bandwidths of up 100Mhz — twice the bandwidth of EDO-SDRAM is a result of a major shift from EDO and Fast Page Mode DRAMs.*

WHAT IS EDO?

- *Extended Data Out is a memory technology that can provide approximately a 5-30% boost in the memory subsystem speed versus Fast-Page Mode.*
- *EDO provides increased performance by loading data at the same time it is searching for new information.*
- *EDO reduces the bottlenecking in data transfers between high-speed processors that need to get data quickly*

WHAT IS ECC?

- *Error checking and correcting memory automatically checks and corrects single-bit errors without bringing the system.*
- *The system will halt when 2-, 3-, 4-bit errors are detected.*
- *ECC memory requires more overhead than parity memory for storing data and causes approximately 3% performance degradation in the memory subsystem, but the resulting error detection and correction can make the trade-off well worth it.*

WHAT IS PC133 memory?

- *PC133 provides a one to one speed match with a FSB that is running at 133MHz. It is the bridge between PC100 SDRAM and future DDR SDRAM.*
- *PC133 improves overall memory timings and it also transfers data 33% faster between the memory and the microprocessor,*
- *The evolution of this new technology gives extra memory performance for the end user*

WHAT IS ULTRA SCSI?

- *Also known as Fast-20, Ultra SCSI supports up to 20MBps burst transfers across 8-bit paths and up to 40MBps burst transfers across Wide 16-bit paths.*
- *As it is pin- and cable-compatible with SCSI-2 Fast and Fast/Wide, there's no need to change the physical connection, although you are restricted to shorter cables for external attachments.*

WHAT IS ULTRA 2 SCSI?

- *Ultra 2 SCSI technology is a doubling of the bus data rates of Ultra SCSI.*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *While Ultra 2 drives are implemented allowing operations on Ultra SCSI data buses, the new performance levels only exist in buses that are Ultra 2 exclusive.*

WHAT IS ULTRA-160/M SCSI?

- *Ultra-160/m SCSI technology provides data transfer rates of up to 160MB/s, thus doubling the bus rates of Ultra2 SCSI*
- *Accomplished through improved noise immunity and transmission speeds offered by a new low voltage implementation of differential signalling technology, sometimes referred to LVDS.*
- *Gives improved scalability and accommodation of faster devices, thus becoming an important building block in creating the worlds' fastest servers.*

Table showing current SCSI categories:

STA TERMS	Bus Speed Mbytes/Sec Max	Bus Width, bits	Max. Bus Lengths, Meters			Max. Device Support
			Single ended	LVD	HVD	
SCSI-1	5	8	6	(2)	25	8
Fast SCSI	10	8	3	(2)	23	8
Ultra SCSI	20	8	1.5	(2)	25	8
Ultra Wide SCSI	40	16	-	(2)	25	16
Ultra2 Wide SCSI	80	16	(1)	12	25	16
Ultra3 SCSI or Ultra-160/m (4)	160	16	(1)	12	(3)	16

(1) Single ended is not defined for speeds beyond Ultra
(2) LVD was not defined in the original SCSI standards for this speed. If all devices on the bus support LVD, then 12-meters operation is possible at this speed. However, if any device on the bus is singled-ended only, then the entire bus switches to single-ended mode and the distances in the single-ended column apply.
(3) HVD (Differential) is not defined for speeds beyond Ultra2
(4) After Ultra2 all speeds are wide only

UNINTERUPTIBLE POWER SUPPLIES

What is Uninteruptible Power Supplies?

- *A piece of hardware that help to protect your server from power outages.*
- *We strongly recommend for all Express5800 servers to be accompanied by a UPS (Uninterruptible Power Supply) which will protect data from any power problems and outages. We offer models in both tower based and 3U rack-mount form factors*
- *Our different UPS models provide a back up power supply to allow the server to overcome power problems. In the event of a complete power failure, the back up time allows the user to shut down the machine without losing important data.*
- *The table below shows the UPS options available. Firstly, calculate the total VA power of the configuration to be connected to the UPS by adding the power of all items of the configuration. Then, select the UPS corresponding to the calculated VA power and the required autonomy (in minutes) supplied by the UPS.*
- *It is recommended that you allow some UPS power margin for future configuration expansion.*

Table 1 Typical and Maximum VA power of Express5800 servers

Model	Typical VA (a)	Max VA (b)	Typical VA (a)	Max VA (b)	Max VA
TM1100	286	407	**HX4600**	1007	1438
LC1400	364	520	**HV8600**	1510	2157
LS2400	315	451	**ST8000**	365	520
MC2400	364	520	**ST1400**	365	520
120Ld	238	340	**4-Port concentrator**	36	52
120Mc2	268	383	**8-Port concentrator**	36	52
120Mc3	285	407	**Monitor 15"**	104	138
MH4500	719	1027	**Monitor 17"**	171	224
HX4500	755	1079	**Monitor 19"**	189	243

Table 2 UPS autonomy (in minutes)

VA	SU700	SU1000	SU1400 SU1400RM	SU2200 SU2200RM	SU3000 SU3000RM
300	**20**	**36**	**60**	**130**	**116**
350	**17**	**28**	**49**	**112**	**101**
400	**14**	**24**	**41**	**98**	**89**
450	**11**	**20**	**36**	**86**	**79**
500	**9**	**18**	**32**	**76**	**70**
550	**7**	**15**	**28**	**68**	**63**
600	**6**	**13**	**25**	**61**	**57**
700	**5**	**11**	**21**	**50**	**46**
800	-	**9**	**17**	**41**	**39**
900	-	**7**	**14**	**35**	**34**
1000	-	**6**	**11**	**31**	**30**
1200	-	-	**9**	**24**	**24**
1400	-	-	**7**	**19**	**19**
1600	-	-	-	**16**	**16**
1800	-	-	-	**13**	**13**
2000	-	-	-	**10**	**10**
2200	-	-	-	**9**	**9**
2500	-	-	-	-	**8**
3000	-	-	-	-	**7**

What is a Smart Slot Interface and a UPS Share Box?

- *These two options provide added data protection for Multiple servers that are using a single UPS. If you are managing multiple servers, we propose that you use a Smart Slot Interface or a UPS share box ...*

TAPE DRIVE TECHNOLOGY

What is DAT?

- *Digital Audio tape (DAT) was originally designed specifically for digital audio recording applications.*
- *When it was realised that 4mm tape could store large amounts of digital data, produce fast data transfer rates and deliver reliability, hence DAT was introduced as a tape backup medium.*

What is DLT?

- *Digital Linear Tape (DLT) - latest development in tape backup technology.*
- *Uses symmetric phase recording technology that alternates head angles to help eliminate cross-track interference.*

MEMORY

- 64MB, 128MB, 256MB 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 100MHz FSB SDRAM Memory
- 64MB, 128MB 256MB ECC 133MHz FSB SDRAM Memory
- 128MB, 256MB, 512MB, 1GB ECC DIMM Memory
- 256MB, 512MB, 1GB ECC DIMM Memory

64MB, 128MB, 256MB 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AME-0511-00-00	AME-0511-IN-00	64MB (1x64) 100MHz FSB SDRAM Memory
AME-0512-00-00	AME-0512-IN-00	128MB (1x128)100 MHz FSB SDRAM Memory
AME-0513-00-00	AME-0513-IN-00	256MB (1x256) 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AME-0511-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0512-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AME-0513-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB ECC 100MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-4064-00-00	AMS-4064-IN-00	64MB (1x64) ECC 100MHz FSB SDRAM Memory
AMS-4128-00-00	AMS-4128-IN-00	128MB (1x128) ECC 100MHz FSB SDRAM Memory
AMS-4256-00-00	AMS-4256-IN-00	256MB (1x256) ECC 100MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-4064-xx-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4128-xx-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-4256-xx-00	32M bit x 72 Synchronous Dynamic RAM high density memory module

64MB, 128MB, 256MB, 512MB ECC 133MHz FSB SDRAM Memory

- Dual In-line memory module
- Synchronous design allows precise cycle control with the use of system clock; I/O transactions are possible every clock cycle.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMS-5064-00-00	AMS-5064-IN-00	64MB (1x64) ECC 133MHz FSB SDRAM Memory
AMS-5128-00-00	AMS-5128-IN-00	128MB (1x128) ECC 133MHz FSB SDRAM Memory
AMS-5256-00-00	AMS-5256-IN-00	256MB (1x256) ECC 133MHz FSB SDRAM Memory
AMS-5512-00-00	AMS-5512-IN-00	512MB (1x512) ECC 133MHz FSB SDRAM Memory

KIT CONTENTS
Memory Board

TECHNICAL SPECIFICATIONS

AMS-5064-00-00	8M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5128-00-00	16M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5256-00-00	32M bit x 72 Synchronous Dynamic RAM high density memory module
AMS-5512-00-00	64M bit x 72 Synchronous Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-6256-00-00	AMD-6256-IN-00	256MB ECC (4x64) 60ns DIMM Memory Upgrade kit
AMD-6512-00-00	AMD-6512-IN-00	512MB ECC (4x128) 60ns DIMM Memory Upgrade kit
AMD-6010-00-00	AMD-6010-IN-00	1GB ECC (4x256) 60ns DIMM Memory Upgrade Kit
Same characteristics for the AMD-7256-00-00, AMD-6512-00-00 and AMD-6010-00-00.		

TECHNICAL SPECIFICATIONS

AMD-6256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-6512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-6010-00-00	32Mx72bits Dynamic RAM high density memory module

256MB, 512MB, 1GB ECC DIMM Memory

- Dual in-line Memory Module

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AMD-8256-00-00	AMD-8256-IN-00	256MB ECC (4x64) 50ns DIMM Memory Upgrade kit
AMD-8512-00-00	AMD-8512-IN-00	512MB ECC (4x128) 50ns DIMM Memory Upgrade kit
AMD-8010-00-00	AMD-8010-IN-00	1GB ECC (4x256) 50ns DIMM Memory Upgrade Kit

TECHNICAL SPECIFICATIONS

AMD-8256-00-00	8Mx72bits Dynamic RAM high density memory module
AMD-8512-00-00	16Mx72bits Dynamic RAM high density memory module
AMD-8010-00-00	32Mx72bits Dynamic RAM high density memory module

HARD DISK DRIVES

- The 5,400rpm EIDE 10.2GB, 15GB HDD
- The 7,200rpm EIDE 12.9GB, 20.4GB HDD
- The 7,200rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 7,200rpm Ultra2 80-pin SCSI 9.1GB, 18.2GB, 36.4GB HDD
- The 7,200rpm Ultra2 68-pin SCSI 9.1GB, 18.2GB HDD
- The 10,000rpm Ultra-160/m 80-pin SCSI 9.1GB, 18.2GB, 36GB HDD
- The 10,000rpm Ultra2 80-pin SCSI 9.1GB, 18.2, 36.4GB HDD

HARD DISK DRIVES

PRICE PERFORMANCE

10.2GB,15GB (1")
5,400rpm
AST : 9/9.5ms
ITR : up to 158Mbit/s
ETR : 33MB/sand 66MB/s
Cache: 128KB to 512KB

12.9GB, 20.4GB (1")
7200rpm
AST : 9ms
ITR : up to 158Mbit/s
ETR : 33MB/s
Cache: 128KB to 512KB

9.1GB, 18.2GB (1")
7,200rpm
68-pin
AST : 6.9 to 8.2ms
ITR : up to 192Mbit/s
ETR : 80MB/s
Cache: 512KB

9.1GB, 18.2GB (1") 36.4GB (1.6") 7,200rpm 80-pin
AST : 6.9 to 7.6ms
ITR : up to 190Mbit/s
ETR : 80MB/s
Cache: 512KB to 1MB

9.1GB, 18.2GB (1"),36.4GB (1.6") 10,000rpm
AST : 5.4 to 6.7ms
ITR : up to 231Mbit/s
ETR : 80MB/s
Cache: up to 4MB

9.1GB, 18.2GB (1"),36.4GB (1.6") 7,2000rpm
AST : 6.9 to 7.5ms
ITR : up to 231Mbit/s
ETR : 160MB/s
Cache: up to 2MB

9.1GB, 18.2G (1"),36.4GB (1. 10,000rpm
AST : 5.4 to 6.
ITR : up to 231
ETR : 160MB
Cache: up to 2M with Fibre Cha

AST : Average Seek Time
ITR : Internal Transfer Rate
ETR : External Transfer Rate

EIDE | U2W SCSI | U-160/m SCSI

EIDE vs SCSI

	EIDE	SCSI
ENVIRONMENT		
	Offers low cost and performance equal to SCSI in Entry level servers and Mobile environments.	Delivers excellent performance for network computers with Intel-Based processors. Data-intensive applications and large numbers of users in LAN Environments.
PERFORMANCE		
	In one to one HDD performance comparison EIDE performs equally well.	A SCSI interface offers the performance edge, especially when coupled with Windows NT.
PRICE		
	Generally least expensive. The controller is standard on the system board Chipset.	Drives are a little more expensive for the same capacity and rotational speed as EIDE. May also require a SCSI adapter.
EXPANDABILITY		
	Can support high hard drive capacity, as well as CD-ROM and tape devices up to 4 devices in all.	Holds more than 9GB. Offers high capacity and performance for muitiple hard disks, a wide variety of devices and long cable connectors for more convenient attachment of external devices. Backwards compatible.
EASE OF INSTALLATION		
	Although most PCs ship with an EIDE interface, ensure that your system's EIDE interface and BIOS support all the new drive's Functionality.	You may need to install a SCSI adapter.

The 5,400rpm EIDE 10.2GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0110-00-10	ADH-0110-IN-00	10.2GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0100-xx-00
Formatted Capacity	
ADH-0100-xx-00	10.2 GB
Interface	ATA-4/Ultra DMA
DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
ADH-0100-##-00	3
Tracks per Surface (Cylinders)	11,530
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320
PERFORMANCE SPECIFICATIONS	
Buffer Size	256 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.56ms
Rotation Speed (±0.1%)	5,400 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 18.6 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 7.5 sec typical

[1] - *Controller overhead not included.*

RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.77 (146.6)
Width inches (mm)	4.02 (102.1)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating ^{0} C	5 to 55
Non-operating ^{0} C	-40 to 71
Operating/Non-operating Relative ^{0} C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb (^{0} C)	27

POWER REQUIREMENTS

MODE	12V ± 5%	5V ± 5%	Power
Spin-up (peak)	1600mA	200mA	20.2W
Seek	650mA	340mA	9.6W
Read/Write	250mA	350mA	4.8W
Idle	250mA	280mA	4.4W
Standby	8mA	160mA	0.9W

The 5,400rpm EIDE, 15GB Hard Disk Drive

- 3.5" high performance hard drives
- Fast average seek time 9.5ms

Fast data transfer rate (up to 66MB/sec)

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0150-00-10	ADH-0150-IN-10	15GB (1") Fast ATA

KIT CONTENTS
HDD + 4 screws

APACITY AND INTERFACE	ADH-0150-00-10
Interfaces	Ultra ATA
Formatted Capacity	15.367
DISK DRIVE ORGANISATION	
Heads	3
Disks	2
PERFORMANCE SPECIFICATIONS	
Buffer Size (KB)	512
Buffer type	SDRAM
Typical Seek Times* (ms)	
Average	9.5
Track-to-Track	1
Rotational Speed (rpm)	5,400
Average Rotational Latency (ms)	5.55
Start time (0-drive ready)	7.3sec typical
Integrated Controller	ATA-5/UDMA
Data Zones per surface	16
Bytes per sector/Block	512
DATA TRANSFER RATES	
To/From Interface	Up to 66.7MB/sec
To/From Media VL20 Series	Up to 36.9MB/sec
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles (min)	50,000
Component Design Life (min)	5 years
Non-recoverable Data Errors(per bits read)	<10 per 10^{14}
Annual return rate	<1%
PHYSICAL DIMENSIONS	
Width (Inches /mm)	4.00/102.0
Length-(Inches /mm)	5.78/146.7
Height-(Inches /mm)	1.02/25.9
Weight-(pounds/kg)	1.30/0.59
ENVIRONMENTAL LIMITS	
Operating Temperature(^{0}C)	5-55
Non Operating (^{0}C)	-40 to 71
Operating/Non-operating Humidity %(non-condensing)	5-95
Maximum Wet Bulb (^{0}C)	30

POWER REQUIREMENTS			
MODE	**12V ± 10%**	**5V ± 5%**	**Power**
Spin-up (peak)	2100mA	275mA	
Seek	740mA	420mA	11.0W
Read/Write	295mA	440mA	5.7W
Idle	230mA	380mA	4.7W
Standby	20mA	220mA	1.3W

The 7,200rpm EIDE 12.9GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- 66/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0130-00-11	ADH-0130-IN-11	12.9GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0130-00-11
Formatted Capacity	12.9 GB
Interface	ATA-4/Ultra DMA/66

DISK DRIVE ORGANISATION	
Data Surfaces/Heads	
Recording Surfaces	4
Tracks per Surface (Cylinders)	16,383
Track Density	9,800 T/inch
Recording Density	156-205 Kbit/inch
Flux Density	166-237 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	269-320

PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	0.9 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	5.55ms
Rotation Speed (±0.1%)	7200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 22.0 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical

[1] - *Controller overhead not included.*

RELIABILITY SPECIFICATIONS	
AFR	< 1.7%
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 10 per 10^{15} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	4.00 (101.6)
Length inches (mm)	5.75 ()146.1)
Width inches (mm)	1.00 (25.4)
Weight lbs. (kg)	1.26 (0.5)

ENVIRONMENTAL LIMITS

Temperature	
Operating^0 C	5 to 55
Non-operating^0 C	-40 to 65
Operating/Non-operating Relative^0 C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb^0 C	27

POWER REQUIREMENTS

Nominal Voltage	**+5/ +12**
Voltage Margin (%)	+5/ +12
Typical Power Draw (W)	
Idle	6.2
Operating	8.8
Peak Current (mA on +5/ +12V)	700/1,830

The 7,200rpm EIDE 20.4GB Hard Disk Drive

- 3.5 inch Hard Disk Drives
- ATA-4/Ultra DMA interface
- 9.0ms Seek Performance
- Up to 33MB/sec data transfer rates

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADH-0200-00-10	ADH-0200-IN-10	20.4GB (1") ATA-4/Ultra DMA

KIT CONTENTS
HDD + 4 screws

CAPACITY AND INTERFACE	ADH-0200-00-10
Formatted Capacity	20.4GB
Interface	ATA-4/Ultra DMA
DISK DRIVE ORGANISATION	
Data Surfaces/Heads	8
Tracks per Surface (Cylinders)	14,850
Track Density	14,522 tpi
Areal Density	3,800Mb per in^2
Recording Density	204-255 Kbit/inch
Flux Density	217-271 kfci
Data Zones per Surface	16
Bytes per sector/Block	512
Sectors per Track	240-403
PERFORMANCE SPECIFICATIONS	
Buffer Size	512 KB
Buffer Type	SDRAM
Seek Times (typical)[1]	
Track to Track	1 ms
Average	9.0ms
Maximum	< 20ms
Average Latency	4.18ms
Rotation Speed (±0.1%)	7,200 rpm
Controller Command Overhead	< 0.5ms
Data Transfer Rate	
To/from Media	Up to 31.2 MB/s
To/from Interface	Up to 33.0 MB/s
Start time (0 - drive ready)	< 8.8 sec typical
RELIABILITY SPECIFICATIONS	
Start/Stop Cycles	50,000 minimum
SMART	Self Monitoring Analysis and Reporting Technology
Component Design life	5 years minimum
Data Reliability	
Data Errors (non-recoverable)[2]	< 1 per 10^{14} bits read

[2]- *Average data error rate allowed with all recovery features activated*

PHYSICAL DIMENSIONS

Height inches (mm)	1.02 (25.9)
Length inches (mm)	5.78 (146.7)
Width inches (mm)	4.00 (102.0)
Weight lbs. (kg)	1.30 (0.59)

ENVIRONMENTAL LIMITS

Temperature	
Operating ^{0} C	5 to 55
Non-operating ^{0} C	-40 to 71
Operating/Non-operating Relative ^{0} C Thermal Gradient	25 per hour maximum
Operating/Non-operating Humidity % (non-condensing)	5 to 95
Maximum Wet Bulb ^{0} C	27

POWER REQUIREMENTS

MODE	12V ± 8%	5V ± 10%	Power
Spin-up (peak)	2400mA	200mA	29.8W
Seek	860mA	340mA	12.1W
Read/Write	460mA	325mA	<8W
Idle	475mA	250mA	<7W
Standby	8mA	160mA	<1W

The 7,200rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Advanced SCSI interface support data transfer rates of up to 160MB/s
- 7,200rpm, 6.19ms average seek time, 21MB/sec maximum sustained
- throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-7945-00-00	CDH-7945-IN-00	9GB Ultra-160/m SCSI,1"
CDH-7845-00-00	CDH-7845-IN-00	18GB Ultra-160/m SCSI,1"
CDH-7645-00-00	CDH-7645-IN-00	36GB Ultra-160/m SCSI,1.6"

KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-7945-00-00	CDH-7845-00-00	CDH-7645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	2	4	8
Number of heads	4	8	16
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
Rotational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1011	10 per 1011	10 per 1011
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.64/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91

NVIRONMENTAL LIMITS			
Operating Temperature	5* to 55*	5* to 55*	5* to 55*
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	1.0	1.0	1.0
Sound Power (bels, Idle)	3.6	3.6	4.0
Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (|G, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC± 5%/12V DC± 5%/	5V DC± 5%/12V DC± 5%/	5V DC± 5%/12V DC± 5%/
Typical Power Draw (W, Idle)	6.5	7.9	10.8
Typical Current Draw (A, Operating)			
5V	0.5	0.5	0.5
12V	0.85	0.90	1.20

The 7,200rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 80MB/s
- 7,200rpm, 4.17ms average latency

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-794#-00-00	BDH-794#-IN-00	9.1GB Ultra2 SCSI,1"
BDH-784#-00-00	BDH-784#-IN-00	18.2GB Ultra2 SCSI,1"
BDF-764#-00-00	BDF-764#-00-00	36.4GB Ultra2 SCSI,1.6"

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500	8	
1		3		5		7	HX4500, HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-794#-00-00	BDH-784#-00-00	BDF-764#-00-00
Interface	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI	Fast & Wide, Ultra2 SCSI
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
DISK DRIVE ORGANISATION			
Number of disks	3	5	10
Number of heads	5	10	20
Areal density (maximum)	N/A Mbits/sq.inch	N/A Mbits/sq.inch	N/A Mbits/sq.inch
Recording density (maximum)	223,000 bits/inch	223,000 bits/inch	223,000 bits/inch
User cylinders	11,737	11,721	11,721
Track density (T/inch)	12,580	12,580	12,580
Sector size	512 Bytes	512 Bytes	512 Bytes
Recording Method	16/17 EPR4	16/17 EPR4	16/17 EPR4
PERFORMANCE SPECIFICATIONS			
Data buffer	1,024KB	1,024KB	1,024KB
Rotational speed	7,200rpm	7,200rpm	7,200rpm
Latency (average)	4.17ms	4.17ms	4.17ms
Media transfer rate	80MB/s	80MB/s	80MB/s
Average seek time	6.9/7.4ms	6.9/7.4ms	7.6ms
Track-to-Track	0.8ms	0.8ms	0.9ms
Full track	15ms	15ms	16ms
RELIABILITY SPECIFICATIONS			
Non recoverable read errors	10 per 10^{15}	10 per 10^{15}	10 per 10^{15}
S.M.A.R.T	Yes	Yes	Yes
MTBF (hours)	1,000,000	1,000,000	1,000,000
PHYSICAL DIMENSIONS			
Height in/mm	1.0/25.4	1.0/25.4	1.63/41.7
Width in/mm	40.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146	5.75/146	5.75/146
Weight (max.)lb/ kg	1.5/0.68	1.5/0.68	2.1/0.93

ENVIRONMENTAL LIMITS			
Idle Accoustics (mean/max Bels)	4.1/4.4	4.1/4.4	4.2/4.5
Operating Temperature	5* to 50*	5* to 50*	5* to 50*
Nonoperating temperature	-40* to 70*	-40* to 70*	-40* to 70*
Operating Shock	15	15	15
Nonoperating shock	75	75	75
Operating vibration (5-350 Hz)	0.5	0.5	0.5
Nonoperating vibration (350 Hz)	2.0	2.0	2.0
POWER REQUIREMENTS			
Start up current (amps)	1.4	1.5	1.4
Idle power (typ.Watts)	9.8	9.8	13.4

The 7,200rpm 68-pin Ultra2 SCSI 9.1GB, 18.2GB, Hard Disk Drives

- Formatted capacities of 9.1 to 36.4 Gbytes
- 7,200-rpm, 4.17 msec average latency
- Ultra2 SCSI (LVD) and Fibre Channel Interfaces
- Advanced SCSI Architecture (ASA II)
- MR heads, embedded servo and PRML channel

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-7930-00-00	BDH-7930-IN-00	9.1GB LVD Ultra2SCSI 68-pin
BDH-7830-00-00	BDH-7830-00-00	18.2GB LVD Ultra2SCSI 68-pin

KIT CONTENTS
HDD + 4 screws

CAPACITY & INTERFACE	BDH-7930-00-00	BDH-7830-00-00
Formatted Gbytes	18.2	36.4
Interface	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)	Ultra2 SCSI (LVD 16-bit,SCA II) Fibre Channel (dual port)
Interface type	68-pin	68-pin
PERFORMANCE		
Internal Transfer Rate	137 to 240 Mbits/s	137 to 240 Mbits/s
Internal Formatted Transfer Rate	12.9 to 22.5 Mbytes/s	12.9 to 22.5 Mbytes/s
External Transfer Rate -Mbytes/s Ultra2 SCSI/Fibre Channel	80/100 per loop	80/100 per loop
Multisegmented Cache, Ultra2 SCSI/FC	1,024 (4,096 optional)	1,024 (4,096 optional)
Track to Track Seek, Read/Write	0.8/1.1 msec	0.8/1.1 msec
Average Seek, read/Write	6.9/7.4 msec	7.4/8.2 msec
Average Latency	4.17 msec	4.17 msec
Spindle speed	7,200	7,200
ks/Heads	3/5	5/10
Embedded	Embedded	Embedded
Sectors/ track (512bytes/sector)	304	304
Cylinders	11,737	11,721
Recording Method (PRML)	16/17 EPR4	16/17 EPR4
S.M.A.R.T Capable	Yes	Yes
Recoverable Read Errors per Bits Read	10 per 10^{12}	10 per 10^{12}
NonRecovarable Read Errors per Bits Read	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	10 per 10^{8}	10 per 10^{8}
Service Life/Limted Warranty	5/5 years	5/5 years
POWER REQUIREMENTS		
+ 12 VDC + 5% (amps) Ultra SCSI, Ultra2 SCSI	0.9/0.9	1.2/1.2
+ 5 VDC + 5% (amps) Ultra SCSI/Ultra2 SCSI	0.8 [1.2]	1.2 [1.25]
Power (Idle watts) Ultra SCSI/Ultra2 SCSI [FC]	9.75 [11.3]	13.35 [15.5]
ENVIRONMENTAL		

Idle Acoustics (mean/max bels)	4.1/4.4	4.2/4.5
Operating Temperature (^{0}C)	5 to 50	5 to 50
Nonoperating Temperature(^{0}C)	-40 to 70	-40 to 70
Shock (Gs) Operating/Nonerating	15/75	15/75
Vibration (Gs) Operating(5-350Hz)		
Nonoperating (-350 Hz)		
Shock (Gs) Operating	0.5 (5-350 Hz)	0.5 (5-350 Hz)
Nonoperating	2.0 (<350Hz)	2.0 (<350Hz)

PHYSICAL

Height (in/mm)	1.0/25.4	1.63/41.7
Width (in/mm)	4.0/101.6	4.0/101.6
Depth (in/mm)	5.75/146.0	5.75/146.0
Weight (lb/Kg)	1.5/0.68	2.1/0.93

The 10,000rpm 80-pin, Ultra-160/m SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- Formatted capacities of 9.1GB, 18.2GB and 36.4GB.
- Interface transfer rate of up to 160MB/s
- 10Krpm, 5.0ms Seek time, 26MB/sec sustained throughput

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
CDH-1945-00-00	CDH-1945-00-00	9GB Ultra-160/m SCSI,1"
CDH-1845-00-00	CDH-1845-00-00	18GB Ultra-160/m SCSI,1"
CDF-1645-00-00	CDF-1645-00-00	36GB Ultra-160/m SCSI,1.6"

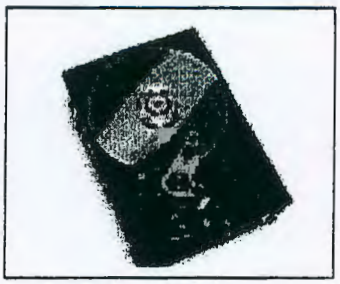
KIT CONTENTS
HDD including hot plug carrier

APACITY AND INTERFACE	CDH-1945-00-00	CDH-1845-00-00	CDF-1645-00-00
Interface	Ultra-160/m, Ultra2, Ultra SCSI 80-pin Wide		
Formatted capacity	9.1GB	18.2GB	36.4GB
Form factor (width)	3.5"	3.5"	3.5"
Form factor (height)	1"	1"	1.6"
Interface type	80-pin	80-pin	80-pin
ISK DRIVE CONFIGURATION			
Number of disks	3	6	12
Number of heads	6	12	24
Areal density (maximum) (Gb/sq.in)	3.4	3.4	3.4
Encoding/Detection Method	24/25RLL PRML	24/25RLL PRML	24/25RLL PRML
Sector size	512 Bytes	512 Bytes	512 Bytes
ERFORMANCE SPECIFICATIONS			
Buffer size	2MB	2MB	2MB
Rotational speed	10Krpm	10Krpm	10Krpm
Latency (average)	3.0ms	3.0ms	3.0ms
Media transfer rate	160MB/s	160MB/s	160MB/s
Average seek time	6.9ms	6.9ms	7.5ms
Track-to-Track	0.8ms	0.8ms	0.8ms
ELIABILITY SPECIFICATIONS			
Data Errors (per bits read)			
Recoverable	10 per 1012	10 per 1012	10 per 1012
Nonrecoverable	1 per 1014	1 per 1014	1 per 1014
Error-Correction Method	352-bit Reed Solomon	352-bit Reed Solomon	352-bit Reed Solomon
HYSICAL DIMENSIONS			
Height in/mm	1.00/25.4	1.00/25.4	1.6/41.4
Width in/mm	4.0/101.6	4.0/101.6	4.0/101.6
Depth in/mm	5.75/146.1	5.75/146.1	5.75/146.1
Weight lb/ kg	1.4/0.64	1.4/0.64	2.0/0.91
NVIRONMENTAL LIMITS			
Operating Temperature (@C)	5 to 50	5 to 50	5 to 50
Condensing humidity	10 to 90	10 to 90	10 to 90
Vibration (|G, 5 to 500Hz)	0.5	0.5	0.5
Sound Power (bels, Idle)	4.0	4.0	4.2

Non Operating Temperature	-40 to 70	-40 to 70	-40 to 70
Non-Condensing humidity	5 to 95	5 to 95	5 to 95
Shock (G, 2ms, 1/2 Sine)	200	200	150
Vibration (|G, 5 to 500Hz)	2.0	2.0	2.0
OWER REQUIREMENTS			
Voltage Requirement (V)	5V DC+ 5%/+12V DC+ 5%/	5V DC+ 5%/+12V DC+ 5%/	5V DC+ 5%/+12V DC+ 5%/
Typical Power Draw (W, Idle)	8/10	10/12	15.5/17.5
Typical Current Draw (A, Operating)			
5V	0.50	0.50	0.55
12V	0.65	0.80	1.25

The 10,000 rpm 80-pin, Ultra2 SCSI 9.1GB, 18.2GB, 36.4GB Hard Disk Drives

- 10,000rpm 3.5 inch disc drive
- Average seek times as fast as 5.2ms
- Unsurpassed formatted data rates of 14.5 to 21.3 Mb/S
- High-Performance Ultra2 SCSI interface



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
BDH-194#-00-00	BDH-194#-IN-00	9.1GB HDD Ultra2 SCSI, 1'
BDH-184#-00-00	BDH-184#-IN-00	18.2GB HDD Ultra SCSI, 1'
BDF-164#-00-00	BDF-164#-IN-00	36.4GB HDD Ultra SCSI, 1.6'

Use # code adapted to Host System as defined in the table below

#	System	#	System	#	System	#	System	#	System
0		2		4		6	MH4500 (9GB only)	8	
1		3	ST8000	5	LC1400, MC2400, ST1400	7	HX4500/ HX4600	9	

KIT CONTENTS
HDD including hot plug carrier

CAPACITY AND INTERFACE	BDH-194#-xx-00	BDH-184#-xx-00	BDF-164#-xx-00
Formatted GB (512 bytes/sector)	9.1GB	18.2GB	36.4GB
Interface	Ultra2 SCSI	Ultra2 SCSI	Ultra2 SCSI
Interface type	80-pin	80-pin	80-pin
DISK DRIVE CONFIGURATION			
Disks/Heads	3 / 6	6 / 12	12 / 24
Sectors per drive (512 Bytes/Sector)	21	28	28
Cylinders	6,962	9,801	9,772
Recording Method	16/17 PR4	16/17 PR4	16/17 PR4
PERFORMANCE SPECIFICATIONS			
Internal Transfer Rate (Mbits/s)	152 to 231	193 to 308	179 to 313
Internal Formatted Transfer Rate (MB/s)	15 to 21	18 to 28	18 to 28
External Transfer Rate	80	80	80
Multi-segmented Cache (KB)	1,024	1,024	1,024
Optional Cache (KB)	4,096	4,096	4,096
Track-To-Track Seek (Read/Write/ms)	0.6 / 0.9	0.6 / 0.9	0.6 / 0.9
Average Seek, Read/Write (ms)	5 / 6	5.2 / 6	5.7 / 6.5
Maximum Seek, Read/Write (ms)	12.2 / 13.2	12.2 / 13.2	14 / 15
Average Latency (ms)	2.99	2.99	2.99
Spindle Speed (RPM)	10,025	10,025	10,016
RELIABILITY SPECIFICATIONS			
MTBF (Power-On hours)	1,000,000	1,000,000	1,000,000
S.M.A.R.T.	Yes	Yes	Yes
Recoverable Read Errors (per Bits)	1 per $10^{10^{\wedge}}$	1 per 10^{10}	1 per 10^{10}
Non-recoverable Read Errors (per Bits)	1 per 10^{15}	1 per 10^{15}	1 per 10^{15}
Seek Errors (per seek)	1 per 10^{8}	1 per 10^{8}	1 per 10^{7}
Service (years)	5	5	5

PHYSICAL DIMENSIONS			
Height (mm)	25.4 (1")	26.1 (1")	40.6 (1.6")
Width (mm)	101.6	101.6	101.6
Depth (mm)	146.1	147	146.1
Weight (kg)	0.54	0.59	0.91
ENVIRONMENTAL LIMITS			
Non-operating Temperature (°C)	-40 to 70	-40 to 70	-40 to 70
Operating Temperature (°C)	5 to 50	5 to 50	5 to 50
Operating Shock (Gs @ msec)	2	5	5
Operating Vibration (Gs @ 5-530 Hz)	0.5	0.5	0.5
Non-Operating Vibration (Gs @ 5-530 Hz)	2	2	2
POWER REQUIREMENTS			
+12 VDC± 5% (amps typical)	0.3	1	1.5
+5 VDC± 5% (amps typical)	0.8	1.1	0.8
Power (Idle watts)	11.1	10.4	15.6

STORAGE CONTROLLERS

PCI SCSI Controllers

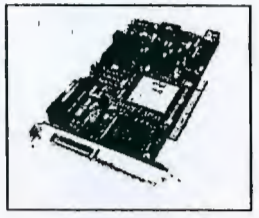
- The PCI Ultra - Wide Single-Ended Differential SCSI-3 Single Channel Controller Card
- The PCI Ultra-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Single Channel Controller Card
- The PCI Ultra2-Wide SCSI-3 Dual channel Controller Card
- The PCI Ultra-Narrow SCSI Single channel Controller Card

PCI RAID Controllers

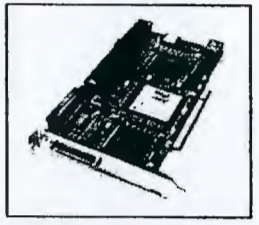
- The SecuRaid 110, PCI RAID Ultra2 SCSI Single Channel RAID Card
- The SecuRaid 210, PCI Ultra-2 SCSI Single Channel RAID card
- The PCI RAID Ultra-Wide SCSI-3 Single Channel RAID card
- The SecuRaid 530 64 bit PCI Ultra2 SCSI Tri-channel
- The Differential Ultra-Wide SCSI to SCSI RAID Kit

RAID CONTROLLERS

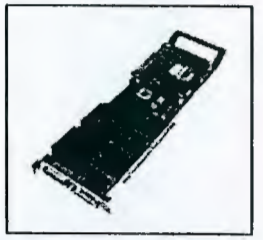
PRICE PERFORMANCE



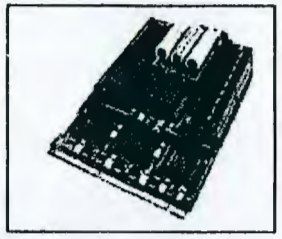
SecuRAID110
1-channel ; Ultra2 Wide SCSI
33Mhz i960 RISC processor
4MB and 16MB cache



SecuRAID210
1-channel ; Ultra2 Wide SCSI
66Mhz i960 RISC processor
8-16-32-64MB cache



SecuRAID530
3-channel ; Ultra2 Wide SCSI
233Mhz StrongArm processor
16-32-64MB cache with or without battery backup



U/W SCSI to SCSI RAID
3-channel (2 drive – 1 host)
U/W SCSI
33Mhz i960 RISC processor
16-32-128MB cache

Internal Storage (PCI based)

The PCI Ultra- Wide SCSI-3 Single Channel Controller Card

- 40 MB/s Ultra Wide SCSI data transfer rate
- Connectivity for up to 15 SCSI peripheral devices in a single PCI slot
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0585-00-00	AIF- 0585-IN-00	Ultra-Wide SCSI-3 Single-Channel
AIF-0586-00-00	AIF-0586-IN-00	Ultra-Wide Differential SCSI-3 Single Channel

KIT CONTENTS
32 Bit Single-ended/Differential SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0585-xx-00 AIF-0586-xx-00
Computer Bus	32-bit PCI Local Bus
PCI Compliance:	PCI 2.0 specification, (PCI 33MHz)
Interface Protocol	Bus master DMA
Host bus Burst data Rate	133 MB/s
Peripheral Bus	8-bit and 16-bit wide Ultra SCSI
SCSI Synchronous	40 MB/s
SCSI Asynchronous data Rate	3.3 MB/s
Device Protocol	SCSI-1, SCSI-2, SCSI-3, Wide Ultra SCSI
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	One 68-pin high density
External Connectors:	One 68-pin high-density
External Drivers :	
IF-0585-xx-00	Single-ended, active termination
AIF-0586-xx-00	Differential, active termination
Device Support	Up to wide 15 devices
OPERATING SYSTEM SUPPORT	
Regulatory Compliance:	FCC Class B, CE, IEC
PHYSICAL DIMENSIONS	
Length inches (cm)	6.87 (17.0)
Height inches (cm)	3.87 (9.5)
ENVIRONMENTAL LIMITS	
Storage Temperature°C	-55 to 85
Operating Temperature°C	0 to 55
Operating Humidity %	10 to 90, non-condensing
Power Requirements	5 V +/-5% at 2.0 amps maximum

The PCI Ultra-Wide SCSI-3 Dual channel Controller Card

- Up to 80 MB/s across two SCSI channels in a single PCI slot
- Connection for up to 30 SCSI devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals
- EZ-SCSI® software

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0587-00-00	AIF-0587-IN-00	PCI Ultra-Wide SCSI-3 Dual Channel

KIT CONTENTS
SCSI Controller Card EZ-SCSI software

CONTROLLER SPECIFICATIONS	AIF-0587-xx-00
Computer Bus	PCI Local bus PCI 2.0 specification, (PCI 33MHz), Two fully independent PCI SCSI channels bridged to systems PCI bus
Interface Protocol	Bus master DMA
Device Protocol	16-bit Ultra SCSI
Host Bus Data Transfer Rate	Up to 133 MB/s
SCSI Synchronous Data Rate	80 MB/s (6 MB/s per channel)
Advanced SCSI Features	Advanced SCSI Programming Interface (ASPI) compliant, Multitasking operating system support (through scatter/gather, disconnect/reconnect, tagged command queuing), Support for 255 simultaneous active SCSI commands per channel, Each channel is programmable via SCSI*Select*
Internal Connectors	Two 68-pin, high-density internal connector
External Connector	One 68-pin, very high density external connector
Electrical Drivers	Single-ended, active termination
Device Support	Up to 30 devices

OPERATING SYSTEM SUPPORT	
I/O Operating Environment	DOS, Windows, Windows95, Windows NT, Windows for Workgroups, OS/2, NetWare, UNIX (SCO, UnixWare)
Regulatory compliance	FCC class B, CE, IEC

PHYSICAL DIMENSIONS	
Length inches (cm)	6,875 (17.463)
Width inches (cm)	4.0 (10.16)

ENVIRONMENTAL LIMITS	
Operating Temperature: °C	-5 to 60
Storage Temperature°C	-60 to 95
Operating Humidity %	10 to 95, non-condensing
Power requirements	5V ± 5% at 2.0 amps max.

The PCI Ultra-Narrow SCSI-3 Single channel Controller Card

- Easy Plug and Play installation of up to seven Fast SCSI hard drives, CD-Re-writaeable drives, scanners, DAT and DLT media peripherals
- Fast SCSI data transfer rate of up to 10MB/sec

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0588-00-00	AIF-0588-IN-00	PCI Ultra-Narrow SCSI-3

KIT CONTENTS
SCSI Controller Card

CONTROLLER SPECIFICATIONS	AIF-0588-xx-00
PC Bus Type	32-PCI
Interface Transfer Method	Bus Master DMA
Total Devices supported	7 total (internal or external)
Data Transfer rate	10MB/s
Supported Protocols	SCSI-1, SCSI-2, and Fast SCSI-2
Boot support	Bootable (on board BIOS)
Internal Connector	50-pin standard (male)
External Connector	50-pin high-density SCSI-2 (female)
OPERATING SYSTEM SUPPORT	IBM-compatible PC-486, Pentium, or above Windows NT, Windows 95, Windows 3.1, MS-DOS 6.0, OS/2, SCO UNIX or UnixWare OS, PCI expansion slot SCSI peripheral
PHYSICAL DIMENSIONS	
Length inches (cm)	4.7" (11.9)
Height inches (cm)	3.0 (7.6)
Weight lbs	Approx 1.5
ENVIRONMENTAL LIMITS	
Operating temperature	-5 to 60
Non-Operating temperature	-55 to 60
Relative Humidity	10 to 90 non-condensing
	5.0v+ /-0.25 at 2.0 amps maximum

The PCI Ultra2 Wide SCSI-3 Single channel Controller Card

- Up to 80MB/s across one SCSI channel in a single PCI slot
- Connection for up to 15 SCSI-2 or SCSI-3 devices
- Compatible with SCSI-1, SCSI-2, and Ultra SCSI peripherals

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0589-00-00	AIF-0589-IN-00	PCI Ultra 2-Wide SCSI-Single Channel

KIT CONTENTS
Symbols SYM8952U

CONTROLLER SPECIFICATIONS	AIF-0589-00-00
SUPPORTED BUSES	
	32-bit, PCI Local bus 16-bit, Wide SCSI bus Single-ended SCSI asynchronous transfers, single-ended Fast/Ultra SCSI synchronous transfers, LVD Ultra2 SCSI Synchronous transfers
SCSI BUS TERMINATION	
	Active, automatic terminating, Universal LVDlink with automatic switching to single-ended Termination power: current limited, self-resetting
SCSI BUS CONNECTION	
	Up to 15 SCSI, SCSI-2 or SCSI-3 devices
BOARD CONNECTORS	
Internal	68-pin, right angle, high density, SCSI bus 4-pin for off-board SCSI Active LED
External	68-pin, high-density connector interconnect
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI asynchronous	Up to 14 MBps
SCSI synchronous single ended	
FAST	Up to 20MBps
ULTRA	Up to 40MBps
SCSI synchronous LVD	
ULTRA2	Up to 80 MBps
PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size	3.5in. x 6.0in
Form Factor	PCI 2.1 universal board
Bracket	ISA/EISA style
Operating temperature	5^0C to 55^0C
Relative humidity range	5^0 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage Temperature	-40^0C to 85^0C
Electrical	5V +/- 5% (1,5A max) 12V +/-5% (50mA max)
MTBF	<500,000 hours
PCI Maximum power dissipation	15 Watts
PRSNT1#	Open
PRSNT2#	**Ground**

The PCI Ultra2-Wide SCSI Dual channel controller Card

- Supports Fast/ Ultra SCSI bus speeds of up to 20 or 40MBps
- Connects up to 15 Fast or Ultra devices

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0590-00-00	AIF-0590-00-00	PCI - ULTRA2 SCSI Dual Channel Host Adapter

KIT CONTENTS
Symbios SYM21002

	AIF-0590-00-00
SUPPORTED BUSES	8-/16-bit Fast/Ultra SE SCSI bus (up to 15 SCSI devices 16-bit Ultra/Ultra2 SE or LVD SCSI bus (up to 15 SCSI devices) up to 80 MBps (Channel B)
SCSI BUS TERMINATION	Active Termination with Tolerant. (active negation) technology on both channels Channel A: Single-ended SCSI Channel B: Universal LVDlink SCSI with automatic switching to single-ended when single-ended devices are connected to SCSI bus
SCSI BUS CONNECTION	Up to 15 Fast SCSI Ultra SCSI peripherals on Channel A Up to 15 Fast SCSI, Ultra or Ultra2 SCSI peripherals on Channel B
BOARD CONNECTORS	
Internal	Universal, 32-bit PCI edge connector Channel A 68-pin, right angle, high density latching SCSI bus Channel A 50-pin low density Channel B 68-pin, right angle, high density latching SCSI bus
External	Channel A 50-pin High Density
Off-board LED Indicator:	Channel A and B SCSI Bus Active 4-pin header for off-board LEDs
On-board jumpers:	The standard SYM21002 is a jumper-less solution

PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 14 MBps (per channel)
SCSI Synchronous single-ended	Fast-up to 40 MBps (per channel)
SCSI Synchronous LVD	Ultra-up to 40 MBps (per channel) Ultra2-up to 80MBps (per channel)

PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS

Board Size:	Approximately 4in. X 7.5in.
Form Factor:	PCI 2.1, 32-bit Universal Board
Bracket:	ISA/EISA style
Operating temperature	0^0C to 55^0
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-40^0 C to 85^0C
MTBF	>400,000 hours
Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts PRSNT1#- open PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B CE VCCI UL94V0

The PCI Ultra-Narrow SCSI Single channel controller Card

- Fastest standard systems bus available today, offering high performance Fast SCSI I/O technology
- Connects up to 7 SCSI devices
- Data transfer rate of up to 10MBps.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0591-00-00	AIF-0591-00-00	PCI - Fast SCSI host adapter

KIT CONTENTS
Symbios SYM20810

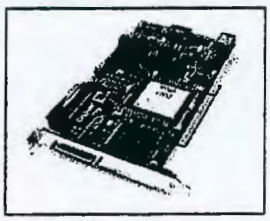
SUPPORTED BUSES	AIF-0591-00-00
	32-bit, DMA bus master, PCI local bus
	8-bit, single-ended SCSI-1, SCSI-2 (Fast SCSI)
SCSI BUS TERMINATION	
	Single-ended with active, auto termination for SCAM (SCSI Configured Automatically) support.
	Fused, self - resetting termination power
SCSI BUS CONNECTION	
	Up to 7 SCSI or SCSI-2 devices
BOARD CONNECTORS	
Internal	50-pin, low density 8-bit SCSI (SYM20810 only)
External	50-pin, high density 8-bit SCSI (SYM20810 / SYM20811)
PERFORMANCE	
PCI transfer rates	Up to 133MBps
SCSI Asynchronous	Up to 7 MBps
SCSI Synchronous	Up to 5 MBps
Fast SCSI-synchronous	Up to 10 MBps
Direct(bus master) memory access for low overhead, 32-bit data burst transfers at PCI bus bus transfer rates	✓
Zero wait state PCI transfer rate	✓
Up to 64-byte PCI burst size to maximise the PCI data transfer rate	✓

PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS	
Board Size:	
Form Factor:	2.5" x 4.75"
Bracket:	ISA/EISA style
Operating temperature	5 to 55
Relative humidity range:	5 to 90% non-condensing
Maximum dew point temperature	32^0 C
Storage temperature	-55 to 8'c
MTBF	>400,000 hours

Electrical	5V +/- 5% (3.0 A max) 12V +/- 5% (50 mA max)
PCI Maximum power dissipation:	15Watts
	PRSNT1#- open
	PRSNT2#- ground
Full agency certification and compliance:	FCC and CISPR Class B
	CE
	VCCI
	UL94V0

The SecuRAID 110, PCI Ultra2 Wide SCSI Single channel RAID card

- Onboard Intel i960RP 33MHz RISC processor
- Single Channel PCI-to-Ultra2 SCSI LVD
- I_20 Ready
- Quick and easy configuration with (GAM) DACCF Software



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0677-00-00	AIF-0677-IN-00	PCI Ultra2 SCSI Single Channel

KIT CONTENTS
RAID card 4MB.16MB cache

CONTROLLER SPECIFICATIONS **AIF-0677-xx-00**

- Intel i960RP 33MHz RISC processor
- PCI 2.1 compliant
- I_2O compliant
- ECC EDO RAM
- 4MB cache, Flash EEPROM, 512K x 8 (72 pin JEDEC SIMM)
- BIOS resident configuration Utility

Internal Connectors
- 1 68-pin High-Density

External Connector
- 1 68-pin Very High-Density

SCSI SPECIFICATIONS

- 1 Ultra2 LVD channel on controller
- SISL Features
- Up to 80MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect/reconnect
- 64 concurrent host commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- RAID Clustering
- Transparent disk drive rebuild
- Background Initialisation
- Immediate RAID Availability
- RAID Migration
- RAID expansion
- Drive travelling during Power-Off
- Automatic detection of failed drives
- Automatic and transparent re-build of replacement drive
- On-line RAID expansion
- Hot Spare drive support

- Hot Drive Swapping support
- SAF-TE enclosure management
- RAID configuration stored on disk and NVRAM

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client Server GUI Interface
- Create, manage, expand and monitor program
- Error statistics and performance
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEMS SUPPORT

- Windows 95 & Windows 98
- Windows NT 3.51, 4.0 Workstation and Server
- NetWare 3.x, 4.x, 5.x & SMP
- SCO UnixWare 2.1
- SCO UNIX OSR 5.x
- DOS 5.x, 6.x & above
- 120 supported platforms and OS environments

PHYSICAL DIMENSIONS

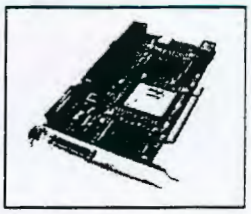
Length inches	7.225
Width inches	4.2
Max.Component inches	0.105 solder side
Height	0.570 component side
Board	Not to exceed the width of one PCI slot

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to + 55
Non-operating Temperature ^{0}C	-20 to +70
Operating Humidity %	10 to 90 relative humidity (non-condensing)
Non-Operating Humidity %	10 to 90 relative humidity (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

The SecuRaid 210, PCI Ultra2 Wide SCSI Single Channel RAID card

- 32bit PCI Ultra2 Single Channel RAID controllers
- Embedded Intel i960RD 66MHZ processor
- Monolithic NT driver that increases overall system throughput



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0685-00-HU	AIF-0685-IN-HU	PCI RAID Ultra2 SCSI Single Channel
AMR-0508-00-00	AMR-0508-IN-00	8MB Cache Memory Module for SecuRAID 210
AMR-0516-00-00	AMR-0516-IN-00	16MB Cache Memory Module for SecuRAID 210
AMR-0532-00-00	AMR-0532-IN-00	32MB Cache Memory Module for SecuRAID 210
AMR-0564-00-00	AMR-0564-IN-00	64MB Cache Memory Module for SecuRAID 210

KIT CONTENTS
RAID card Documentation

CONTROLLER SPECIFICATIONS — AIF-0685-xx-HU

- Intel i960RD RISC Processor / 66MHz
- PCI 2.1 Compliant
- I_2O Ready
- 8/16/32/64MB cache
- ECC EDO RAM in a 72 pin JEDEC SIMM
- RAID firmware on 1 MB Flash EEPROM
- Hardware XOR
- ECC Memory Support

SCSI SPECIFICATIONS

- Supports SCSI1, SCSI2, Ultra SCSI and Ultra2 SCSI devices
- Full support for Low Voltage Differential (LVD) devices
- SISL Features
- Up to 80 MB/s Burst data rate
- Automatic SCSI bus termination
- Disconnect / reconnect
- 64 concurrent host commands
- 256 tagged commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to 25m for two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID levels 0, 1, 0+1, 5 and JBOD
- Transparent disk drive rebuild
- On-Line RAID expansion (M.O.R.E.)
- Up to Eight Controllers per System (NT)
- Logical drive size of 2 Terabytes, 32 logical drives per controller
- Background initialisation; Immediate RAID Availability
- RAID migration

- Variable stripe size per controller
- Variable cache line size per controller
- Up to 8 non-disk devices per controller
- Drive travelling during power off
- SAF-TE enclosure management
- Automatic error recovery
- Write through or write back cache support / logical device
- Automatic detection of failed drives
- Automatic rebuild of hot spare drive
- Hot drive swapping support
- ECC detection/correction on cache memory
- Support for SMART capable drives
- Configuration data stored on disk and NVRAM

RAID MANAGEMENT

- Client Server GUI Interface
- Global Array Manager
- Create, manage, expand and monitor program
- Error statistics and performance information
- BCU BIOS configuration utility - RAID manager

OPERATING SYSTEM SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare 3.x, 4.x (non NWPA) & SMP
- SCO UnixWare 2.1, 7.0, UNIX OSR 5.x
- OS/2.x,3.x &SMP
- DOS 5.x, 6.x and above

PHYSICAL DIMENSIONS

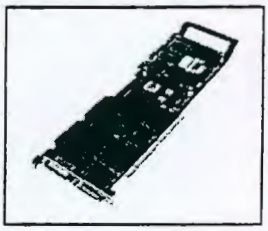
- Half Length PCI Footprint (7.225" x 4.2")

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to 55
Power Requirements	+5.0V (+- 5%), 3.5 A (max); 17.5 watts max.
MTBF Hrs	200,000

The SecuRaid 530 64 bit PCI Ultra2 Wide SCSI Tri-channel RAID card

- A 64bit PCI Ultra2 SCSI RAID Controller for extreme performance
- Intel's leading edge DSP a 233MHZ StrongArm micro-controller
- Offers Uncompromising fault tolerance, data availability , superior configuration and management flexibility.



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0690-00-HU	AIF-0690-IN-HU	64 bit PCI Ultra2 SCSI Tri-channel
AMR-0616-00-00	AMR-0616-IN-00	16MB Cache Memory Module for SecuRAID530
AMR-0617-00-00	AMR-0617-IN-00	16MB Cache Memory Module+ Battery Backup Unit for SecuRAID53
AMR-0632-00-00	AMR-0632-IN-00	32MB Cache Memory Module for SecuRAID530
AMR-0633-00-00	AMR-0633-IN-00	32MB Cache Memory Module + Battery Backup Unit for SecuRAID5
AMR-0664-00-00	AMR-0664-00-00	64MB Cache Memory Module for SecuRAID530
AMR-0665-00-00	AMR-0665-00-00	64MB Cache Memory Module + Battery Backup Unit for SecuRAID5

KIT CONTENTS
RAID card Disks Documentation

CONTROLLER SPECIFICATIONS — AIF-0690-xx-HU

- Intel DSP 233MHz RISC micro-controller
- 64Bit PCI Hot plug support
- 8MB to 64MB
- 1_2O Hardware ready
- SDRAM in a 72 pin JEDEC SIMM
- RAID Hardware on 4MB FLASH EEPROM
- Hardware XOR
- ECC Memory Support

SCSI SPECIFICATIONS

- 3 Ultra2 SCSI channels
- Full support for Low Voltage Differential (LVD) devices
- Up to 80Mb/s Burst data rate
- Automatic SCSI bus termination
- Disconnect/reconnect
- Support of embedded SCSI controllers through a specific I/O Slot (SSIL feature)
- 256 tagged commands per controller
- Automatic sector re-mapping
- Ultra2 SCSI (LVD) cable length up to two devices or 12m for 15 devices

FAULT TOLERANCE

- RAID Levels 0,1,0+1, 5 and JBOD
- Transparent disk drive rebuild
- Up to 16 controllers per system (NT)
- Onboard BIOS: Embedded in the firmware

- On-line RAID expansion (M.O.R.E)
- Automatic Detection of failed drives
- Automatic and transparent re-build of replacement drives
- Automatic error recovery
- SAF-TE enclosure management
- Write through or write back cache support/ logical device
- Hot Drive Swapping support
- RAID configuration stored on disk and NVRAM
- Memory write and Invalidate command

RAID MANAGEMENT

- Global Array Manager (GAM)
- Client GUI Interface (GAM client)
- Create manage, expand system drives, error statistics and performance information
- BCU BIOS config utility with RAID manager (DACCF)

OPERATING SYSTEMS SUPPORT

- Windows NT 3.51, 4.0 & Advanced Server
- NetWare3.x, 4.x & SMP
- SCO UnixWare 2.1
- SCO UnixWare 2.1
- DOS 5.x, 6.x & above
- Sun Solaris
- I_2O supported platform and OS environments

PHYSICAL DIMENSIONS

Length inches	12,280
Width inches	4,750
Max Component inches	0.105 solder side of board
Height inches	0.570 component side of board

ENVIRONMENTAL LIMITS

Operating Temperature ^{0}C	0 to +55
Non-Temperature ^{0}C	-20 to +70
Operating Relative Humidity %	10 to 90 (non-condensing)
Non-Operating Relative Humidity %	10 to 90 (non-condensing)
Operating Altitude m (ft)	Up to 3,048 (10,000)
Non-Operating Altitude m (ft)	Up to 15,240 (50,000)

SERVER OPTIONS

Server Management

- The ISA Server Management Board

Network & Communication

- The 32bit PCI 10/100Mbps Ethernet (Intel Pro100+ Server)Adapter
- The 32bit Dual Port 10/100Mbps Ethernet (Intel Pro100+Dual Port Server) Adapter
- The 32 bit PCI 10 / 100Mbps Ethernet Adapter (3COM)
- The External Fax Modem 56Kbps
- The 32 bit PCI Gigabit Ethernet (Alteon ACenic)Adapter

CD-ROM Drives

- The 40x Internal SCSI CD-ROM drive
- The 40x Internal IDE CD-ROM drive

Tape Backup Options

- The 4GB IDE Internal Tape Drive
- The DDS2 4/8GB, DDS3 12/24GB, Autoloader 48/96GB SCSI DAT Tape Backup
- The DDS4 20/40GB SCSI DAT Tape Backup
- The 20/40GB SCSI DLT External/Internal Tape Drive
- The 35/70GB SCSI DLT External/Internal Tape Drive

ISA Server Management Board

- Supported in ESMPRO Management Suite 1.5 and above
- Optional External modem
- Security (user name, password, call back feature)

CUSTOMER INTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AIF-0702-00-00	AIF-0702-IN-00	ISA Server Management Board

KIT CONTENTS
ISA Server Management Board
AC Power Module
Cables x 2
Installation Documents

! Requires an external modem

FUNCTIONS	AIF-0702-000
BUSI/F	ISA
Processor	H8/3003
NVRAM	128K
Serial port	Dual A sync Serial port
Battery	Internal
AC adapter	External
Modem	External
RTC	Internal
Reset I/F	Requires same cable as NEC's SMB
Power control	Requires same cable as NEC's SMB
Sensor	Temperature, Voltage, Optic chassis open
Interrupt	1
WDT	Internal
MONITORING	✓
Post monitoring	✓
BOOT monitoring	✓
Watch dog Timer+	✓
Shutdown (Shut down at trouble, User shut down)	✓
Temperature, Voltage, Chassis open	✓
OS Hang (Stall panic)	✓
LOG	
HW Error Log (ex. Troubles detected by monitoring)	✓
NT Event Log (System, Application, Security)	✓
OS Event Log area	✓
ALERT	
Information capturing (POST code)	✓
WAN (Atomic Alert)	✓
Pager	✓

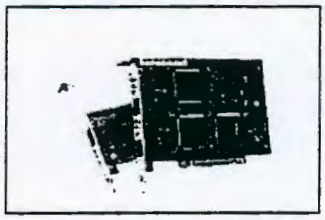
REMOTE MAINTENANCE	
Shutdown	✓
Remote Power Control (Reset, Power OFF, ON)	✓
Remote SMB configuration	✓

OTHER	
FW update	N/A
Set Threshold	✓
Security (user name, ID, Password)	✓

SOFTWARE ENVIRONMENT	
ESMPRO	✓
EV2701	✓
Windows NT,	✓
Netware	✓

The 32bit PCI 10/100Mbps Ethernet (Intel Pro 100+ Server) Adapter

- Scalable performance (up to 800Mbps) reduces server bottlenecks
- Redundant connections maximise server uptime
- Remote Server Management increases IT staff efficiency



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0519-00-00	ALN-0519-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter
1 NT disk
1 Netware disk
1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0519-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Connectors	Single: RJ-45
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	6K cache
Interrupt levels	INTA
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558

NETWORK-MANAGEMENT	
WfM baseline v2.0 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
Intel Pro/	✓
SNMP-manageable	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓

Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓

ENVIRONMENTAL LIMITS

Operating temperature ^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT

.67 Watts @ +5VDC

The 32bit PCI 10/100Mbps Ethernet (Intel Ethernet Pro 100+Dual Port Server) Adapter

- Two 10/100Mbps ports on one card
- Aggregate bandwidth up to 800Mbps
- PCI Hotplug lets you swap out an adapter with the server
- High-link availability through Adapter Fault Tolerance

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0619-00-00	ALN-0619-IN-00	

CONTROLLER SPECIFICATIONS	ALN-0619-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	Dual: PILA8472
Connectors	Dual: RJ-45
ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5-packs
Switchless board configuration	✓
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	✓
Data rate(s) supported per port	10 & 100Mbps
On-board memory	12K cache
Interrupt levels	INTA and INTB
IEEE support	802.2&802.3
Data path width	32-bit
Hardware certifications	FCC B, CE
Data transfer mode	Bus-master DMA
Controller or processor	Intel 82558
NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	✓
DMI 2.0 support	✓
Board and network diagnostics	✓
SNMP-manageable	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓
Windows* 95,98	✓
Novell NetWare* 3.11, 3.12, 4.1X & 5 Server	✓
SunSoft Solaris*	✓
SCO UnixWare*	✓
OS/2	✓
DOS	✓

ENVIRONMENTAL LIMITS	
Operating temperature ^{0}C	0-55
Operating humidity %	85 @+ 55^{0}C

POWER REQUIREMENT	
	6.5 Watts @+5VDC

The 32bit PCI 10/100Mbps Ethernet Adapter (3COM)

- DMI 2.0 support which enables PC asset Management and diagnostics via standard DMI browsers
- Integrated Managed PC Boot Agent (MBA) allows for after hour updates, installations and repairs.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0922-00-00	ALN-0922-IN-00	32 BIT PCI 10/100 Ethernet Adapter

KIT CONTENTS
Server Adapter
1 NT disk
1 Netware disk
1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0918-00-00
IEEE Standard/Network Topology	10Base-T, 100Base-TX
Bus architecture	PCI
Wiring	Cat5, 2pr
Product Code	3C905B-TX
Connectors	Single: RJ-45 (female)
ADAPTER PRODUCT FEATURES	
Adaptive Technology	✓
Multi-packs	5 packs
Switchless board configuration	
Plug 'n play specification support	Standard
Automatic driver installation	✓
Full-duplex capable	✓
Auto-negotiation	✓
Adapter Fault Tolerance	✓
Adaptive Load Balancing	✓
Fast EtherChannel* (when used with a Fast EtherChannel-enabled switch)	✓
PCI Hotplug	
Data rate(s) supported per port	10 & 100Mbps
On-board memory	4K cache
Interrupt levels	
IEEE support	802.3
Data path width	32-bit
Hardware certifications	
Data transfer mode	
Controller or processor	
NETWORK-MANAGEMENT	
WfM baseline v1.1 enabled for servers	
DMI 2.0 support	✓
Board and network diagnostics	
SNMP	Optional
RMON	✓
ACPI Support	✓
OPERATING SYSTEM SUPPORT	
Windows NT* 3.51, 4.0	✓

Windows* 95,98	✓
Novell NetWare* 3.x and 4.x server drivers	✓
SCO UnixWare*	✓
OS/2 ODI	✓
DOS Windows 3.x	✓
Windows for Workgroups	✓
SCO Open Server 5	✓
LAN Manager	✓

ENVIRONMENTAL LIMITS

Operating temperature ^{0}C	0-70
Operating humidity %	10-90%

The NICs described in the table above can support the latest 3 sophisticated technologies:

- ✓ **Adapter Fault Tolerance**
- ✓ **Asymmetric Port Aggregation (aka "Adaptive Load Balancing")**
- ✓ **Symmetric Port Aggregation (aka "Fast EtherChannel")**

For more information visit our website at www.neccsd-europe.com and look in our Technology section.

The 32bit PCI 1Gigabit Ethernet Adapter (Alteon ACEnic)

- Full-duplex Gigabit Ethernet Interface
- Replaces multiple 100Mbps interfaces in congested servers
- Adaptive interrupt frequency
- Completely interoperable with existing Ethernet equipment

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ALN-0400-00-00	ALN-0400-IN-00	32-bit PCI Gigabit Ethernet Adapter

KIT CONTENTS
Server Adapter 1 NT disk 1 Netware disk 1 SCO disk

CONTROLLER SPECIFICATIONS	ALN-0400-00-00
Bus interface	PCI bus master, 32/64-bit, 33/66 MHz Adaptive DMA
Connections	SC Fiber connector for 62.5/125 micron fiber or 50/125 micron fiber

ADAPTER PRODUCT FEATURES	
Adaptive Interrupt Technology	✓
Separate Read & Write DMA	✓
Aggregate bandwidth	2Gbps
Full-duplex capable	✓
Data rate(s) supported per port	1Gbps
IEEE support	802.1Q
Data path width	32-bit
Maximum IP addresses per adapter	64
Embedded 32-bit RISC processor	✓

OPERATING SYSTEM SUPPORT	
Windows NT 4.0	✓
Novell NetWare 4.10 & 4.11	✓
Solaris 2.5.1, 2.6 & 2.7	✓

ENVIRONMENTAL LIMITS	
Operating temperature °C	0-50
Operating humidity %	5-85% (non-condensing)

OPERATING DISTANCES	
62.5 MICRON MM fiber	2-260 meters
50 mi	2-550 meters

The External Fax/Modem 56 Kbps

- Up to 56 Kbps Internet Connectivity
- K56flex upgradeable to ITU/TIA standard
- Enhanced ADPCM/PCM voice operation with concurrent DTMF detection

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESRIPTION
ACC-0056-**-00		External Modem 33.6KBps

**country code BB=British, FF=French, DD=German, TT=Italian, EE=Spanish, JJ=Dutch, SS=Swedish, AA=Danish, NN=Norwegian, YB=Belgian/English, CF=Swiss/French.

KIT CONTENTS
Modem adapter
Cable for power socket

MODEM FEATURES	DCC-115-AO
Modem Speed	56 Kbps Internet connectivity
Chipset Resolution	Rockwell RCVDL56ACFW/SP modem chip Downloadable MCU & Data Pump firmware from Host
DATA Modem	56 Kbps Internet connectivity (K56flex upgradeable to ITU/TIA standard) V.34bis (33.6) V.34 (28.8 Kbps) V.32 bis (14.4 Kbps) V.32, V.23, V.22, V.22 A/B, V.21 Bell 212A, Bell 103
Data Compression	V.42 bis, MNP 5
Error Correction	V.42LAPM, MNP 2-4
Fax Modulations	V.17, V.29, V.27ter
Fax Control/Protocol	Class 1, V.21 Channel 2 and Group 3 fax mode
OPERATING SYSTEM SUPPORT	
	Windows 3.1x Widows 95 Windows NT3.5x TAPI compliant
MODEM COMPONENTS	
Indicator lights	AA (auto Answering lights up when the modem is configured to answer the ring automatically TR (Data Terminal Ready) lights up when the computer raises the Data Terminal Ready (DTR) line, indicating it is ready to begin communications. CS (Clear to send) lights up when the data transfer path is clear for data transmission. OH (Off Hook) lights up when modem is connected to another modem and off hook CD (Data Carrier Detect) lights when modem detects a carrier signal the telephone line. SC (Send Data) lights up when the modem transmits data to the computer RD (Receive Data) lights up when data is receive by the modem.
CONNECTORS AND SWITCHES	
	1 x ON/OFF rocker switch 1 POWER socket for supplied cable 1 x 9-pins SERIAL PORT connector RJ11 Telephone socket for telephone line/handset 3.5mm jack for Mono Mic-Input

The 40x Internal SCSI, CD-ROM

- Up to 6,000KB/s Sustained Transfer Rate
- SCSI Interface
- 80ms Average Random Access
- 256KB Buffer

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADO-5703-00-00	ADO-5703-IN-00	40x internal SCSI CD-ROM

KIT CONTENTS
CD-ROM + Screws
Users Guide

CAPACITY AND INTERFACE	ADO-5703-xx-00
Interface	Internal SCSI-2 (ID 0 to 7)
FORMAT SPECIFICATIONS	
Average Random Access (32X)	80 ms
Compatible CD Roms Standards:	Red-Book, Yellow-Book, CD-ROM XA, CD-I Bridge (Photo-CD, Video CD), CD-I, CD-I Ready, CD-G and Multisession (Photo-CD, CD-Extra, CD-RW, CD-R), CD-TEXT
PERFORMANCE SPECIFICATIONS	
Sustained Mode 40X	2,595KB/s (20MB/s Sync.)
Burst (SCSI)	6,000 KB/s (20MB/s Sync)
Buffer Cache Size	256KB
RELIABILITY SPECIFICATIONS	
ERROR RATES	
UNRECOVERABLE-Mode 1	< 1 in 10^{15}
UNRECOVERABLE-Mode 2	< 1 in 10^{12}
Seek	< 1 in 10^{6}
MTBF	1000,000 POH @ 20% Duty Cycle
ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 50
Storage Temperature ^{0}C	-10 to 60
Operating Humidity %	8 to 80 non-condensing
Wet Bulb	27 ^{0}C max
POWER REQUIREMENTS	
Avg. DC +12v, +5v (± 5%)	6.9W
Standby DC +12v, +5v (± 5%)	0.5W

The 40x Internal IDE CD ROM

- 6 MB/sec maximum data transfer rate
- 100 ms average access time
- 256 KB buffer memory
- MPC-III compliant
- E-IDE/ATAPI interface

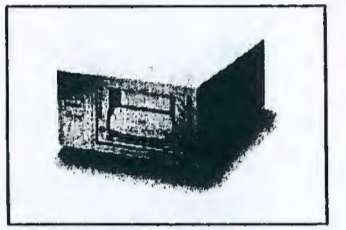
CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADR-0400-00-10	ADR-0400-IN-10	40x Internal IDE CD-ROM

KIT CONTENTS
CD-ROM + Screws
Users Guide

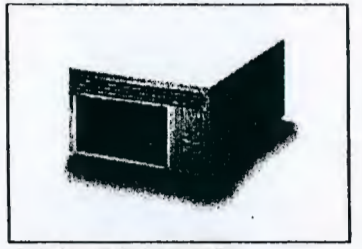
CAPACITY AND INTERFACE	ADR-0400-00-10
Interface	E-IDE/ATAPI
FORMAT SPECIFICATIONS	
Supported Formats	ISO 9660, High Sierra Group, Photo CD multisession, CD-ROM XA Mode 2 Form 1 & 2, CD-ROM mode 1& 2, CD-i FMV*, Video CD*, CD-DA, Enhanced-CD, MPC-III compliant, CD-RW, CD-R
PERFORMANCE SPECIFICATIONS	
Transfer Rate	Maximum data transfer rate 6 MB/sec
Average Access Time	100 ms(typical)
Rotation Method	CAV (constant angular velocity)
Buffer	256 KB
RELIABILITY SPECIFICATIONS	
MTBF	: 60,000 hours 10% duty cycle
PHYSICAL DIMENSIONS	
Width inches (mm)	5.87,5.87, 5.87(149)
Depth inches (mm)	7.95, 7.87, 7 (202) (200) (178)
Height inches (mm)	1.65, 1.65, 1.65 (42)
Weight kg (lbs)	1.0kg (2.2)
ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	5 to 40
Storage Temperature^{0}C	-10 to 60
Relative Humidity %	20% to 85%RH
POWER REQUIREMENTS	
Voltage Tolerance-5V DC	± 5%
Voltage Tolerance-12V DC	± 5%
Ripple+Noise Tolerance-peak to peak-5V DC	< 90 mVpp
Ripple+Noise Tolerance-peak to peak-12V DC	< 90 mVpp
Hold Track (max.)-5V DC	1200mA
Hold Track (max.)-12V DC	500mA
Seeking current (peak)-5V DC	1200mA
Seeking current (peak)-12V DC	700mA

BACKUP TAPES

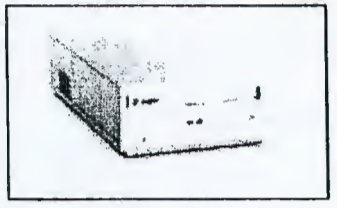
PRICE PERFORMANCE



DLT 35/70GB
DLT 40/80GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast/Wide (20MB/s)



DLT 20/40GB
STR : 1.5/3.01MB/s
Interface : SCSI-2 Fast (10MB/s)



DDS-2 4/8GB,
DDS-3 12/24GB
DDS-4 20/40GB
DDS-3 Autoloader 48/96GB
STR DDS2-Autoloader: 1,100/2,200KB/s
STR DDS3: 550/1,100KB/s

Travan 4/8GB
STR : 300/600KB/s
Interface : IDE ATAPI (4MB/s)

STR : Sustained Transfer Rate

Travan DAT DLT

The 4GB IDE Internal Tape Drive

- Up to 2,000- Kbyte per second native transfer rate
- Read-after-write , four head design
- High-performance 1-Mbyte buffer
- Compatible with most popular operating systems

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0800-00-00	ADT-0800-IN-00	4GB ATAPI Tape Drive

KIT CONTENTS
Internal Tape Drive
Cleaning Kit
4 screws
Tape Band
Users Guide

CAPACITY AND INTERFACE	ADT-0800-xx-00
Capacity	
Native	4.0
Interface	
Physical	IDE/ATAPI

TAPE FORMAT SPECIFICATIONS	
Compatibility	
Read only Media Compatibility	QIC-3020 QIC-3010 QIC-80
Read/Write Media Compatibility	3M Travan TR-4 Seagate8000TR4 Seagate 4000QT Sony QW-3080XLF

PERFORMANCE SPECIFICATIONS	
Performance	
Transfer Rate (Kbytes/sec)	600/450/300**
Tape Speed Read/Write (ips)	92/69/46
Search/Rewind (ips)	100
Backup Rate, Sustained (Native Mbytes/min, max)	30

RELIABILITY SPECIFICATIONS	
Read While write	No
MTBF (20% duty cycle)	330,000

PHYSICAL DIMENSIONS
1-inch high; configurable as 3.5-inch x 1.0-Inch or 5.25-inch x half-height (1.7inch)

ENVIRONMENTAL LIMITS	
Operating Temperature	
Internal ^{0}C	5 to 45
External ^{0}C	5 to 35

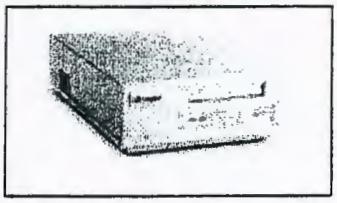
Non-Operating Temperature ^{0}C	-40 to 65
Relative Humidity %	20 to 80 non-condensing
Wet Bulb Temperature	26^{0}C

POWER REQUIREMENTS	+5V ± 5%		+12V ± 5%
Operating Internal			
Idle/Stepping (amps)	0.63/1.0		0.25/1.8
Idle Watts		0.15	
Normal Watts		15	
Max Watts		17.0	

**Based on fast sense capability

The DDS2 4/8GB, DDS3 12/24GB,DDS3 Autoloader 48/96GB SCSI DAT Tape Backup

- Native transfer rates up to 1,100 Kbytes per second
- Read-after-write, four head design
- High-performance 2-MB buffer
- Compatible with most popular operating systems



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-0409-00-00	ADT-0409-IN-00	4/8GB DDS-2 DAT
ADT-2400-00-00	ADT-2400-IN-00	12/24GB DDS-3 DAT
ADT-4896-00-00	ADT-4896-IN-00	48/96GB DDS-3 DAT Autoloader

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-0409-xx-00	ADT-2400-xx-00	ADT-4896-xx-00
Compressed (GB)2			
90 Metre Tape	4.0	4.0	16.0
120 Metre Tape	8.0	8.0	32.0
125 Metre Tape	NA	24.0	96.0
Native			
90 Metre Tape	2.0	2.0	8.0
120 Meter tape	4.0	4.0	16.0
125 Metre tape	NA	120	48.0
Internal Connector			
TAPE FORMAT SPECIFICATIONS			
Recording Method	DDS-DC, DDS Helical Scan (R-DAT) ANAI/ECMA	DDS-DC,DDC Helical Scan (R-DAT) ANAI/ECMA	DDS-2, DDS-3 DDS-C, DDS Helical Scan (R-DAT) ANSI/ECMA
PERFORMANCE SPECIFICATIONS			
Transfer rate			
Native/Compressed(Kbytes/sec)	550/1,100	1,1000/2,200	1,100/2,200
Tape Speed (in/sec, mm/sec)	0.47/11.9	0.47/11.9	0.47/11.9
Head to Tape Speed (in/s, mm/s)	270/6,858	270/6,858	270/6,858
Search/Rewind speed (x normal speed)	200	200	200
Average access Time			
90 Metre Tape (sec.)	30	30	30
120 Metre tape (sec.)	40	40	40
125 Metre Tape (sec.)	NA	40	40
Buffer (Mbytes)	Flash	Flash	Flash
EEPROM	DDS-2	DDS-2	DDS-2, DDS-3
RELIABILITY SPECIFICATIONS			
MTBF (20% duty cycle)			

Internal (hours)	265,000	265,000	135,000
External (hours)	150,000	150,000	80,000
Error Rate (bits)	<1 per 10^15	<1 per 10^15	<1 per 10^15
Limited Warranty(years)	2	2	2
MTTR	<30 minutes	<30 minutes	<30minutes

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)			

ENVIRONMENTAL LIMITS

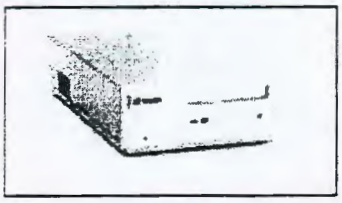
Operating Temperature			
Internal (hours)	5 to 45	5 to 45	5 to 45
External (hours)	5 to 35	5 to 35	5 to45
Non-operating Temperature Relative ^{0}C	-40% to 65	-40 to 65	-40 to 65
Humidity (%non-condensing)	20^{0}C to 80	20 to 80	20 to 80
Wet Bulb Temperature (°C)	26	26	26

POWER REQUIREMENTS

Internal +5V+12V	0.44/0.28	0.48/0.3	1.5/0.8
Watts (typ)	5.5	5.5	17.0
External (VAC universal)	100 to240	100 to 240	100 to240

The DDS4 20/40GB SCSI DAT Tape Backup

- Compressed data-transfert rates up to 5.5 Mbytes per second and 20Gbytes per hours
- Highest reliability with an MTBF of over 400,000 hours
- Read-after-write, four-head design
- High-performance 8-Mbyte buffer
- Compatible with most popular operating systems



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2000-00-00	ADT-2000-IN-00	20/40GB DDS-4 DAT

KIT CONTENTS
Tape Drive + 4 screws
Users Guide
Cleaning Cartridge
1 x Blank Tape
1 x Charger

5.25 inch internal (with 3.5-inch bezel)

CAPACITY AND INTERFACE	ADT-2000-xx-00
Compressed (Gbytes)	
90 Meter Tape	4.0
120 Meter Tape	8.0
125 Meter Tape	24.0
150 Meter Tape	40.0
Native	
90 Metre Tape	2.0
120 Meter tape	4.0
125 Metre tape	12.0
125 Metre tape	20.0
Interface	Ultra2 SCSI

PERFORMANCE SPECIFICATIONS	
Transfer rate	
Native/Compressed(Mbytes/sec)	2.75/5.5
Tape Speed (in/sec, mm/sec)	0.81/20.4
Cylinder speed (RPM)	10,000
Search/Rewind speed (x original DDS-1 speed)	400
Average access Time	
90 Metre Tape (sec.)	9.5
120 Metre tape (sec.)	12.6
125 Metre Tape (sec.)	13.2
150 Metre Tape (sec.)	15.8
Buffer (Mbytes)	8
Recording Method	DDS-4, DDS-3, DDS-2, DDS-DC,DDS, Helical Scan, ANSI/ECMA

RELIABILITY SPECIFICATIONS	
MTBF (20% duty cycle)	
Internal (hours)	>400,000
External (hours)	>200,000
Error Rate (bits)	<1 per 10^{15}
Limited Warranty(years)	3

MTTR	<0.5

PHYSICAL DIMENSIONS

3.5-inch x half-height or 5.25-inch x half-height (1.7 inch)	✓

ENVIRONMENTAL LIMITS

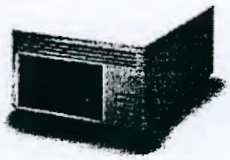
Operating Temperature	
Internal (°C)	5 to 45
External (°C)	5 to 45
Non-operating Temperature Relative ^{0}C	-40 to 65
Humidity (%non-condensing)	20 to 80
Wet Bulb Temperature (°C)	0 to 90

POWER REQUIREMENTS

Internal +5V +/- 5%	0.7/1.5
Internal +12V +/- 10%	0.05/0.25
Watts (typ)	10.5
Auto-ranging Input Voltage (external)	100 to 240

The 20/40GB SCSI DLT External/Internal Tape Drive

- 5MB/sec native transfer rate
- 20 GB native capacity
- 64-bit Cyclical Redundancy Check (CRC)
- SCSI-2 Bus and internal data path.



CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-2040-00-00		20/40GB SCSI DLT External Tape Drive
ADT-4000-00-00	ADT-4000-IN-00	20/40GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes cable
Blank Cartridge
Cleaning Kit
Documentation

CAPACITY AND INTERFACE	ADT-2040-xx-00 ADT-4000-xx-00
Formatted Capacity	
Native (GB)	20
Compressed (GB)	40*
Average File Access (sec)	68
Interface	SCSI-2 Fast Single-End
Internal Connector	50-Pin

TAPE FORMAT SPECIFICATION	
Recording Format	128 track serial serpentine
Recording Density	82 kbits per inch
Track Density (tpi)	256
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20GB native capacity
DLT Cleaning Tape	20 uses
Read/Write Compatible With All Previous DLT Formats	
Archive Storage	More than 30 years with less than 5% loss in demagnetisation (at 20oC and 40% non-condensing humidity)
Durability	Average 1,000,000 head passes in Typical office/computer environment

Actual transfer rate and capacity will vary depending on data.

PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	1.5
Compressed	3.01
Burst Transfer Rate (MB/sec) Synchronous	10

RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	10,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 x 1017 bits read
Undetected Error Rate	1 x 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including Media
Non-operating Temperature ^{0}C	-40 to 151
Non-Condensing Humidity	10% to 95%
Condensing Humidity %	20to 80

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	25 watts

The 35/70GB SCSI DLT External/Internal Tape Drive

- 5 MB per second native transfer rate
- 35 GB native capacity
- Recording head life of more than 30,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLTtape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-3570-00-00		35/70GB SCSI DLT External Tape Drive
ADT-7000-00-00	ADT-7000-IN-00	35/70GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-3570-xx-00 ADT-7000-xx-00
Formatted Capacity	
Native (GB)	35
Compressed (GB)	70*
Interface	SCSI-2 Fast /Wide Single-ended
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	86 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
DLTtape III	2.6, 6, and 10 GB native capacities
DLTtape IIIXT	15 GB native capacity
DLTtape IV	20 and 35 GB native capacities
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	5
Compressed	10*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	200,000 hours
Head Life	30,000 hours

Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 1017 bits read
Undetected Error Rate	1 X 1027 bits read
Warranty (years)	3

PHYSICAL DIMENSIONS	External	Internal**
Height	4.87 (124)	3.25 (82.5)
Width inches (mm)	9.0 (229)	5.75 (144.8)
Length inches (mm)	12.75 (325)	9.0 (228.6)
Weight–pounds (kg)	15 (6.63)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	37 Watts

Read/Write compatible with all previous DLT formats

**Actual transfer rate and capacity will vary depending on data*

***Excluding bezel*

The 40/80GB SCSI DLT External/Internal Tape Drive

- 6 MB per second native transfer rate
- 40 GB native capacity
- Recording head life of more than 50,000 hours, media durability greater than 1,000,000 media passes
- Read and write backward compatible with all DLT tape formats

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ADT-4080-00-00		40/80GB SCSI DLT External Tape Drive
ADT-8000-00-00	ADT-8000-IN-00	40/80GB SCSI DLT Internal Tape Drive

KIT CONTENTS
Internal/External Tape Drive
External includes Cable
Blank Cartridge
Cleaning kit

CAPACITY AND INTERFACE	ADT-4080-xx-00 ADT-8000-xx-00
Formatted Capacity	
Native (GB)	40
Compressed (GB)	80*
Interface	SCSI-2 Fast /Wide (SE/LVD or HVD)
Internal Connector	50-pin
TAPE FORMAT SPECIFICATIONS	
Recording Format	208 Track Serial Serpentine
Recording Density	98 kbits per inch
Track Density (tpi)	416
Encoding Method	RLL 2,7
Data Compression	DLZ
MEDIA/FORMAT COMPATIBILITY	
DLTtape III	10GB native capacities
DLTtape IIIXT	15GB native capacity
DLTtape IV	20, 35 and 40GB native capacities
Read/write compatible with all previous	DLT formats
DLT Cleaning Tape	20 uses
PERFORMANCE SPECIFICATIONS	
Sustained Transfer Rate (MB/sec)	
Native	6
Compressed	12*
Burst Transfer Rate (MB/sec)	
Synchronous	20
Asynchronous	12
Average File Access (sec)	60
RELIABILITY SPECIFICATIONS	
MTBF	250,000 hours @ 100% duty cycle
Head Life	50,000 hours
Media Durability	1,000,000 passes (15,000 uses)
Uncorrected Error Rate	1 X 10^{17} bits read
Undetected Error Rate	1 X 10^{27} bits read

PHYSICAL DIMENSIONS	External	Internal**
Width - inches (mm)	6.88 (174.8)	5.7 (144.8)
Length - inches (mm)	12.8 (325.1)	9.0 (228.6)
Height - inches (mm)	6.48 (164.6)	3.25 (82.5)
Weight–pounds (kg)	14 (6.35)	6 (2.9)

ENVIRONMENTAL LIMITS	
Operating Temperature ^{0}C	50 to 104 including media
Non-Operating Temperature ^{0}C	-40 to 151 including media
Altitude (ft. maximum)	40,000
Condensing Humidity (%)	20 to 80
Non-Condensing Humidity (%)	10 to 95
Altitude (ft. maximum)	30,000

POWER REQUIREMENTS	
Voltage	+5V, +12V
Power Consumption (typical)	28 Watts

Read/Write compatible with all previous DLT formats

**Actual transfer rate and capacity will vary depending on data*

***Excluding bezel*

UNINTERRUPTIBLE POWER SUPPLIES

UPS Tower Format

- Smart UPS 230V/ 700VA,
- Smart UPS 230V/1000VA
- Smart UPS 230V/1400VA
- Smart UPS 230V/3000VA

UPS Rack Format (only for AZA-xx-xx rack frames)

- 3U Rackmountable 230V/1400VA UPS
- 3U Rackmountable 230V/2200VA UPS
- 3U Rackmountable 230V/3000VA UPS

UPS Accessories

- Smart Slot Interface Expander
- UPS Share Box
- Signal cable for Interface Expander and Share Box
- Link Power Cord for UPS or PDU

Uninterruptible Power Supplies

- UPS Tower based format
- Increased data protection by supporting network grade batttery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-0700-00-00	Smart UPS 700VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1000-00-00	Smart UPS 1000VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-1400-00-00	Smart UPS 1400 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3100-00-00	Smart UPS 3000 VA, 4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

	ABA-0700-00-00	ABA-1000-00-00	ABA-1400-00-00	ABA-3100-00-00
OUTPUT				
Output Power Cap..VA/ watts	700 / 450	1000 / 670	1400 / 950	3000 / 2250
Output Voltage	230 V	230 V	230 V	230V
Output connections	(4) IEC-320-C13	(4) IEC-320-C13	(4) IEC--320-C13	(8)IEC-320-C13
Waveform Type	Sinewave	Sinewave	Sinewave	Sineware
Transfer Time (ms)	2 (4 ms max)	2 (4 max)	2 (4 ms max)	2 (4 ms max)
Nominal input voltage	230V	230V	230V	230V
Input frequency (auto sensing)	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz	50/60 Hz +/-3 Hz
Input connection	IEC- 320-C14	IEC- 320-C14	IEC- 320-C14	IEC- 320-C20
BATTERIES				
Typical backup time (at half load)	18.2 min	20.1 min	24.0 min	18.1 min
Battery type	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte; leakproof	Lead-Acid + suspended electrolyte leakproof	Lead-Acid + suspended electrolyte leakproof
Recharge time (hrs)	4.0	4.4	5.14	4.5
Replacement battery catridge	RBC5	RBC6	RBC7	RBC11
COMMUNICATIONS AND MANAGEMENT				
Interface port	RS-232 port	RS-232 port	RS-232 port	RS-232 port
Management Software	PowerChute Smart-UPS bundle	PowerChute UPS bundle	PowerChute Smart-UPS bundle	PowerChute Smart UPS bundle
Control panel (LED status display withload and battery bar-graphs and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓	✓
Audible alarm	✓	✓	✓	✓
Emergency Power Off (EPO)	Optional	Optional	Optional	Optional
SURGE PROTECTION AND FILTERING				
Surge Energy rating (joules)	320	320	320	320
Filtering				

Full time multi pole noise filtering;	✓	✓	✓	✓
% IEEE surge let-through	0.7	0.3	0.3	0.3
0 clamping response time	✓ 0	✓ 0	✓ 0	✓ 0
meets UL 1440	✓	✓	✓	✓

PHYSICAL DIMENSIONS

Height (inches / cm)	6.2 / 15.7	8.5 / 2.6	8.5 / 21.6	17 / 43.2
Width (inches / cm)	5.4 / 13.7	6.7 / 17.0	6.7 / 17.0	7.7 / 19.6
Depth (inches / cm)	14.1 / 35.8	17.3 / 43.9	17.3 / 43.9	21.5 / 54.6
Weight (lbs / kg)	29.0 / 13.2	41.5 / 18.8	58 / 26.3	123 / 55.8

ENVIRONMENTAL

Operating temperature ºC / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions ºC / F	-15-45 / 32-120	-15-45	-15-45	-15-45
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	41 dBA	41 dBA	45 dBA	53 dBA
On line thermal dissipation	85 BTU / hr	100 BTU / hr	135 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Uninterruptible Power Supplies

- Rack based format
- Increased data protection by supporting network grade battery back up when power fails
- PowerChute Software that provides network administrators with useful UPS information.

CUSTOMER INSTALLABLE	DESCRIPTION
ABA-1401-00-00	3U Smart UPS (SU1400RM),1400VA4 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-2201-00-00	3U Smart UPS (SU2200RM), 2200VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software
ABA-3001-00-00	3U Smart UPS (SU3000RM), 3000VA, 8 outlets, 1 power cord, 1 link power cord, 1 signal cable and PowerChute software

TECHNICAL SPECIFICATIONS	ABA-1401-00-00	ABA-2201-00-00	ABA-3001-00-00
Output Power Capacity VA/ watts	1400 / 950	2200 / 1600	3000 / 2250
Output Voltage	230V	230V	230V
Output connections	(4) IEC-320-C13	(8)-IEC-320-C13 (1)-IEC-320-C19	8)-IEC-320-C13 (1)-IEC-320-C19
Waveform Type	Sinewave	Sinewave	Sinewave
Transfer Time (ms)	2 (4 max)	2 (4 max)	2 (4 max)
Nominal input voltage	230V	230V	230V
Input frequency	50 / 60 Hz +/- 5 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)	50 / 60 Hz +/- 3 Hz (autosensing)
Input connection	IEC-320-C14	IEC-320-C20	IEC-320-C20
BATTERIES			
Typical backup time (at half load)	16.9 min	23.2 min	12.4 min
Battery type	Lead-Acid, suspended electrolyte; leakproof	Lead-Acid suspended electrolyte; leakproof	LeadAcid,suspended electrolyte; leakproof
Recharge time (hrs)	4.2	4.5	4.5
Replacement battery catridge	RBC8	RBC12	RBC12
COMMUNICATIONS AND MANAGEMENT			
Interface port	RS-232	RS-232	RS-232
Management Software	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle	PowerChute Smart-UPS Bundle
Control panel (LED status display withload and battery bar-graphs and Online; ON battery;Replace battery and Overload indicators)	✓	✓	✓
Audible alarm	✓	✓	✓
Emergency Power Off (EPO)	optional	optional	Optional
SURGE PROTECTION AND FILTERING			
Surge Energy rating (joules)	320	320	320
Filtering			✓
Full time multi pole noise filtering;	✓	✓	✓
% IEEE surge let-through	0.3	0.3	0.3
0 clamping response time	✓	✓	✓
meets UL 1440	✓	✓	✓

PHYSICAL DIMENSIONS			
Height (inches / cm)	5.2 / 13.2	5.2 / 13.2	5.2 / 13.2
Width (inches / cm)	19.0 / 48.3	19.0 / 48.3	19.0 / 48.3
Depth (inches / cm)	14.0 / 35.6	25 / 63.5	25.0 / 63.5
Weight (lbs / kg)	58 / 26.3	103 / 46.8	114 / 51.8
Rack height	3U	3U	3U
ENVIRONMENTAL			
Operating temperature °C / F	0-40 / 32-104	0-40 / 32-104	0-40 / 32-104
OperatingRelative Humidity %	0-95	0-95	0-95
Operating Elevation (m/ft)	0-3000 / 0-10000	0-3000 / 0-10000	0-3000 / 0-10000
Storage conditions °C / F	-15-45 / 32-120	-15-45 / 32-120	-15-45 / 32-120
Storage Operating elevation (m/ft)	0-15000 / 0-50000	0-15000 / 0-50000	0-15000 / 0-50000
Audible noise (1m from surface)	45dBA	47 dBA	47 dBA
On line thermal dissipation	135 BTU / hr	275 BTU / hr	375 BTU / hr

**Each UPS is delivered standard with PowerChute Software. This will shut down Novell Netware, Windows NT, Windows 95/98, Windows 3.X. It is also includes SNMP agents for Novell Netware and Windows NT.*

Smart Slot Interface Expander and UPS Share Box

- Enables thorough management of servers in mixed OS environments
- Essential tools to properly managing signalling from a single UPS

CUSTOMER INSTALLABLE	DESCRIPTION
AEX-2200-00-00	Smart Slot Interface Expander to manage up to 2 additional servers
AEX-2008-00-00	UPS Share Box to manage up t o 8 servers

FEATURES AND BENEFITS	AEX-2200-00-00 AEX-2008-00-00
Central UPS Management	Use one server to manage the power environment for servers with multiple UPS
Integrates with PowerChute Software	Each server runs its own copy of PowerChute plus software, for monitoring and power management of the UPS
WARRANTY AND APPROVALS	
Product Warranty	2 year warranty
Approvals	Smart Slot Interface Expander :FCC Class B, EN50022, En50082-1 Share UPS-:FCC Class A, EN50082-1

Signal Cable for Interface Expander or Share Box

CUSTOMER INSTALLABLE	DESCRIPTION
ACN-2000-00-00	Kit of 1 Cable for Interface Expander or Share Box
ACN-2001-00-00	Kit of Link Power cord for UPS or PDU

DESCRIPTION	ACN-2000-00-00
Smart Signalling UPS Link Cable	Smart Signalling RS-232 communication cable

DESCRIPTION	ACN-2001-00-00
Power cord	Smart Signalling RS-232 communication cable

MISCELLANEOUS

- Ultra2 SCSI cable Kit for internal HDD and Media device support
- SCSI cable Kit for internal UN Media device support
- SCSI cable Kit for internal UW Media support
- SCSI cable Kit with 68-pin High density External connector
- Y-shape SCSI-3 Termination cable
- SCSI Wide (68-pin) to Narrow (50-pin) connector

Ultra2 SCSI cable Kit for internal HDD and Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0025-00-00	ACN-0025-IN-00	68-Pin internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal Cable to connect Media and HDD SCSI devices

CONNECTORS	7
TYPE	68-pin
Hard Disk	3
Media Devices	3 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	37

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0026-00-00	ACN-0026-IN-00	50-pin Narrow Internal SCSI cable

KIT CONTENTS
SCSI Cable

External 50-pin conductor ribbon for Huron Chassis

CONNECTORS	
Type	50-pin
Media Devices	4
CD-ROM	✓
DAT/DDS 2	✓
DLT	To Be Confirmed
Adaptec 2920	1
PHYSICAL DIMENSIONS	
Length inches	53

SCSI cable Kit for internal UN Media device support

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0027-00-00	ACN-0027-IN-00	68-pin Internal SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
Tape Drive	1 (50-pin)
Motherboard	1
PHYSICAL DIMENSIONS	
Length inches	10.25

SCSI cable kit with 68-pin High Density External Connector

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACN-0028-00-00	ACN-0028-IN-00	68-pin External SCSI cable

KIT CONTENTS
SCSI Cable

Internal 68pin to connect motherboard to internal SCSI Tape Drive

CONNECTORS	
Type	68-pin
External SCSI (HD)	1
Internal SCSI (HD)	1 (50-pin)
PHYSICAL DIMENSIONS	
Length cm	45

SCSI Wide (68-pin) narrow (50-pin) converter

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ACT-0010-00-00	ACT-0010-IN-00	SCSI Internal converter 68 pin HD female pins to 50 pin female pins.

KIT CONTENTS
SCSI Converter

Mouse

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
MSS-0392-01-00	MSS-0392-02-00	2 Button Mouse

KIT CONTENTS
1x 2 Button Mouse

TECNICAL SPECIFICATIONS

- 2 Button Mouse
- Resolution 320 dpi
- Microsoft complient

The 16 Bits Sound Card

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASX-0591-00-00	ASX-0591-00-00	16 Bits ISA Sound Card

KIT CONTENTS
1 16 Bits Sound Card

TECNICAL SPECIFICATIONS

- 16 Bits CD-Quality stereo recording and playback
- 32 voices of wave table audio with Creative
- WaveSynth/WG

Keyboard

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AKB-0587-00-00	AKB-0587-00-00	104 Keys Keyboard

KIT CONTENTS
1 x 104 keys Keyboard

MONITORS

	VR 15 Affordable Viewing Comfort	HR 15 Superior Quality for Advanced Needs	VR 17 Perfect for Business Applications
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT	CRT
Screen diagonal	15"	15"	17"
Viewable diagonal	13.8"	13.7"	16"
Anti-Glare Coating	Yes	Yes	Yes
Anti-Static Coating	Yes	Yes	Yes
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.28	0.28	0,27
Video Bandwidth (MHz)	Over 85	Over 95	Over 110
Horizontal scan frequency (kHz)	30-54	30-70	30-70
Vertical refresh rate (Hz)	50-120	50-150	55-120
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			
Contrast ratio			
Top flicker-free VESA (>75Hz)	800 x 600 @ 85Hz	1024 x 768 @ 85Hz	1024 x 768 @ 85Hz
Max non-interlaced resolution	1024 x 768 @ 60Hz	1280 x 1024 @ 60Hz	1280 x 1024 @ 60Hz
Resolutions supported	640 x 480 @ 60, 75, 85Hz 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60Hz	640 x 480 @ 60, 85, 120Hz 720 x 400 @ 70Hz 800 x 600 @ 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz, 1280 x 1024 @ 60Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz, 1024 x 768 @ 75, 85Hz 1280 x 1024 @ 60Hz
OTHER SPECIFICATIONS			
Front panel control	Digital Control	On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	Yes	Yes
TCO 95	No	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 H1		
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes for NCM 1520 NO	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	380 x 360 x 381mm	376 x 365 x 396mm	420 x 403 x 418mm
Weight	12.5 kg	11.9 kg	15.5 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	Up to 3 years on site	Up to 3 years on site	Up to 3 years on site
Reference	**NCM-1520-H1-00** **French price list only**		
Reference	**NCM-1520-N0-00** **Rest of Europe only**	**NCM-1550-H0-00**	**NCM-1720-N0-00**
Notes	**Our monitors can only be sold together with a PC.**		

CRT and LCD MONITORS

	HR 17	HR 19	LR 15
SCREEN SPECIFICATIONS			
Monitor Type	CRT	CRT short length tube	Colour TFT active matrix
Screen diagonal	17"	19"	15"
Viewable diagonal	16"	18"	15"
Anti-Glare Coating	Yes	Yes	-
Anti-Static Coating	Yes	Yes	-
DISPLAY SPECIFICATIONS			
Dot Pitch (mm)	0.26	0,25	0.297
Video Bandwidth (MHz)	Over 200	Over 202	Over 95
Horizontal scan frequency (kHz)	30-95	30-95	31-69
Vertical refresh rate (Hz)	50-150	50-150	56 - 85
Multi-synchronous inputs	Yes	Yes	Yes
Luminance/Brightness			200cd/m^2
Contrast ratio			200:01:00
Top flicker-free VESA (>75Hz)	1280 x 1024 @ 85Hz	1280 x 1024 @ 85Hz	-
Max non-interlaced resolution	1600 x 1200 @ 75Hz	1600 x 1200 @ 75Hz	-
Resolutions supported	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85, 100Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 75, 85Hz, 1600 x 1200 @ 75Hz	640 x 480 @ 60, 85, 120Hz, 720 x 400 @ 70Hz 800 x 600 @ 60, 75, 85Hz 1024 x 768 @ 60, 75, 85, 100Hz 1280 x 1024 @ 60, 75, 85Hz, 1600 x 1200 @ 60, 75Hz	640 x 350 @ 70, 85Hz 640 x 400 @ 70, 85Hz 720 x 400 @ 70Hz 640 x 480 @ 60, 72, 75, 85Hz 800 x 600 @ 56, 60, 72, 75, 85Hz 1024 x 768 @ 60, 70, 75, 85Hz
OTHER SPECIFICATIONS			
Front panel control	One Touch On Screen Display	One Touch On Screen Display	On Screen Display
VESA/DPMS Power management	Yes	Yes	Yes
Automatic Tension Selection	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range	Yes 100-240 VAC Full-range
REGULATORY & SAFETY			
DDC1/2B - Plug & Play	Yes	Yes	Yes
Energy Star	Yes	Yes	Yes
MPRII	Yes	No	No
TCO 95	Yes	Yes	Yes
CE Mark, TUV-GS, ISO 9241-3, DHHS, NEMKO			
CE Mark, TUV-GS, UL, CSA, FCC, ISO 9241-3, DHHS, NEMKO	Yes	Yes	Yes
PHYSICAL SPECIFICATIONS			
Size (HxWxD)	419 x 410 x 447mm	480 x 468 x 419 mm	384 x 380 x 174 mm
Weight	17.3 kg	22,0 kg	5,0 kg
WARRANTY			
Standard warranty	1 year exchange	1 year exchange	1 year exchange
Warranty extension	up to 3 years on site	up to 3 years on site	up to 3 years on site
Reference	**NCM-1750-H0-00**	**NCM-1950-H0-00**	**NCL-1500-H0-00**
Notes	**Our monitors can only be sold together with a PC.**		

RACK SOLUTIONS

- The 27U, 36U and 42U 19" Rack Mount Frame
- Rack Mount Concentrator and Options
- The 24A Power Distribution Unit

The 27U, 36U and 42U 19"Rack Mount Frame

- Available in 27U, 36U or 42U form factors
- Designed to host your chosen combination of rackmountable Express5800 servers and storage units

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AZA-2700-00-00	N/A	19" rack mount frame 27U
AZA-3600-00-00	N/A	19" rack mount frame 36U
AZA-4200-00-00	N/A	19" rack mount frame 42U

KIT CONTENTS
Front/Rear metal vented doors and front stabiliser

PHYSICAL DIMENSIONS

U	27	36	42
Width (mm)	600	600	600
Height (mm)	1400	1800	2000
Depth (mm)	1000	1000	1000
Colour	Mist White	Mist White	Mist White

Rack-Mount Concentrator and Options

- 8-port model
- Control up to 64 servers from one console
- Patented OSCAR (On-Screen Configuration and Activity
- Reporting) user Interface allows for very easy access and control.
- Programmable scanning, naming, security and broadcast functions.

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
AEX-8000-00-00	N/A	1U 8 Port Monitor/Keyboard/Mouse Concentrator
ACN-0009-00-00	N/A	7' BSU to Concentrator Monitor / keyboard/ Mouse cable
ACN-0010-00-00	N/A	12' BSU to to Concentrator Monitor / keyboard/ Mouse cable
ACN-0011-00-00	N/A	12' Keyboard/Mouse/Monitor extension Cable Extension

KIT CONTENTS
8 Port Concentrator /3 cable Kit

TECHNICAL SPECIFATIONS	AEX-8000-00-00
OSCAR	On-screen pop-up menu system
Windows NT	Microsoft certified
Password security	Restrict system access through the switch
Broadcast Commands	Send the same keyboard or mouse commands to multiple computers (configurable)
Programmable scanning	Set system view time and selection pattern
SnapShot	Manages communication with the CPU during power-down
Long-line operation	Separate switch and CPUs by up to 12'
On-screen diagnostics	Displays technical assistance information on-screen
Automatic System Restart	Provides unattended reboot without administrative intervention
Power Supply	Auto senses 100-240 VAC internal
Flexible applications	SVGA, VGA, XGA, and PS/2 support Serial mouse capable with ACN-00xx00-00
Video	VGA, SVGA XGA
Regulatory	FCC-A, UL, cUL, TUV/GS, CISPER-A, VCCI, CE Mark, NEMKO
Connections	
Output:	
Console Video	HD15
Console Keyboard	PS/2
Console Mouse	PS/2
Input:	
System Video	HD15
System Keyboard	PS/2
System Mouse	PS/2
PHYSICAL DIMENSIONS	
Height inches (cm)	1.75 (4.45)
Depth inches (cm)	10.8 (27.7)
Width inches (cm)	17.0 (43.2)
Wight lbs (Kg)	9.0 (4.09)
ENVIRONMENTAL LIMITS	
Temperature (^{0}C)	10-40

The 230V Rackmountable Power Distribution Unit

CUSTOMER INSTALLABLE	FACTORY INSTALLABLE	DESCRIPTION
ASP-0001-00-00	N/A	24A Power Distribution Unit, including 10 outlets

KIT CONTENTS
Power Distribution Unit 3 connection cords 1 power cord

TECHNICAL SPECIFICATIONS

AC Input	120/240 V
AC Output	120/240V
Current	24A/16A
Max. Current	30A/20A
Circuit Breaker	30/20/20
EMI/RFI Filter	30A
Transient Protection	6500PA
Receptacle Outlets	10, 14/16
Receptacle type	NEMA/IEC
Power Cord	12/3 - 15'
Power Plug 220V	L5-30P

	EXPRESS5800 120Ld	EXPRESS5800 120Mc2
DESIGN		
Form factor	Tower or 5U Rack	Tower or 6U Rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 2 (SMP)
Type	Pentium® III 600 to 800 MHz	Pentium® III 600 to 800 MHz
Slot type	Slot 1	Slot 1
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	256KB ECC L2 on-die
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	133 MHz
ARCHITECTURE		
Chipset	ServerSet III LE	ServerSet III LE
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	64MB/ 2GB / ECC SDRAM
Memory slots	4 DIMM	4 DIMM
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	All
MEDIA AND STORAGE		
CD ROM drive	40x EIDE	40x EIDE
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives EIDE 5400 RPM		
Hard Disk Drives EIDE 7200 RPM		
Hard Disk Drives SCSI 7200 RPM	U2W: 9.1/18.2GB	U 160/m: 9.1/18.2GB
Hard Disk Drives SCSI 10 kRPM	U2W: 9.1/18.2GB	U 160/m : 9.1/18.2GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board
RAID controller	Option	Option
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	3 / 2	4 / 3
3.5" Media bays (total / free)	1 / 0	1 / 0
3.5" Non-Hot Swap HDD bays	4 x 1.6" ***OR***	-
3.5" Hot swap HDD bays	6 x 1" (choose one type)	7 x 1" or (3 x 1.6" and 4 x 1")
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	4MB/4MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	-/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	1xUW SCSI	Option
System Management	Integrated	Integrated
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	300W
Hot-Plug PSU option	-	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1	1 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	445x220x620mm	533x289x591 mm
Weight	30 kg	30 kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35° C, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1

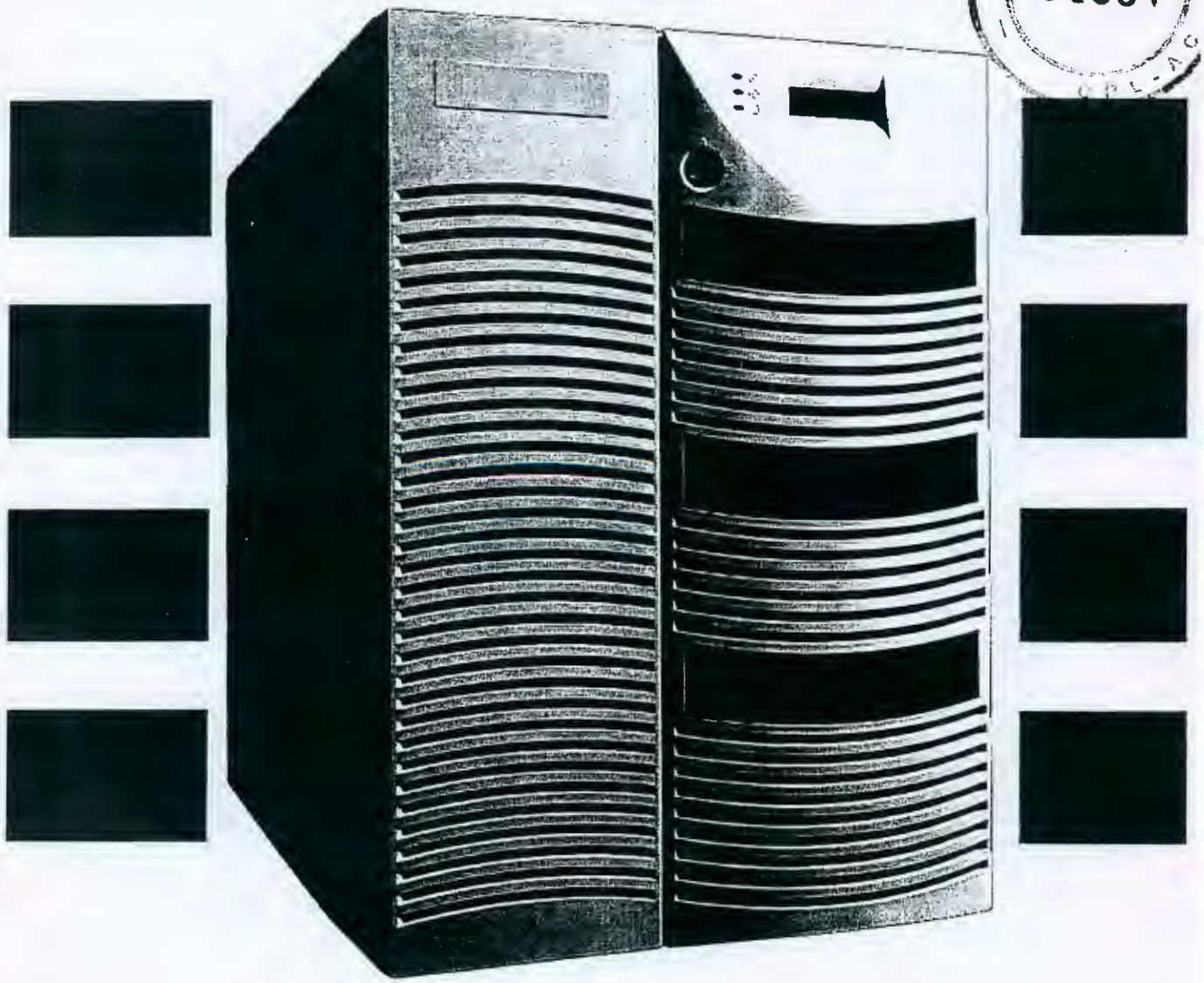
SERVERS AT A GLANCE

	EXPRESS5800 120Mc3	EXPRESS5800 HX4600
DESIGN		
Form factor	Tower or 7U Rack	Dual Tower or 14U rack
Tower-Rack convertible	Yes	Yes
PROCESSOR		
Number of processors	Up to 2 (SMP)	Up to 4 (SMP)
Type	Pentium® III Xeon 733-800MHz	Pentium® III Xeon 550MHz
Slot type	Slot 2	Slot 2
Integrated L1 cache	32K	32K
L2 cache std / max / type	256KB ECC L2 on-die	512KB or 1MB or 2MB ECC L2
L3 cache	-	-
Processor front side bus (FSB) speed	133 MHz	100MHz
ARCHITECTURE		
Chipset	ServerSet III LE	Intel 450NX
I_2O Ready	Yes	Yes
MEMORY		
Memory Min/Max/Type	64MB/ 2GB / ECC SDRAM	256MB / 8GB / ECC RAM
Memory slots	4 DIMM	16 or 32 DIMM (with add. Memory board)
I/O SLOTS		
Bus slots (ISA / PCI / Combo / AGP)	2 PCI64/66 + 3 PCI32 + 1 Combo or 3 PCI64/33 + 3 PCI32 + 1 Combo	4 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
Bus slots free (ISA / PCI / Combo / AGP)	All	3 PCI64 + 4 PCI32 hot plug + 2 PCI32 + 1 Combo
MEDIA AND STORAGE		
CD ROM drive	40xEIDE	40x SCSI
Floppy Disk Drive	1.44MB	1.44MB
Hard Disk Drives SCSI 7200 RPM	U 160/m: 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Hard Disk Drives SCSI 10 kRPM	U 160/m : 9.1/18.2GB	U2W: 9.1/18.2/36.4GB
Standard HDD and Media controllers	1x Ultra 160/m SCSI on board 1x U2W SCSI on board 1x EIDE on board	1x U2W SCSI on board 1x UN SCSI on board
RAID controller	Option	Standard (U2/W tri)
Maximum Internal Storage capacity	127.4GB (7x18.2)	436.8GB (12x36.4)
Storage Expansion Unit	External Option	External Option
BAYS		
5.25" Media bays (total / free)	4 / 3	4 / 3
3.5" Media bays (total / free)	1 / 0	2 / 1
3.5" Non-Hot Swap HDD bays	-	-
3.5" Hot swap HDD bays	7 x 1" or (3 x 1.6" and 4 x 1")	8 or 12 x 1" or 1.6"
VIDEO		
Video controller	SVGA on board	SVGA on board
Video memory std / max / type	4MB/4MB VRAM	2MB/2MB VRAM
NETWORK		
Network interface controller	On-board 10/100 Ethernet	On-board 10/100 Ethernet
SECURITY		
2 level passwords	Yes	Yes
Front door / Intrusion protection	-/Yes	Yes/Yes
I/O PORTS		
USB ports	2	2
Serial port	2 - RS-232C	2 - RS-232C
Parallel port	1 - Centronics	1 - Centronics
Mouse / keyboard port	2	2
SVGA video port	1	1
External SCSI connector	Option	1x UN SCSI
System Management	Integrated	Optional board
Ethernet port	RJ45	RJ45
POWER SUPPLY		
Power Supply Unit	300W	560W
Hot-Plug PSU option	Yes	Yes
Bivolt Alimentation	Yes	Yes
Power supply numbers	1 standard + 1 option	2 standard + 1 option
VENTILATION		
Fan specifications	Redundant	Redundant
PHYSICAL SPECIFICATIONS		
Size (HxWxD)	533x289x591 mm	620x445x678 mm
Weight	30 kg	77 Kg
Operating constraints	10 to 35° C, 45 to 70% RH	10 to 35°, 45 to 70% RH
OS AND SOFTWARE		
Operating system	MS-DOS	MS-DOS
Management software	ESMPRO Management Suite	ESMPRO Management Suite
Installation & Configuration software	ExpressBuilder Setup and Configuration software	ExpressBuilder Setup and Configuration software
Software certification	Windows NT Server 4.0, Windows 2000, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1	Windows NT Server 4.0, Novell Netware 4.11, 5.0 SMP and IntranetWare, SCO OpenServer 5, SCO UNIXware 7.0, Tested with Red Hat Linux 6.1
WARRANTY		

Warranty extension	Option	Option
REGULATORY & SAFETY		
Year 2000 ready	Yes NTSL certified	Yes
Regulatory compliance	UL, CSA, CE	UL, CSA, CE
RECOMMENDED UPS	SU 1400 (option)	SU 2200 (option)

(1) 4-way : 1 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit ; 8-way : 2 standard + 1 option in Base Unit, 1 standard + 1 option in Disk Unit
(2) 4-way : 1 standard + 1 option ; 8-way : 2 standard + 1 option
(3) Additional Disk Unit option and UPS option are mutually exclusive

PRODUCT INFORMATION GUIDE



Item 04 – Servidor Tipo INT4
Manual Técnico 3

EXPRESS5800 HX4600

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PRODUCT OVERVIEW

Express5800 HX4600

Redefining power erformance in Enterprise Computing

The Redefinition, the Express5800 HX4600 is more than just an enterprise server, it is designed to optimise system performance making full use of the latest innovations in server technology. The HX4600 is fully equipped with 4 of the much-appraised Pentium III Xeon processors at a maximum of 500MHz supported by the Intel 450NX chipset. The Express5800 HX4600 has been especially created for high availability, expandability and unparalleled price/performance ratios.

Each Pentium III Xeon 500MHz processors can support 512KB, 1MB or 2MB of L2 ECC cache. Sustaining up to **8GB of ECC protected memory** and the **fully-featured SecuRAID530 Ultra2 SCSI RAID controller as standard**, the HX4600 ensures maximum data integrity. With Integrated SCSI controllers and powerful 7,200rpm Ultra2 SCSI or the unprecedented performance 10,000rpm **Ultra2 SCSI hot swappable Hard Disk Drives** your server is guaranteed for outstanding data throughput.

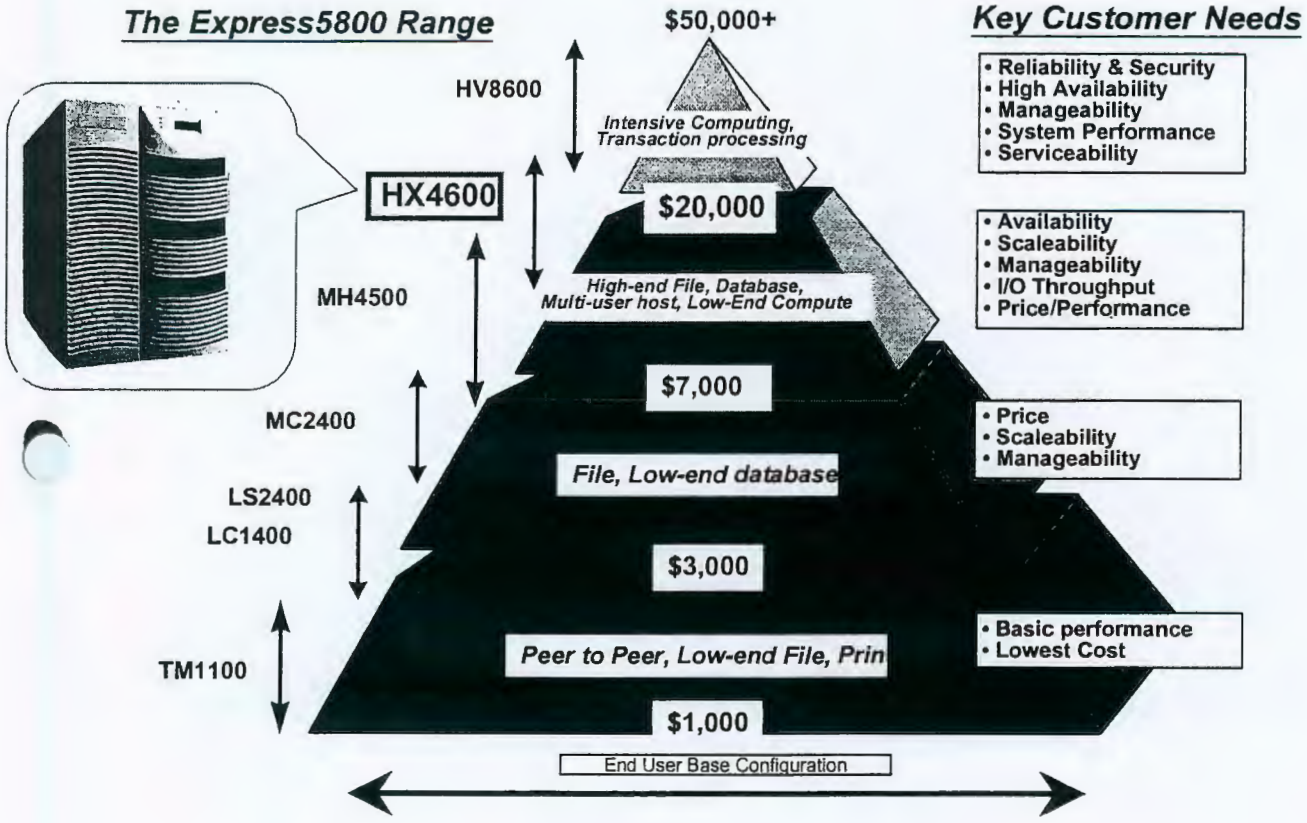
What more, the HX4600 features a complete range of redundant/hot-swap components including **redundant cooling redundant hot-swappable power supplies, and the essential** availability of hot-plug PCI. The Express5800 HX4600 comes with **8 or 12 highly configurable HDD bays** in 3 Ultra2 LVD disk cages (4, 8 or 12 disk drives) for a **massive internal storage of 436.8GB, 11 expansion slots** (9 PCI/2 ISA) and **32 memory sockets** for facilitated expansion and upgrade. Moreover, all the HX4600 servers are **14U Rack-mountable** for all your business expansion requirements.

Facilitated set-up and manageability, the Express5800 HX4600 comes standard with **ExpressBuilder** set-up/configuration software and **ESMPRO** management software. Thanks to our assemble-to-order (ATO) capability, Express5800 HX4600 systems will be ready for immediate installation, right up to the optional preloading of Microsoft Windows **NT** Server 4.0 or NT Server 4.0 Enterprise Edition.

Ideal for distributed department and enterprise computing applications, the Express5800 HX4600 outdoes itself when handling business-critical applications, large database processing and decision support, transaction processing and server application consolidation.

Designed with ultimate availability, expandability and unmatched price performance as key considerations, the Express5800 HX4600 gives a redefinition to power performance in enterprise computing.

TARGET AUDIENCES



POINTS WORTH NOTING

- Up to 500MHz Quad Pentium III Xeon design for premium power performance
- Optimised data throughput with 100MHz system Front Side Bus and the Intel 450NX chipset
- A maximum of 8GB memory with ECC protection providing superior scalability for easy expandability
- Up to 436.8GB of hot-swap disk capacity of 8 or 12 highly configurable Ultra2 SCSI disk bays
- Flexible choice between a powerful 7,200 rpm or the increasingly eminent performance of 10,000 rpm Ultra2 SCSI HDDs
- Added data security using the utmost in RAID controllers SecuRAID530 Ultra2 SCSI as standard
- Redundant hot-swap power supplies, Hot swap PCI and redundant cooling maximising system uptim
- Integrated 3Com Network Interface controller
- Microsoft Windows NT Server 4.0 or NT Enterprise Edition preload option
- 14U Rack-mountable

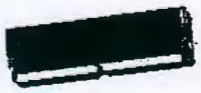
KEY PRODUCT FEATURES & USER BENEFITS

The Accelerated Power Performance Pentium III Xeon processing

The Express5800 HX4600 supports up to 4 Pentium III Xeon processors, each packaged in a Single Edge Contact (S.E.C.). The S.E.C. cartridge includes the processor core with an internal 16KB primary (L1) cache, the secondary (L2) cache, a thermal plate and a back cover. A retention module attached to the baseboard secures the cartridge.

Pentium III Xeon processors feature either 512KB, 1MB or 2MB ECC L2 cache configurations as standard and come with frequencies of 500MHz Added to this, the HX4600 supports the new Intel 450NX chipset and a high-speed 100MHz Front Side Bus for optimised data throughout and superior system performance.

Advanced Memory architecture



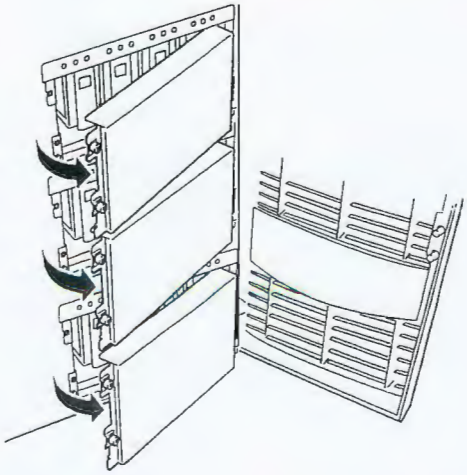
Express5800 HX4600's memory capacity is scaleable from 256MB (4 x 64 in bank #1) up to 8GB memory (32 slots occupied) using industry-standard EDO DIMMs with a 4-way interleave memory organisation. The HX4600 comes with one memory board as standard allowing up to 4GB of ECC Memory and an additional optional memory board enabling a maximum of 8GB. The HX4600 allows an easy expansion of system's capabilities to memory-intensive environments and comes standard with 9-bit parity/ECC protection for maximum data integrity.

Exceptional expandability with a maximum of 436.8GB hot swap storage capacity

The Express5800 HX4600 allows flexible configuration of HDD capacity for large data storage (up to 436.8GB with 12 x 1.6" hot swap Ultra2 SCSI HDDs) and offers 6 media bays (including two 3.5" bays with one occupied by a 1.44MB floppy drive and four 5.25" bays with one occupied by a 32x speed SCSI CD-ROM drive).

The Express5800 HX4600 can accommodate 2 kinds of hot-swappable HDDs:

- Powerful 7,200 rpm Ultra2 LVD SCSI (4.5GB, 9.1GB, 18.2GB, 36.4GB)
- High-performance 10,000 rpm Ultra2 LVD SCSI (9.1GB, 18.2GB)



Ultra2 SCSI Hard Drive Cages

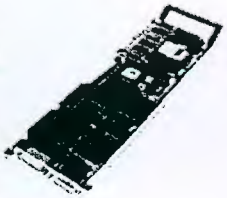
Integrated I/O controllers

The Express5800 HX4600 comes built with:

- an onboard single-channel Wide/Narrow SCSI controller on the PCI-A bus providing a narrow SCSI interface for 5.25" devices (SCSI CD-ROM drive, DAT, DLT)
- an onboard single-channel Ultra2 SCSI LVD controller on the PCI-B bus providing an Ultra2 SCSI interface.

Three-channel Ultra2 SCSI RAID board as standard

Every Express5800 HX4600 comes standard with the fully-featured SecuRAID530 Ultra2 SCSI RAID board for advanced levels of performance and fault-tolerance when running demanding server applications and databases.



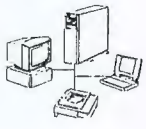
The SecuRAID530 RAID controller integrates a 233MHz Intel StrongArm on-board RISC processor with Mylex's own newly enhanced intelligent firmware. It also supports 3 Ultra2 SCSI channels, 16/32MB of cache with or without battery backup unit, Synchronous DRAM memory and 4MB of flash EEPROM. The SecuRAID530 allows advanced RAID 5 operation through hardware XOR and provides many fault detection and fault tolerance features such as automatic detection and transparent rebuild of failed drives, hot swap drive support, on-line RAID capacity expansion, hot spare drive support or RAID configuration stored in both disk and in non-volatile RAM, SMART capable drive support and SAF-TE enclosure management. The SecuRAID530 enables administrators to improve storage system performance simply by adding extra drives

Added to this, the board helps prevent system failure and protects valuable data with absolute flexibility and management features.

Integrated 10/100Mbps Ethernet

The HX4600 comes with a 3Com Network interface controller that is integrated on the motherboard.

Optional auto-sensing 10/100Mbps Ethernet



The Express5800 HX4600 can support optional auto-sensing 10/100Mbps EtherExpress PRO/100+ Server Adapter from Intel, optimising server performance and providing immediate network-readiness. By installing multiple PRO/100+ server adapters, several high-availability (load balancing, fault tolerance) and top performance (server bandwidth scaleable up to 800Mbps) features are provided for the most demanding networking environments.

Video

The HX4600 also features an onboard SVGA controller with 2MB of Video memory offering high-performance graphics capability to display high-quality images with a wide selection of colours. Supported resolutions include:

Resolution	*Number of colors*
640 x 480	16 700 000
800 x 600	16 700 000
1024 x 768	64 000
1280 x 1024	256

11 I/O expansion slots

The server's expansion capabilities meet the needs of enterprise/database servers for high-performance I/O by providing a combination of 4 PCI 64-bit, 4 PCI 32-bit hot plug, 2 PCI 32-bit and 1PCI/ISA. All the I/O expansion slots are Plug and Play ready and PCI connectors are parity enabled.

PCI/ISA Plug and Play

The Express5800 HX4600 supports PCI/ISA Plug and Play in the BIOS. By using Plug and Play compliant operating systems and options, users can easily upgrade and auto-configure the system.

External Device Connectors

The external I/O connectors of the Express5800 HX4600 provide support for a PS/2-compatible mouse and a keyboard, connectors for VGA monitor, two 9-pin serial port connectors and one 25-pin parallel port connector. It also provides a narrow SCSI external connector.

Rack-mount kit

The Express5800 HX4600 is 14U rack-mountable to respond to your expanding business requirements.

Hot Plug PCI

Customers today need high-availability solutions that minimise or eliminate downtime, that is why the Express5800 HX4600 comes as standard with 4 Hot Plug PCI. The technology allows a PCI adapter to be added, upgraded, or replaced while the host system is running and while other adapters in the system provide uninterrupted service. Generally speaking, a fully capable hot-plug system includes the hot-plug system hardware, hot-plug aware software and Os support, hot-plug capable device drivers, and a hot-plug aware user interface. All these elements enable enhanced PCI flexibility without powering down the Server. Incidentally Hot Plug PCI can only be integrated with the support of the NT2000 software, which will be available

Hot-swap Redundant power supplies and redundant cooling,

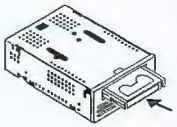
Two 560-Watt auto-voltage-sensing power supplies provide system power. These supplies auto-sense between 110V (60Hz) and 220V (50Hz) AC inputs, supporting use in most parts of the world. Both power supplies are designed to operate together during system operation. They comply with existing emissions standards and provide sufficient power for a fully loaded system configuration. An optional third power supply can be added to the system as a backup unit.

The HX4600 can also support a maximum of 7 fans for efficient cooling and airflow: 4 redundant fans for CPUs (front and rear) 2 fans not redundant for chipset cooling, 1 fan for I/O slots cooling not redundant.

Optional Backup devices

The system can also accommodate multiple options for faster performing and efficient back up:

- DAT (12/24GB)
- DAT Autoloader (48/96GB)
- Internal or external DLT (20/40GB, 35/70GB)



Comprehensive network protection with MacAfee Netshield

With every Express5800 HX4600 ordered with the NT Server preload, McAfee's NetShield Antivirus software is included free of charge with a 2-year free update. MacAfee is an extremely flexible and easily manageable software package giving comprehensive protection to your entire network by detecting and eliminating more than 96% of known viruses.

NT Server preload option

Preloaded Microsoft NT Server 4.0 or NT Enterprise Edition allow companies to have the server up and running with the most up-to-date network operating system. Added to this, is the free inclusion of McAfee's reputed Netshield software (see above).

Operating Environments

The Express5800 HX4600 is certified for the following OS: Windows NT Server 4.0, Novell Netware 4.11 and 5.0 SMP and IntranetWare, SCO 5 OpenServer and UnixWare 7.0, SunSoft Solaris SMP 2.5.

System management software: ESMPRO

The Express5800 HX4600 includes the SNMP-based ESMPRO Suite to enable system administration within the frame of a networked environment. Included in the ESMPRO Suite are the following components:

- **the SNMP agents (for the Windows NT and NetWare environments) accommodating all Express5800 servers**
- **a complete standalone Server Management framework for organisations without any existing system administration solution**
- **WebAccess for easy management of the network from an Internet web browser**
- **a snap-in application to comprehensively integrate Express5800 systems into HP OpenView for Windows or Bull OpenMaster (AIX) management platforms.**

System installation software: ExpressBuilder

All Express5800 HX4600 systems include ExpressBuilder set-up and configuration software providing a logical and comprehensive process by which the server may be configured to best suit individual customer needs.

System security

The Express5800 HX4600 design ensures secure operation in unattended environments. Physical security include lockable front doors and side panels which restrict access to the disk bays, floppy drive, CD-ROM and power or reset switches. Key integrated features include intrusion sensors, which are fitted to lockable accesses to warn system administrators (via ESMPRO) of any system violations, as are temperature sensors that monitor and control internal cooling. Lock loops are also fitted to the power supply units to avoid unwanted removals. Internal switches disable BIOS update, set-up access and floppy write protection, all preventing unauthorised access. The SCU utility controls the enabling/disabling of all I/O ports, including the floppy drive, preventing unauthorised booting of the system. Logical password protection is ensured by the dual level (Supervisor and User) password.

Warranty

The Express5800 HX4600 systems are backed with a three-year on-site warranty and optional extended service contracts which protects customer's investment assuring a lasting and reliable performance.

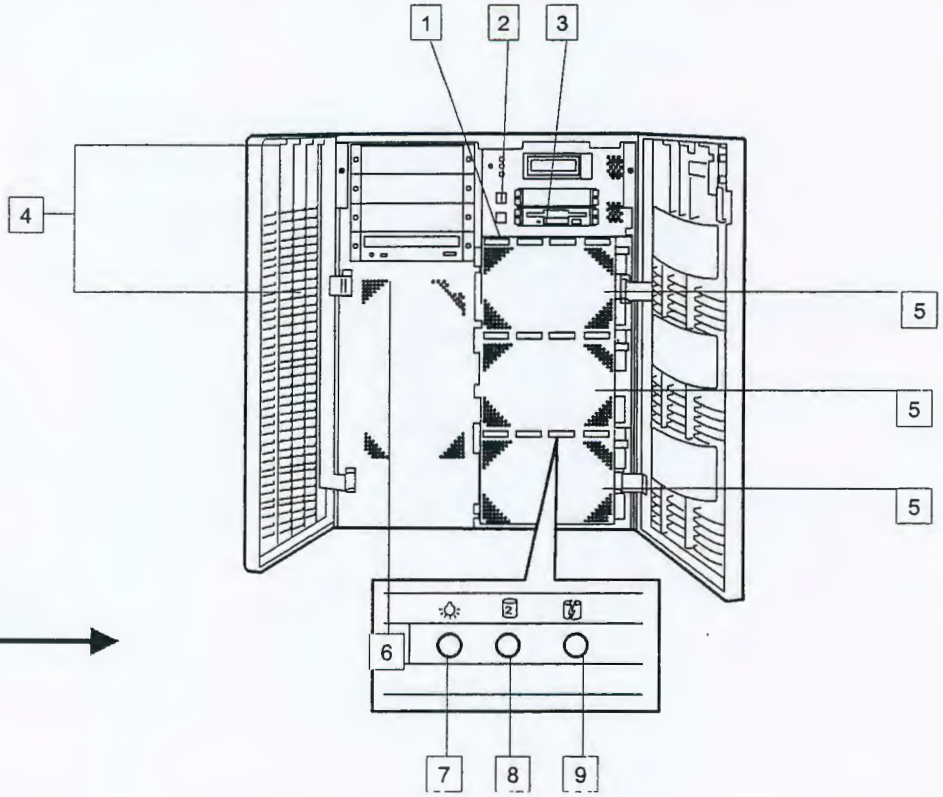
COMPETITION ANALYSIS

July 1999

	EXPRESS5800	COMPAQ	COMPAQ	HEWLETT PACKARD	IBM	DELL
	HX4600	**ProLiant 6000 Xeon**	**ProLiant 7000 Xeon**	**NetServer LH 4 PII Xeon**	**Netfinity 7000 M10**	**PowerEdge 6300**
Form factor	Dual Tower or 14U rack	Dual Tower or 14U rack	14U Rack	Tower or 8U rack	Tower or 11U rack	Minitower or 7U rack
Max # of CPU supported	4	4	4	1 or 4	4	4
Processor Type	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz	Pentium III Xeon 500MHz
Chipset	Intel 450NX	-	-	-	Intel 450NX	Intel 450NX
L2 Cache	512K to 2MB ECC	512K to 2MB	512K to 2MB	512KB/1MB	512KB, 1MB and 2MB ECC	512KB/1MB ECC
Bus speed	100MHz	100MHz	100MHz	100MHz	100MHz	100MHz
Max RAM capacity	8GB ECC EDO	8GB ECC EDO	8GB ECC EDO	4GB ECC EDO	8GB ECC EDO	4GB ECC EDO
Memory Slots	16 DIMM (32 option)	16 DIMM	16 DIMM	16 DIMM	16 DIMM	16 DIMM
HDD controllers	1 integrated UW SCSI	2 Integrated U/W SCSI	2 Integrated U/W SCSI	2 Integrated U2W SCSI	Integrated dual-channel U/W SCSI	2 integrated U2W SCSI 1 Integrated U/N SCSI
RAID	Integrated 3-channel U2W SCSI on board	2-channel U2W SCSI board	Integrated 3-channel U/W board	Integrated 3-channel U2W board option	3-channel U2W SCSI board option	1 or 2-channel U/W or U2W S board options
CD-ROM	32x speed SCSI	32x speed IDE	24x speed SCSI	32x speed EIDE	32x speed IDE	32x speed SCSI
HDD type	U2W SCSI 7200rpm/10Krpm	UW SCSI 7200rpm/10Krpm	UW SCSI 7200rpm/10Krpm	U2W SCSI 7200rpm/10Krpm	UW SCSI 7200rpm/10Krpm	U2W SCSI 7200rpm/10Krpm
Max internal disk capacity	436.8GB	327.6GB	327.6GB	144GB	72.8GB	126GB
# of drive bays	8 or 12 x 1" or 1.6"	18x1" or 12x1.6"	18x1" or 12x1.6"	8x1.6"+12x1"	4x1" or 2x1.6"	6x 1.6" or 8x1"
Hot swap disks	8 or 12 x 1" or 1.6"	18x1" or 12x1.6"	18x1" or 12x1.6"	8x1.6"+12x1"	4x1" or 2x1.6"	6x 1.6" or 8x1"
# of media bays	6 (4x5.25+2x3.5)	6 (5x5.25+1x3.5)	6 (5x5.25+1x3.5)	4 (3x5.25" + 1x3.5")	2 (1x5.25" + 1x3.5")	5 (3x5.25" + 1x3.5")
Total I/O expansion slots	11 (1PI+10P)	10 (9P+1I)	10 (9P+1I)	8 (7P+1P/I)	12P	7P
32 bits PCI slots	4H + 2	4	5 H	8	7 H	3H
64 bits PCI slots	4	5	4 H	-	5 H	4H
Ethernet	10/100Mbps board option	Integrated 10/100Mbps board	10/100Mbps board option	Integrated 10/100Mbps board	Integrated 10/100Mbps board	Integrated 10/100Mbps boar
Remote management	Option	Option	Option	HP Top Tools board option	option	optional Dell Remote Assista Card
PSU standard capacity	2 x560W RHPS	1x750W RHPS	2x750W RHPS	3HPS	2 x400W RHPS	2x320W RPS
Max PSU optional capacity	3x560W RHPS	3x750W RHPS		4RHPS	3x400W RHPS	1x320W RPS
Cooling fans	redundant	standard 2+1/PSU + option 2 R	2 RH	8 RH	4RH	RH
Server management soft	ESMPRO Management Suite	Insight Manager	Insight Manager	HP OpenView ManageX/SE	Netfinity Manager	DELL Open Manage
Installation software CD	Express Builder	SmartStart	SmartStart	HP Net Server Navigator	Open Manage	DELL DirectStart
Other software	-	-	-	-	-	-
Standard warranty duration	3 years on site	3 years on site	3 years on site	3 years on site	3 years on site	1 year on site + 3 years free pa delivery support
Intervention delay	-	4 hours option	4 hours option	1 day	4 hours (option)	1 day

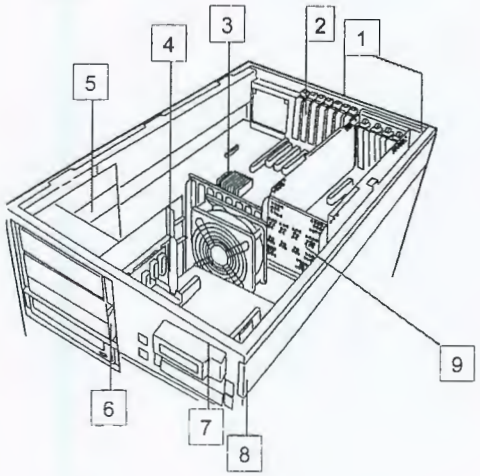
Slots: **P**-PCI, **HSP**-Hot Swap PCI, **I**-ISA, E-EISA, **S**-Shared
Bays: **M**-Media, **D**-Disk, **HSD**-Hot Swap Disk
Power: **RHS**-Redundant Hot Swap PSU

EXPRESS5800 HX4600 DETAILED VIEWS



FRONT VIEW

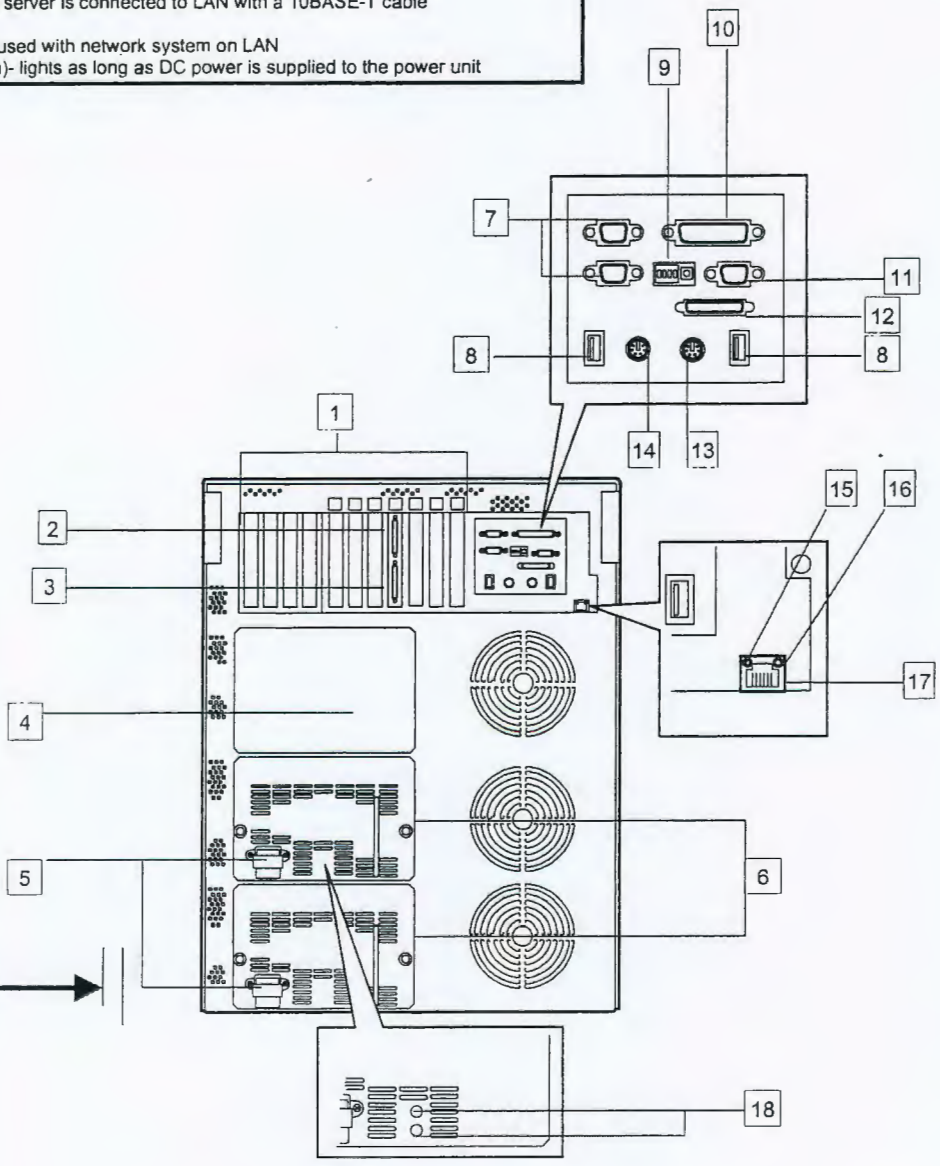
FRONT FEATURES AND CONTROL	
1	Power Switch - used to turn on/off Express 5800 server
2	Sleep Switch - when pressed servers enters power saving mode
3	3.5- inch floppy disk drive
4	5.25- inch device bay used to mount DAT drive or optical magnetic disk drive,
5	3.5- inch device bay - used to mount additional HDD cage to contain optional 3.5" HD's
6	CD-ROM drive- reads data from CD-ROM
7	Disk power lamp- lights when power is supplied to 3.5"hard disks
8	Disk access lamp- lights while 3.5" hard disk is operating
9	Disk error lamp- lights when 3.5-inch hard disk fails



SYSTEM I/O-SERVER TOP VIEW BOARD

SYSTEM I/O BOARD- SERVER TOP VIEW	
1	Additional PCI/ISA slot
2	Riser card (peripheral device connector repeater card)
3	System I/O board
4	Front panel board
5	5.25" device drive bay
6	CD-ROM drive (standard configuration)
7	LCD
8	3.5" floppy disk drive
9	Cooling fan

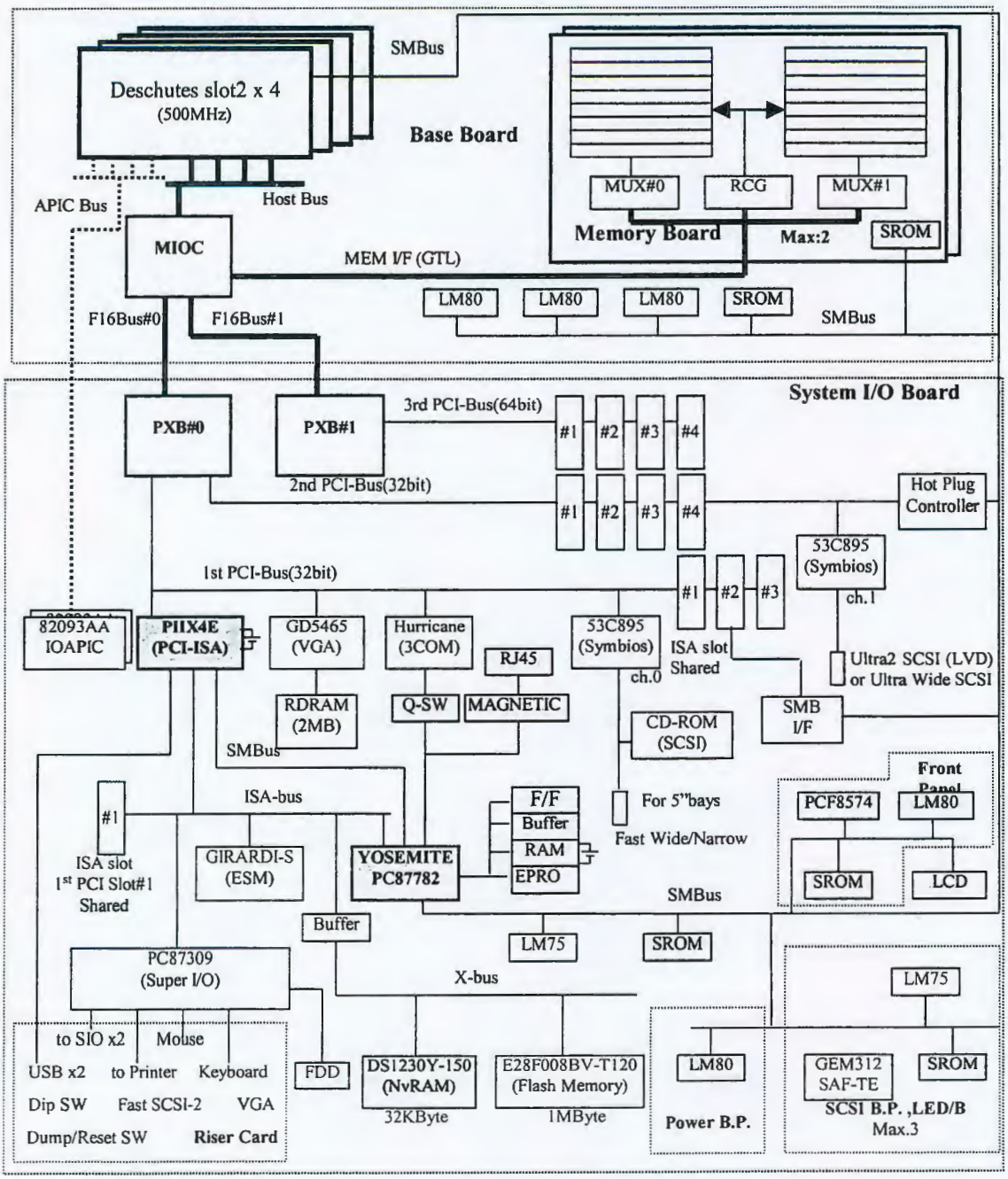
REAR VIEW OF FEATURES AND CONTROLS	
1	PCI/ISA board slot
2	Disk array controller connector (ch.0)
3	Disk array controller connector (ch.1)
4	Slot for additional power unit
5	AC inlet - used to connect power cord
6	Power unit - used to supply DC power to the server
7	Serial port 1 - used to connect with device which has a serial interface
8	USB connector- used to connect device supporting the USB interface
9	Control switch- Pressing this switch resets the server or executes dump
10	Printer port connector
11	Monitor connector
12	SCSI connector- used to connect with an external SCSI device which has a SCSI-2 interface
13	Keyboard connector
14	Mouse connector
15	Status lamp- Lights when server is connected to LAN with a 10BASE-T cable
16	Active Lamp
17	100 Base-TX connector- used with network system on LAN
18	Power status lamp (green)- lights as long as DC power is supplied to the power unit



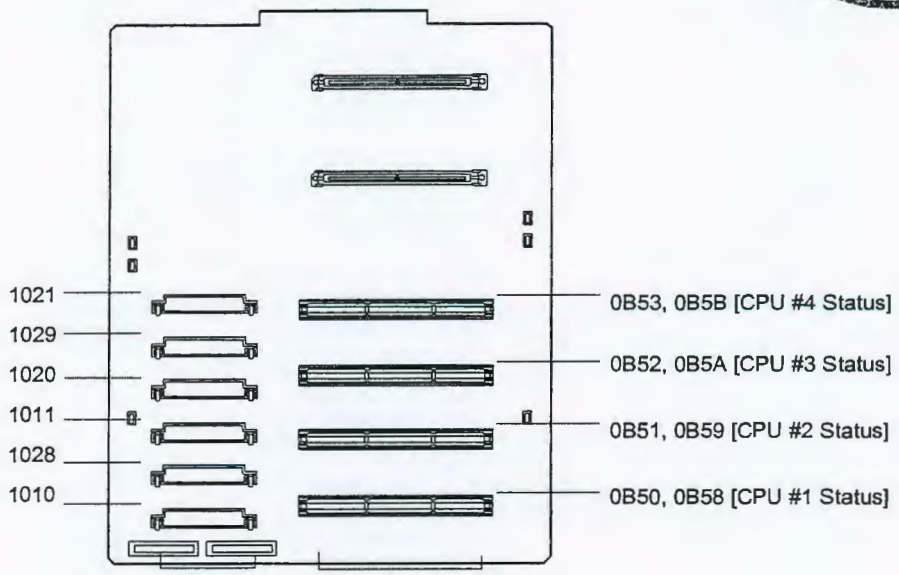
REAR VIEW

HX4600 SYSTEM BLOCK DIAGRAM

HX4600 Block diagram as follows: 5vs, 3.3vs Devices



CPU BASE BOARD



VRM connectors

Express5800 HX4600

FORM FACTOR	
Tower-Rack convertible	Yes, Dual Tower or 14U Rack
PROCESSOR	
Number of processors	1-4
Type	Pentium III Xeon 500MHz
Socket / slot type	Slot 2 Xeon
Integrated L1 cache	32KB
L2 cache std / max / type	512KB/ 1MB or 2MB
ARCHITECTURE & MOTHERBOARD	
Chipset	Intel 450NX
Processor front side bus (FSB) speed	100 MHz
I2O ready	Yes
MEMORY	
Memory min / max / type	256/8GB ECC RAM
Memory slots	16/32 (1 or 2 Memory Boards)
STORAGE	
Optional Hard disk drives	4.5 / 9.1 / 18.2 / 36.4GB 7,200rpm Ultra2 SCSI 9.1/ 18.2GB 10Krpm Ultra2 SCSI
HDD and Media controllers	PCI Ultra2 Wide (80MB/s) and Wide/Narrow SCSI Integrated Ultra2 Wide SCSI RAID board
RAID controller	3 channel Ultra2 64bit PCI
Max internal storage capacity	436.8GB
CD ROM drive	32X SCSI
Floppy disk drive	1.44MB
Disk expansion unit	Optional
BAYS	
5.25" Media bays (total / free)	4 / 3
3.5" Media bays (total / free)	2 / 1
3.5" Hot swap HDD bays	8 or 12 Hot Swap Bays
SLOTS	
Bus slots	11
Bus slots free (ISA/PCI/Combo/AGP)	10 4 PCI 64 / 4 PCI 32 hot plug / 2 PCI 32/ 1 PCI/ ISA

VIDEO	
Video controller	PCI SVGA
Video memory std / max / type	2MB /2MB /VRAM
NETWORK	
Network interface controller	Integrated (3com)
SECURITY	
2 level passwords	Yes
Limited access to front panel	Yes / Yes
I/O PORTS	
USB Port	2
Mouse / Keyboard port	2
Parallel port	1
Serial port	2
External SCSI connector	1x UN SCSI
Ethernet port	RJ45
POWER SUPPLY	
Power supply specs	560W
Power supply numbers	2 standard + 1 option
Hot-plug power supply	Yes
VENTILATION	
Fan specifications	Redundant, Hot swap
PHYSICAL SPECIFICATIONS	
Size (H x W x D)	620mm x 445mm x 678mm
Weight	77 kg
Operation constraints	5°C to 35°C '@ 20% to 80% RH
OS AND SOFTWARE	
Operating System	MS-DOS
Management software	ESMPRO Management Suite
Installation & configuration software	ExpressBuilder Set-up and Configuration software
Vendor certification	Windows NT Server 4.0, Novell NetWare 4.11 and 5.0, SMP and IntranetWare, SCO 5 OpenServer, SCO UnixWare 7.0, Sunsoft Solaris
WARRANTY	
Standard warranty	3 years on-site
Warranty extension	Optional
REGULATORY & SAFETY	
Year 2000 safety ready	Yes
Regulatory compliance	UL, CSA, CE

EXPRESS5800 HX4600 ACCESSORIES

Description	Reference	
	Customer installable	Factory installable
MEMORY		
256MB ECC (4x64MB) 50ns DIMM Memory upgrade kit	AMD-8256-00-00	AMD-8256-IN-00
512MB ECC (4x128MB) 50ns DIMM Memory upgrade kit	AMD-8512-00-00	AMD-8512-IN-00
1GB ECC (4x256MB) 50ns DIMM Memory upgrade kit	AMD-8010-00-00	AMD-7010-IN-00
Additional memory board with 16 dimm sockets	AEX-6008-00-00	AEX-6008-IN-00
HARD DISK DRIVES		
80-pin SCA SCSI 7200rpm Hot Swap Hard Disk Drives		
4.5GB Ultra2 SCSI HDD (7.5ms, 7200rpm, 80pin, 1") including Hot-Plug carrier	ADH-7447-00-00	ADH-7447-IN-00
9.1GB Ultra2 SCSI HDD (6.9/7.4ms, 7200rpm, 80 pin, 1") including Hot Plug carrier	BDH-7947-00-00	BDH-7947-IN-00
18.2GB Ultra 2 SCSI HDD (7.1ms, 7200rpm, 80 pin, 1.6") including Hot Plug carrier	ADH-7847-00-00	ADH-7847-IN-00
18.2GB Ultra 2 SCSI HDD (7.1ms, 7200rpm, 80 pin, 1") including Hot Plug carrier	BDH-7847-00-00	ADH-7847-IN-00
80-pin SCA SCSI 10000rpm Hot Swap Hard Disk Drives		
9.1GB Ultra2 SCSI HDD (6.3ms, 10000rpm, 80 pin, 1") including Hot Plug carrier	ADH-1947-00-00	ADH-1947-IN-00
18.2GB Ultra2 SCSI HDD (7,5ms, 10000rpm, 80 pin, 1.6") including Hot Plug carrier	ADH-1847-00-00	ADH-1847-IN-00
9.1GB Ultra2 SCSI HDD (6.3ms, 10000rpm, 80 pin, 1") including Hot Plug carrier	BDH-1947-00-00	BDH-1947-IN-00
18.2GB Ultra2 SCSI HDD (7,5ms, 10000rpm, 80 pin, 1") including Hot Plug carrier	BDH-1847-00-00	BDH-1847-IN-00
Hard Disk Drive Accessories		
Additional 4-bay Ultra2 LVD SCSI Hot-Swap HDD Cage	AZA-3997-00-00	AZA-3997-IA-00
STORAGE CONTROLLERS		
PCI SCSI Controllers		
32 bit PCI Ultra-Wide SCSI-3 Single Channel controller card	AIF-0585-00-00	AIF-0585-IN-00
32 bit PCI Ultra-Wide SCSI-3 Dual Channel controller card	AIF-0587-00-00	AIF-0587-IN-00
32 bit PCI Ultra-Wide Differential SCSI-3 Single Channel controller card	AIF-0586-00-00	AIF-0586-IN-00
32 bit PCI Ultra2 Wide SCSI Single Channel controller card (internal : 1x68-pin HD, external : 1x68-pin HD)	AIF-0589-00-00	AIF-0589-IN-00
32 bit PCI Ultra-Wide SCSI-3 Dual Channel controller card (internal : 1x50-pin LD + 1x68-pin HD, external : 1x50-pin HD)	AIF-0590-00-00	AIF-0590-IN-00
32 bit PCI Ultra-Narrow SCSI Single Channel controller card (internal : 1x50-pin LD, external : 1x50-pin HD)	AIF-0591-00-00	AIF-0591-IN-00
PCI Fully-Featured RAID controllers		
SecuRAID 530 64 bit PCI Ultra2 SCSI Tri-Channel RAID card (mode 0, 1, 5, 0+1) model 0, with 0MB cache, drivers and documentation (1)	AIF-0690-00-HU	AIF-0690-IN-HU
16MB Cache Memory Module for AIF-0690	AMR-0616-00-00	AMR-0616-IN-00
16MB Cache Memory Module + Battery Backup Unit for AIF-0690	AMR-0617-00-00	AMR-0617-IN-00
32MB Cache Memory Upgrade Module for AIF-0690	AMR-0632-00-00	AMR-0632-IN-00
32MB Cache Memory Module + Battery Backup Unit for AIF-0690	AMR-0633-00-00	AMR-0633-IN-00
64MB Cache Memory Upgrade Module for AIF-0690	AMR-0664-00-00	AMR-0664-IN-00
64MB Cache Memory Module + Battery Backup Unit for AIF-0690	AMR-0665-00-00	AMR-0665-IN-00
NETWORK & COMMUNICATION		
32 bit PCI 10/100Mbps Ethernet Adapter (Intel Ethernet Pro100+ single port)	ALN-0319-00-00	ALN-0319-IN-00
32 bit PCI 10/100Mbps Dual Port Ethernet Adapter (Intel Ethernet Pro100+ dual port)	ALN-0619-00-00	ALN-0619-IN-00
MEDIA PERIPHERALS		
CD-ROM Drives		
32x internal SCSI CD-ROM drive	ADO-5702-00-00	ADO-5702-IN-00
Tape Backup Options		
12/24GB SCSI 4mm DDS-3 DAT internal drive incl. blank cartridge & cleaning kit	ADT-2400-00-00	ADT-2400-IN-00
48/96GB SCSI DDS-3 DAT Autoloader internal drive incl. blank cartridge & cleaning kit	ADT-4896-00-00	ADT-4896-IN-00
20/40GB SCSI DLT Internal Tape Drive, incl. blank cartridge, cleaning kit and cables	ADT-4000-00-00	ADT-4000-IN-00
35/70GB SCSI DLT Internal Tape Drive, incl. blank cartridge, cleaning kit and cables	ADT-7000-00-00	ADT-7000-IN-00
Rack-mount kit	NZA-4600-00-00	NZA-4600-IN-00
REDUNDANT POWER SUPPLIES		
Redundant 560W Power Supply Unit	APM-0210-EU-00	UBS-0210-EU-IN
PROCESSOR & CPU BOARDS		
Pentium III 500MHz/512 KB ECC Processor Kit	APC-2532-1C-00	UBP-2532-1C-IN
Pentium III 500MHz/1MB ECC Processor Kit	APC-2533-1C-00	UBP-2533-1C-IN
Pentium III 500MHz/2MB ECC Processor Kit	APC-2534-1C-00	UBP-2534-1C-IN
FACTORY-INSTALLED SOFTWARE PRELOAD FOR EXPRESS5800 SERVERS (2)		
Software Preload for Express5800 NETWORK models (3)		
Microsoft Windows NT Server 4.0, 10 users	-	JUT-N409-IN-**
Software Preload for Express5800 ENTERPRISE models (3)		
Microsoft Windows NT Server 4.0 Enterprise Edition, 25 users	-	JUT-E409-IN-**

(1) For SecuRAID530 it is MANDATORY to add the corresponding AMR reference
(2) Microsoft Factory installed Software preloads are only available at the initial purchase of an Express5800 system
(3) Mac Afee antivirus solution (including 10 or 25 users licenses and 2 years of free update) offered with each factory pre-installed software preload.
= Product and preload code, to be selected from the above matrix
*** = Country Code/Pre-load language: FF, CF, YF: with national keyboard and French preload, EE : with Spanish keyboard and preload, DD, CD : with German keyboard and preload, BB, TT, JJ, SS, AA, NN, UU, YB, TU, YY with national keyboard and English preload*

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Printed April 2000.

EXPRESS5800/120Mc3

User's Guide

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PN: 456-01533-000

NEC

First Print – November 1999

Contents

3 Configuring Your System

4 Upgrading Your System

Using This Guide

This User's Guide provides a quick reference to information about your server system. Its goal is to familiarize you with your system and the tasks necessary for system configuring and upgrading.

This guide contains the following information:

- Chapter 1, "System Overview" provides an overview of your system and describes your system's major system components. See this chapter to familiarize yourself with your system.
- Chapter 2, "Setting Up Your System" tells you how to select a site, unpack the system, assemble the rack-mount subsystem, make cable connections, and power on your system.
- Chapter 3, "Configuring Your System" tells you how to configure the system and provides instructions for running the BIOS Setup Utility and the Adaptec Configuration Utility, which is used to configure SCSI devices in your system. This chapter also provides information on system board jumper settings.
- Chapter 4, "Upgrades and Options" provides you with instructions for upgrading your system with an additional processor, optional memory, options cards, peripheral devices, and redundant power supply.
- Chapter 5, "Problem Solving" contains helpful information for solving problems that might occur with your system.
- Appendix A, "System Cabling" includes cabling information for the two onboard SCSI controllers, the onboard IDE controller, and the optional RAID controllers.
- Appendix B, "Management Workstation Application (MWA)" provides you with information on using MWA for managing your server remotely in a network environment.
- Appendix C, "System Status Hardware Information" helps you identify a system status hardware item indicated by a software monitoring component.
- "Glossary" defines the standard acronyms and technical terms used in this manual.
- "Equipment Log" provides you with a sample equipment log for documenting the system configuration and future updates you may make to your system.
- "Index" provides an alphabetic listing of topics in the guide and the page numbers where the topics are found.

Text Conventions

This guide uses the following text conventions.

Warnings, cautions, and notes have the following meanings:

⚠ WARNING

Warnings alert you to situations that could result in serious personal injury or loss of life.

⚠ CAUTION

Cautions indicate situations that can damage the system hardware or software.

Note: Notes give important information about the material being described.

- Names of keyboard keys are printed as they appear on the keyboard. For example, **Ctrl**, **Alt**, or **Enter**.
- Text or keystrokes that you enter appear as boldface type. For example, type **abc123** and press **Enter**.
- File names are printed in uppercase letters. For example, AUTOEXEC.BAT.

Related Documents

In addition to this guide, the following system documentation is included with your server either as electronic files on EXPRESSBUILDER or as paper copy shipped with your server.

- *Getting Started Sheet*
  The Getting Started Sheet provides several easy-to-follow steps to become familiar with your server documentation and to complete your installation successfully.
- *System Release Notes*
  Release Notes provide you with the latest information about your system. This information was not available at the time the user's guide was released for printing.
- *Software Release Notes*
  Software Release Notes provide up-to-date information on installing executable software that might come preloaded on your system.
- *Network Operating System Configuration Guide*
  This guide contains supplemental instructions needed to install and configure your server Windows NT 4.0 plus Service Pack 6, Novell NetWare v5.0, Santa Cruz Operation (SCO) OpenServer Release 5.05, and UNIXWare 7.1 Network Operating Systems. This document is intended to complement the more detailed procedural documents available from the vendor of the network operating system.

Safety Notices

- **Caution:** To reduce the risk of electric shock which could cause personal injury, follow all safety notices. The symbols shown are used in your documentation and on your equipment to indicate safety hazards.
- **Warning:** Lithium batteries can be dangerous. Improper handling of lithium batteries may result in an explosion. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists.
- **Warning:** The detachable power supply cords are intended to serve as the disconnect devices.
- **Warning:** This equipment has a 3-wire, grounded power cords. To prevent electrical hazards, do not remove or defeat the ground prong on the power cords. Replace a power cord if it gets damaged. Contact your dealer for an exact replacement.
- **Warning:** The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, +5vdc is present on the system board whenever the AC power cords are connected between the system and an AC outlet. Before doing the procedures in this manual, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

In the U.S.A. and Canada, the power cord must be a UL-listed detachable power cord (in Canada, CSA-certified), type ST or SJT, 16 AWG, 3-conductor, provided with a molded-on NEMA type 5-15 P plug cap at one end and a molded-on cord connector body at the other end. The cord length must not exceed 9 feet (2.7 meters).

Outside the U.S.A. and Canada, the plug must be rated for 250 VAC, 10 amp minimum, and must display an international agency approval marking. The cord must be suitable for use in the end-user country. Consult your dealer or the local electrical authorities if you are unsure of the type of power cord to use in your country. The voltage change occurs via a switch in the power supply.

- **Warning:** Under no circumstances should the user attempt to disassemble the power supply. The power supply has no user-replaceable parts. Inside the power supply are hazardous voltages that can cause serious personal injury. A defective power supply must be returned to your dealer.

Safety Notices for Users Outside of the U.S.A. and Canada

- **PELV (Protected Extra-Low Voltage) Integrity:** To ensure the extra-low voltage integrity of the equipment, connect only equipment with mains-protected electrically-compatible circuits to the external ports.
- **Remote Earths:** To prevent electrical shock, connect all local (individual office) computers and computer support equipment to the same electrical circuit of the building wiring. If you are unsure, check the building wiring to avoid remote earth conditions.
- **Earth Bonding:** For safe operation, only connect the equipment to a building supply that is in accordance with current wiring regulations in your country. In the U.K., those regulations are the IEE.

Care and Handling

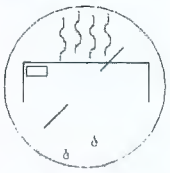
Use the following guidelines to properly handle and care for your system.

Protect the system from extremely low or high temperatures. Let the system warm (or cool) to room temperature before using it.

Keep the system away from magnetic forces.

Keep the system dry. Do not wash the system with a wet cloth or pour fluid into it.

Protect the system from being bumped or dropped.



Check the system for condensation. If condensation exists, allow it to evaporate before powering on the system.

Keep the system away from dust, sand, and dirt.

1

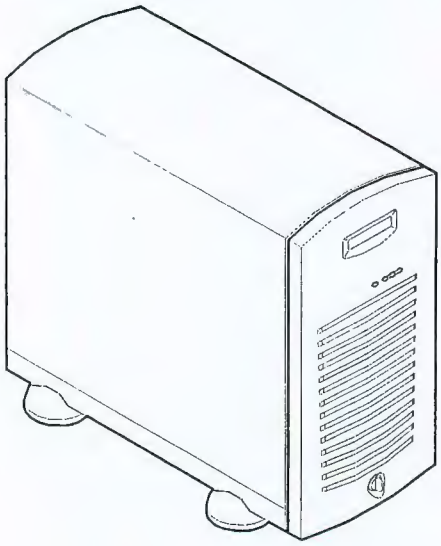
System Overview

- Overview
- System Chassis
- Power Supply
- Peripheral Bays
- SAF-TE (SCSI Accessed Fault Tolerant Enclosure) Board
- System Board Features
- AC Link Mode
- Remote Power-On (Wake On LAN) Function
- System Security

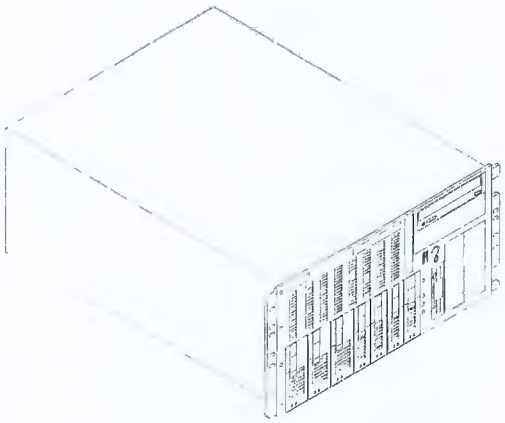
Overview

This server is a modular, multiprocessing server based on the Intel® Pentium® III Xeon™ microprocessor. The combination of compute performance, memory capacity, and integrated I/O provides a high performance environment for many server market applications. These range from large corporations supporting remote offices to small companies looking to obtain basic connectivity capability such as file and print services, email, web access, web site server, and more.

The server is available as a tower-based system or as a rack-mount system that fits into a standard EIA 19-inch rack assembly.



Tower-Based System Front View



Rack-Mount System Front View

The server system is designed for minimum downtime. To this end, the server includes or has the options to include the following:

- Chassis that supports up to two power supplies. The second power supply can be added to provide redundant power (i.e., the system continues to operate with a single power supply failure).
- Self-contained power supply units that can be easily installed or removed from the back of the chassis without turning the system power off.
- SCSI drive bays accessible from the front of the chassis.
- Hot-swap SCSI disk drive backplane; a failed drive can be removed and replaced with a new drive without system power being turned off, if an optional Redundant Array of Independent Disks (RAID) controller is installed.
- High degree of SCSI disk fault tolerance and advanced disk array management features through the use of RAID technology, if an optional RAID controller is installed.

As application requirements increase, you can expand your server with an additional processor, additional memory, add-in boards and peripheral devices.

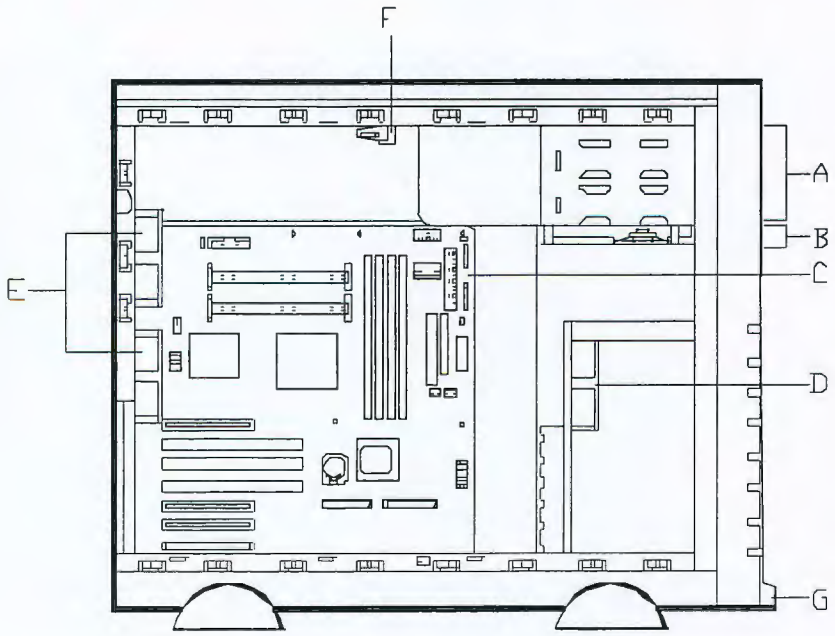
Your server features the following major components:

- Single or dual high-performance Pentium III Xeon processor(s) installed in a Slot 2 connector on the system board.
- 64 MB to 4 GB of memory, using up to four DIMMs.
- Seven PCI expansion slots for add-in boards (one slot shared with an ISA slot).
- One ISA expansion slot shared with a PCI slot for add-in board.
- Embedded PC-compatible support (serial, parallel, mouse, keyboard, diskette, IDE, USB, LAN, and video).
- Integrated onboard ATI RAGE IIC Super Video Graphics Array (SVGA) controller with 4 MB of video memory.
- Adaptec AIC7899 SCSI controller providing Wide Ultra2 and Ultra-160/M SCSI interfaces.
- Integrated onboard Network Interface Controller (NIC), an Intel 82559 PCI LAN controller for 10 or 100 Mbps Ethernet networks with an RJ-45 Ethernet connector.
- Single Channel enhanced IDE controller.
- Chassis that holds up to 12 drives: seven hot-swap bays for Ultra-160/M SCSI hard drives; four media bays with a CD-ROM installed; and a 3.5-inch bay with a diskette drive.
- Integrated dual Universal Serial Bus (USB) ports. Note that the USB ports do not support the keyboard or mouse.
- SCSI backplane is Ultra-160/M capable.

- Seven hot-swap SCSI hard disk drive bays accessible from the front of the chassis. The bays are secured behind a lockable front door (tower version only) where the drives can be swapped in or out of the system without powering it down, if RAID is configured in the system.
- One standard power supply with a slot available for an additional redundant power supply. When an additional power supply is installed, both the standard and additional redundant power supply slots become hot swappable.
- Hardware monitors (temperature, fans, and voltage) and software monitors to indicate failures.
- Mechanical: Keylock at the front of the chassis and two metal padlock loops (one at the back of each side panel). One intrusion sensor switch for the front door of the chassis (tower version only). Two power inter-lock switches for the left and right side panel covers.

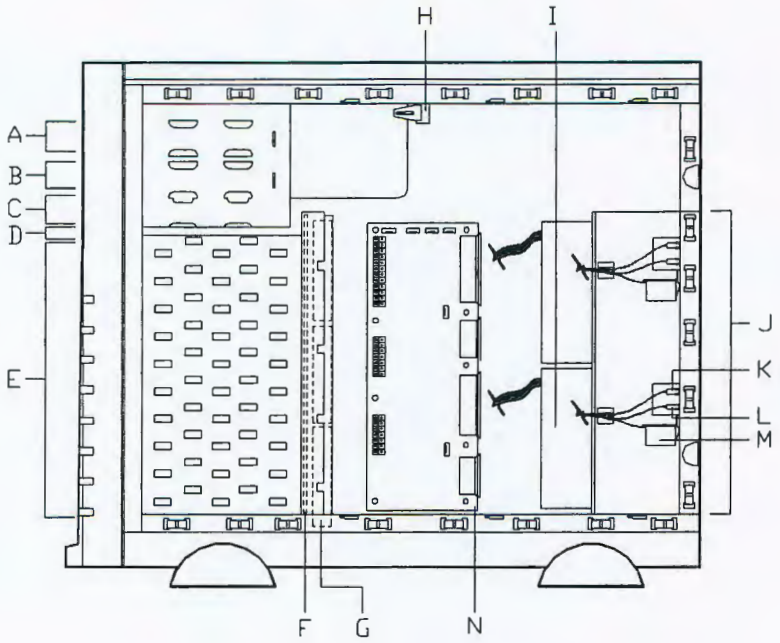
System Chassis

The system chassis is an easy-to-expand, fabricated metal structure. The major system components are shown in the following figures.



A – Removable media bays (2)
B – Speaker/Switch assembly
C – System board
D – Front input fan
E – Rear exhaust fans
F – Interlock switch - Side Covers
G – Intrusion switch - Front Cover (tower version only)

System Chassis (Left Side View)



A – CD-ROM drive
B – Removable media bay
C – 1.44 MB 3.5"diskette drive
D – SAF-TE board
E – SCSI disk drive bays (7)
F – SCSI backplane board
G – Fans, behind SCSI disk drive bays (3 standard fans)
H – Interlock switch
I – Standard power supply
J – Power supply module slots (one standard power supply slot and one optional power supply slot)
K – Power supply status LED
L – DC power LED
M – Power available switch
N – Power supply distribution board

System Chassis (Right Side View)

Power Supply

The ATX300 watt power supply is switch-selectable for 115 or 230 Vac at an operating frequency of 50/60 Hz. It is designed to comply with existing emission standards and provides sufficient power for a fully loaded system configuration. The power supply voltage selection switch is factory set to 115Vac for systems used in the United States; it is set to 230Vac for systems used in Europe.

Peripheral Bays

The system supports a variety of standard PC AT-compatible peripheral devices. The chassis includes these peripheral bays:

- A 3.5-inch front panel bay for mounting the standard 3.5" diskette drive (supports 720 KB and 1.44 MB diskette media)
- Four 5.25-inch removable media front panel bays for mounting half-height 5.25-inch peripheral devices: standard CD ROM drive and optional tape drives, etc.
- Seven hot-swap SCSI hard disk drive bays for mounting up to seven SCSI hard disk drives in easily removable drive carriers.

> ***Note:*** The SCSI hard disk drive bays contain a hot-swap back plane that require an 80-pin single connector attachment (SCA) connector on the drives that you install.

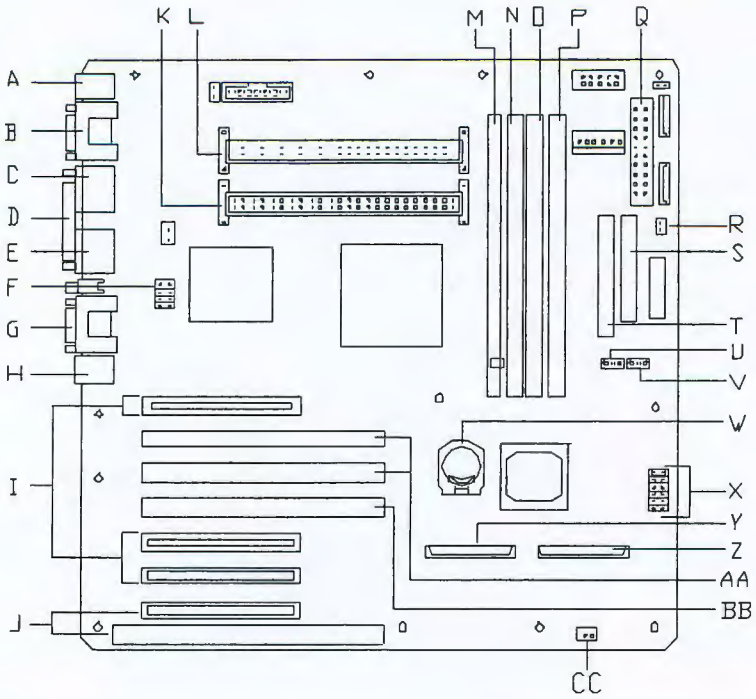
SAF-TE Board

The system has a SAF-TE (SCSI Accessed Fault Tolerant Enclosure) board that provides an interface to the disk subsystem that supports status signals, hot swapping drives, and enclosure monitoring.

The transport mechanism for the standardized alert detection and status reporting is the SCSI bus. Disk drives, power supplies, cooling fans, and temperature are continually monitored and the conditions then reported over the SCSI bus to the system. When used with RAID management software the user can be alerted of impending or imminent disk conditions requiring attention. This allows the user to react to conditions that could normally go unnoticed until data loss.

System Board Features

The system board offers a "flat" design with the processor and memory subsystems residing on the board. The following figure shows the major components on the system board. The following subsections describe the system board major components.



A – USB Connectors (top USB 1, bottom USB 2)
B – Serial Port Connectors (top COM1, bottom COM2)
C – Keyboard Connector, PS/2 Compatible
D – Parallel Port Connector
E – Mouse Connector, PS/2 Compatible
F – Upper Rear Fan Connector (P10)
G – SVGA Monitor Port Connector
H – LAN RJ-45 Network Controller Connector
I – 32-Bit/33-MHz PCI Slots (3)
J – PCI/ISA Shared Slots
K – Secondary Processor Slot 2 Connector
L – Primary Processor Slot 2 Connector
M – DIMM Module Slot 3 Connector
N – DIMM Module Slot 2 Connector
O – DIMM Module Slot 1 Connector
P – DIMM Module Slot 0 Connector
Q – Power Connector
R – Speaker Connector
S – Diskette Drive Connector
T – IDE Connector
U – Front Fan Connector (P20)
V – Lower Rear Fan Connector (P21)
W – CMOS Battery
X – Jumper Block
Y – Ultra-160/M SCSI Connector
Z – Ultra2 SCSI Connector
AA – 64-Bit/66-MHz PCI Slots (2)
BB – 64-Bit/33-MHz PCI Slot (1)
CC – Reset Switch Connector

System Board

Pentium III Xeon Processor

Depending on system configuration, each system includes one or two Pentium III Xeon processors. Each Pentium III Xeon processor is packaged in a cartridge. The cartridge contains the processor core with an integrated 16 KB primary (L1) cache, a secondary (L2) cache, and a back cover. A passive heat sink is attached to the back cover of the cartridge. The cartridge is secured to the system board by a retention module and electrically connected to the board through a Slot 2 connector.

The processor external interface operates at a maximum of 133 MHz. The second-level cache is located on the substrate of the processor cartridge. The cache includes burst pipelined synchronous static RAM (BSRAM).

System Memory

The system board contains four 168-pin DIMM sockets. Memory is partitioned as four banks of registered SDRAM DIMMs (PC133 compatible), each providing 72 bits of noninterleaved memory (64-bit main memory plus ECC). Your system might include from 64 MB to 4 GB of memory, using up to four DIMMs.

System memory begins at address 0 and is continuous (flat addressing) up to the maximum amount of DRAM installed (exception: system memory is noncontiguous in the ranges defined as memory holes using configuration registers). The system supports both base (conventional) and extended memory.

I/O Expansion Slots

The server's expansion capabilities meet the needs of file and application servers for high performance I/O by providing a combination of PCI and ISA expansion slots.

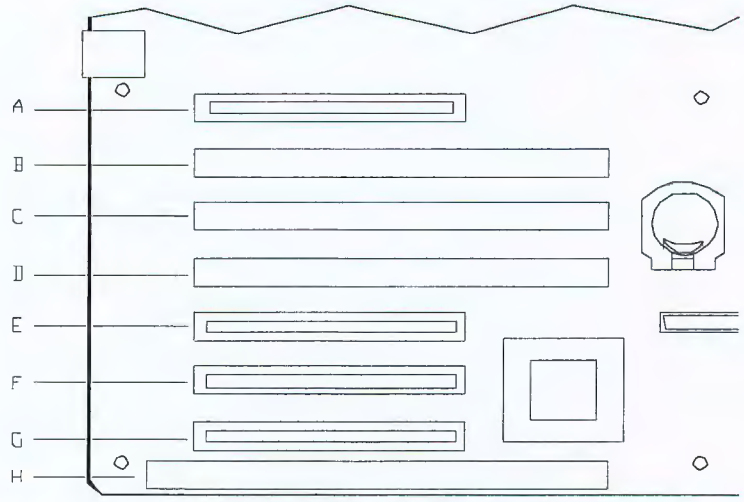
The system board has two 66 MHz PCI connector slots that can accommodate either a 32 or 64 bit PCI board (see the following figure). The system board also has one 33 MHz PCI connector slot that can accommodate either a 32 or 64 bit PCI board.

> ***Note:*** The bus speed for the two 66 MHz PCI connector slots (PCI 2 or PCI 3) is decreased to 33 MHz if a 33 MHz PCI board is installed into connector slot PCI 4 or if a 33 MHz PCI board is installed into either of the two 66 MHz PCI connector slots.

64-bit PCI features:

- Bus speed up to 66 MHz (PCI 2 and PCI 3)
- Bus speed up to 33 MHz (PCI 4)
- 32-bit memory addressing
- 5 V/3.3 V signaling environment
- Burst transfers up to a peak of 264 MB/s (64 bit, 33 MHz PCI) and 528 MB/s (64 bit, 66 MHz PCI)
- 8-, 16-, 32-, or 64-bit data transfers
- Plug and Play ready
- Parity enabled.

> ***Note:*** If a 33 MHz PCI board is installed into one of the 64-bit PCI slots, the bus speed for the 66 MHz PCI slots is decreased to 33 MHz.



A – PCI 1, 32-bit/33 MHz
B – PCI 2, 32- or 64-bit/66 MHz
C – PCI 3, 32- or 64-bit/66 MHz
D – PCI 4, 32- or 64-bit/33 MHz
E – PCI 5, 32-bit/33 MHz
F – PCI 6, 32-bit/33 MHz
G – PCI 7, 32-bit/33 MHz
H – ISA 1, 16-bit/8.33 MHz

PCI/ISA Connector Slot Locations

The system board has four 33 MHz 32 bit PCI connector slots (see the preceding figure "PCI/ISA Slot Locations"). The bottom PCI connector slot (PCI 7) shares a connector slot with an ISA connector (ISA 1).

32-bit PCI features:

- Bus speed up to 33 MHz
- 32-bit memory addressing
- 5 V signaling environment
- Burst transfers up to a peak of 132 MB/s
- 8-, 16-, or 32-bit data transfers
- Plug and Play ready
- Parity enabled.

The system board has one full-length ISA connector (see the preceding figure, "PCI/ISA Connector Slots"). The ISA connector (ISA 1) shares a chassis connector slot with a PCI connector (PCI 7).

ISA features:

- Bus speed up to 8.33 MHz
- 16-bit memory addressing
- 8- or 16-bit data transfers
- Plug and Play ready.

Real-Time Clock/Calendar

The real-time clock provides system clock/calendar information stored in a non-volatile memory. The real-time clock battery provides power backup for the real-time clock.

BIOS

The BIOS and Setup Utility are located in the Flash EPROM on the system board and include support for system setup and legacy device configuration. A number of security, reliability, and management features also have been incorporated to meet vital server needs.

IDE Controller

The system includes a single channel enhanced IDE 32 bit interface controller for intelligent disk drives with disk controller electronics onboard. The controller has a connector located on the system board that supports a master and a slave device. The IDE controller provides support for the internally mounted CD-ROM.

The device controls:

- PIO and DMA transfer modes
- Mode 4 timings
- Transfer rates up to 33 MB/s
- Buffering for PCI/IDE burst transfers
- Master/slave IDE mode
- Up to two devices.

Keyboard and Mouse Controller

The keyboard and mouse controller is PS/2 compatible.

Network Controller

The system board includes a 10BASE-T/100BASE-TX network controller based on the Intel 82559 Fast Ethernet PCI Bus Controller. As a PCI bus master, the controller can burst data at up to 132 MB/sec. The controller contains two receive and transmit FIFO buffers that prevent data overruns or underruns while waiting for access to the PCI bus. The controller has the following:

- 32-bit PCI bus master interface (direct drive of bus), compatible with *PCI Bus Specification, Revision 2.1*
- Chained memory structure with improved dynamic transmit chaining for enhanced performance
- Programmable transmit threshold for improved bus utilization
- Early receive interrupt for concurrent processing of receive data

- On-chip counters for network management
- Autodetect and auto switching for 10 or 100 Mbps network speeds
- Support for both 10 Mbps and 100 Mbps networks, capable of full or half duplex, with back-to-back transmit at 100 Mbps
- Support for Wake On LAN.

SCSI Controller

The system board includes an embedded Adaptec AIC7899 dual function SCSI controller. The AIC7899 provides Ultra-160/M and Wide Ultra2 SCSI interfaces as two independent PCI functions. As implemented on the system board, interface A attaches to an Ultra-160/M SCSI backplane that supports up to seven Ultra-160/M SCA drives. Controller B the Wide Ultra2 SCSI interface may be used to support SCSI devices in the removable media bays.

Video Controller

The system has an integrated ATI Rage IIC 64 bit high-performance SVGA subsystem that supports the following:

- BIOS compatibility with VGA, EGA, CGA, Hercules Graphics, and MDA
- 4 MB of 10 ns onboard Synchronous Graphics Memory (SGRAM)
- Pixel resolutions up to 1280 X 1024
- Analog VGA monitors (single and multiple frequency, interlaced and noninterlaced) with a maximum vertical retrace noninterlaced frequency of 100 Hz.

Peripheral Controller

The advanced integrated peripheral controller supports two serial ports, two universal serial bus ports, one parallel port, diskette drive, PS/2-compatible keyboard and mouse, and integrated Real Time Clock (RTC). The system provides the connector interface for each port.

Serial Ports

Both serial ports are relocatable. Each serial port can be set to one of four different addresses and can be enabled separately. When disabled, serial port interrupts are available to add-in boards.

Parallel Port

One IEEE 1284-compatible 25-pin bidirectional EPP (supporting levels 1.7 and 1.9) parallel port is provided. BIOS programming enables the parallel port and determines the port address and interrupt. ECP mode is supported with 2 possible DMA channels. When disabled, the interrupt is available to add-in boards.

External Device Connectors

The external I/O connectors provide support for a PS/2 compatible mouse and a keyboard, for a SVGA monitor, 2 serial port connectors, a parallel port connector, LAN port, and two USB connections.

System Board Management Controller (BMC)

Server management is concentrated in the System Board Management Controller (BMC). The BMC and associated circuits are powered from a 5Vdc standby voltage, which remains active when system power is switched off, but the ac power source is still on and connected.

The BMC supports the Management Workstation Application (MWA), which allows remote server management via a modem, LAN, or direct connection to a manager system. Events monitored by the manager system include over/under temperature and over/under voltage conditions, fan failure, or chassis intrusion.

Information on the Management Workstation Application (MWA) is in Appendix B of this user's guide.

One major function of the BMC is to autonomously monitor system management events, and log their occurrence in the nonvolatile System Event Log (SEL). The events being monitored include over/under temperature and over/under voltage conditions, fan failure, or chassis intrusion. To enable accurate monitoring, the BMC maintains the nonvolatile Sensor Data Record (SDR), from which sensor information can be retrieved. The BMC provides an ISA host interface to SDR sensor information, so that software running on the server can poll and retrieve the server's current status.

The BMC performs the following:

- Monitors server board temperature and voltage
- Monitors processor presence and controls Fault Resilient Boot (FRB)
- Detects and indicates baseboard fan failure
- Manages the SEL interface
- Manages the SDR Repository interface
- Monitors the SDR/SEL timestamp clock
- Monitors the system management watchdog timer
- Monitors the periodic SMI timer
- Monitors the event receiver
- Controls secure mode, including video blanking, diskette write-protect monitoring, and front panel lock/unlock initiation
- Controls Wake On LAN via Magic Packet support.

ACPI

The Advanced Configuration and Power Interface (ACPI) aware operating system can place the system into a state where the hard drives spin down, the system fans stop, and all processing is halted. However, in this state the power supply is still on and the processors are still dissipating some power such that the power supply fan and processor fans are still running.

> **Note:** ACPI requires an operating system that supports its feature.

This server system BIOS supports sleep states s0, s1, s4, and s5. However, with future versions of Microsoft Windows 9X that support ACPI, the system BIOS only supports sleep states s0, s1, and s5. With future versions of Microsoft Windows NT that support ACPI, the system BIOS will only support sleep states s0, s1, s4, and s5.

> **⚠ CAUTION**
>
> Only when the AC power is disconnected is the system completely off.

The sleep states are defined as follows:

- s0: Normal running state.
- s1: Processor sleep state.
  No context will be lost in this state and the processor caches will maintain coherency.
- s4: Hibernate or Save to Disk.
  The memory and machine state are saved to disk. Pressing the power button or other wakeup event restores the system state from the disk and resumes normal operation. This assumes that no hardware changes have been made to the system while it was off.
- s5: Soft off.
  Only the RTC section of the chip set and the BMC are running in this state.

AC Link Mode

The AC link mode allows the system to monitor its AC input power so that if AC input power is lost and then restored, the system returns itself to one of the following pre-selected settings:

- Power On
- Last State (Factory Default Setting)
- Stay Off.

The AC link mode settings can be changed by running the BIOS Setup Utility (F2). Refer to Chapter 3 "Configuring Your System."

Remote Power-On (Wake On LAN/Ring) Function

The remote power-on function turns on the system power by way of a network or modem. If the system power is set to Off, it can be turned on remotely by sending a specific packet from the main computer to the remote system.

> ***Note:*** The standard default value of the remote power-on function is "Enabled". To disable it, the Wake On LAN/Ring item in the System Hardware menu of the BIOS Setup Utility described in Chapter 3 "BIOS Setup Configuration Settings" must be changed to "Disabled."

System Security

To help prevent unauthorized entry or use of the system, the system includes a full lockable front panel and Server Management software that monitors the system intrusion switches.

Security with Mechanical Locks and Monitoring

The front panel of the tower-based system contains a mechanical lock to prevent access to the front of the computer chassis. In addition, each side cover contains a padlock loop (padlock not provided) located on the rear of the chassis to prevent removal of the side covers and access to the inside of the computer chassis.

The chassis includes an intrusion switch for the front cover and interlock switches for both the left side and the right-side covers (as viewed from the front). When the intrusion switch is opened, the switch transmits an alarm signal to the system board, where server management software processes the signal. The side cover switches operate as interlock switches controlling power shut down to the system for safety reasons.

Security with the rack-mount system is identical to the tower-based system stated above, except that there is no front cover associated with the rack-mount system.

Software Locks via the BIOS Setup Utility

The BIOS Setup Utility provides a number of security features to prevent unauthorized or accidental access to the system. Once the security measures are enabled, access to the system is allowed only after the user enters the correct password(s). For example:

- Enable the keyboard lockout timer so that the server requires a password to reactivate the keyboard and mouse after a specified time-out period (between 1 to 120 minutes).
- Set and enable an administrative password.
- Set and enable a user password
- Set secure mode to prevent keyboard or mouse input and to prevent use of the front panel reset and power switches.
- Disable writing to the diskette drive when secure mode is set.

2

Setting Up the System

- Overview
- Selecting a Site
- Unpacking the System
- Rack-Mount Subsystem Assembly
- Getting Familiar with the System
- Making Connections
- Setting the Line Voltage
- Connecting the Power Cord(s)
- Powering On Your System

Overview

This chapter describes how to select a site, unpack the system, make cable connections, and power on the tower-based or rack-mount system units. Also, provided are the instructions for assembling the rack-mount system unit.

Selecting a Site

The system operates reliably in a typical office environment. Choose a site that is:

- Near grounded, three-pronged power outlets.

Note: For the United States and Canada, this means a NEMA 5-15R outlets for 100-120 VAC or NEMA 6-15R outlets for 200-240 VAC. For other international sites, this means three-pronged power outlets applicable for the electrical code of the region.

⚠ WARNING

Be sure the power service connection is through a properly grounded outlet.

⚠ CAUTION

When two power supplies are installed in the system, the power plug from each of the power supplies must be plugged into the same common ground power outlets.

- Clean, dust-free, and well ventilated. Front and rear ventilating openings kept free of obstructions. Away from sources of heat, vibration, or physical shock.
- Isolated from strong electromagnetic fields and electrical noise produced by electrical devices (such as air conditioners, large fans, large electric motors, radio and TV transmitters, and high-frequency security devices)
- Spacious enough to provide at least five inches (13 centimeters) behind the system and three inches (eight centimeters) on each side of the system for proper cooling, airflow, and cable clearance.
- Easily accessible for system maintenance and installation of system upgrades.

Unpacking the System

⚠ WARNING

Your system weighs approximately 65 pounds (29.25 kg). If your system contains numerous optional boards and peripheral devices, it will weigh more. To avoid personal injury, make sure you have someone help you lift or move the system.

When you receive your system, if the shipping boxes are damaged, note the damage, and if possible, photograph the damage for reference. After removing the contents of the containers, keep the cartons and the packing materials. If the contents appear damaged when you unpack the boxes, file a damage claim with the carrier immediately.

Rack-Mount Subsystem Assembly

This section provides the instructions for assembling the rack-mount server unit into a standard EIA 19 inch rack cabinet.

Before You Begin

Before you begin, review the following cautions, warnings, and general guidelines.

⚠ WARNING

Be sure that power to the system is turned off and unplugged. All voltage is removed only when the power cords are unplugged.

- Avoid excessive vibration and shock. Dropping an electronic component can cause serious damage.
- Do not disconnect or remove parts other than those specified in the procedure.
- Do not touch I/O connector pins.
- All screws are Phillips-head, unless otherwise specified.
- On completion of any assembly or reassembly, perform a power-on test. If a fault occurs, verify that the assembly or reassembly was performed correctly. If the problem persists, see "Problem Solving" in Chapter 5.

Static Precautions

An electrostatic discharge (ESD) can damage disk drives, option boards, and other components. You can provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground when handling system components.

Electronic devices can be easily damaged by static electricity. To prevent damage, keep them in their protective packaging when they are not installed in your system.

Assembly

This section describes how to assemble your rack-mount server unit into a standard EIA 19 inch rack cabinet.

⚠ CAUTION

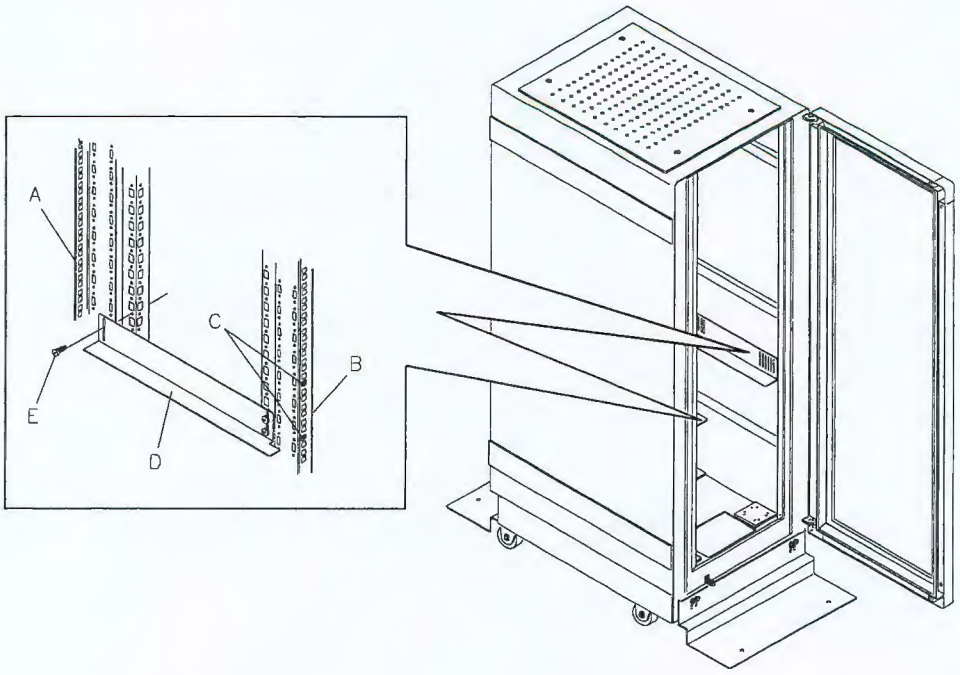
Ensure that the location of the rack-mount server unit does not create an unstable condition when installed in the rack cabinet.

1. Select an appropriate location in your rack cabinet for the rack-mount server unit. To improve rack stability, mount heavier items towards the bottom of the rack cabinet.

   Note: When planning your system configuration for the rack cabinet you should consider the length of the cables that interconnect system components.

2. Locate the two support brackets (D). Using four self tapping screws (E) supplied with the rack cabinet for each support bracket, attach the two support brackets to the vertical mounting rails (A and B) of the rack cabinet.
3. Install the four caged nuts (C) that secure the front of the rack-mount server unit to the rack cabinet. Position the caged nuts to align with the screw holes in the front bezel of the rack-mount server unit.

   Note: The caged nuts are secured into the vertical mounting rails of the rack cabinet by inserting one side of the nut into the slot and squeeze while pressing the opposite side until it snaps into place.



A – Rear vertical mounting rail
B – Front vertical mounting rail
C – Four caged nuts
D – Two support brackets
E – Eight self-tapping screws

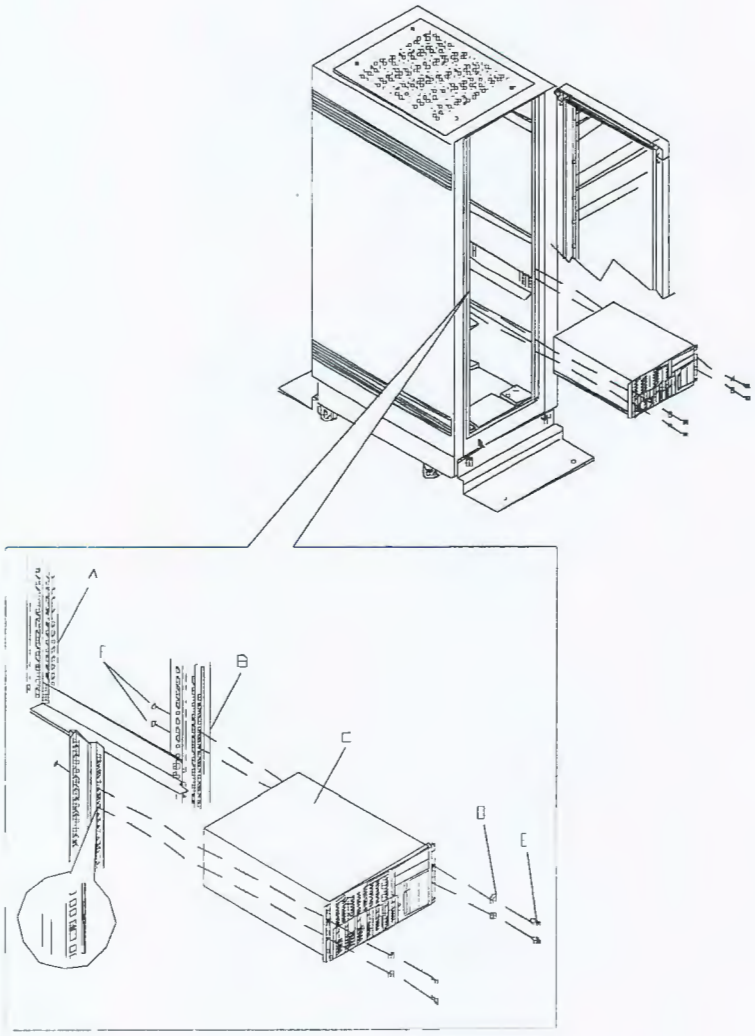
Assembling the Support Brackets in the Rack Cabinet

4. Lift the rack-mount server unit (C) onto the two support brackets and slide it toward the rear of the rack cabinet.

⚠ WARNING

It is strongly recommended that two people lift and assemble the rack-mount server unit into a rack cabinet.

5. Secure the front bezel to the rack cabinet's front vertical mounting rails (B) using the four screws (E) and plastic washers (D) provided with the rack cabinet.



A – Rear vertical mounting rail
B – Front vertical mounting rail
C – Rack-mount server unit
D – Four plastic washers
E – Four screws
F – Caged nuts

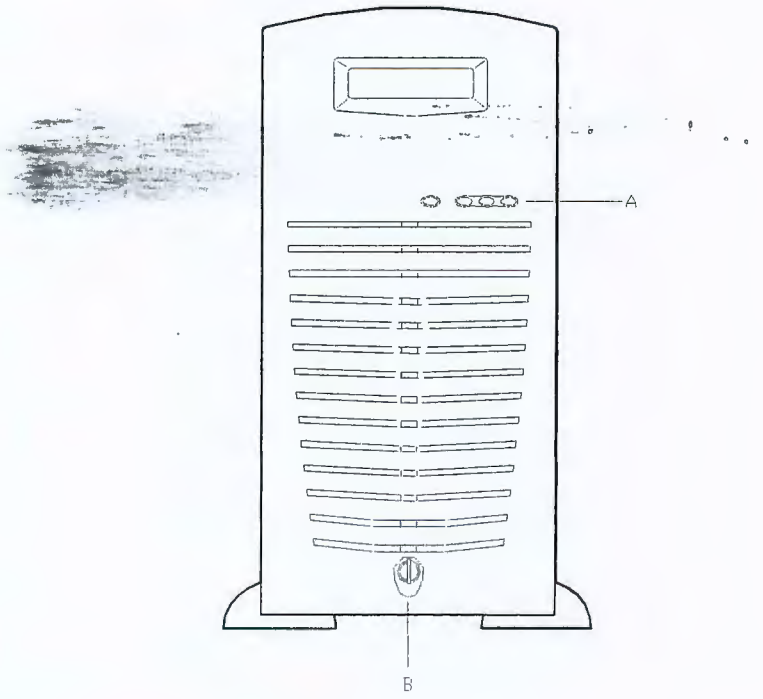
Installing the Rack-Mount Server Unit into the Rack Cabinet

Getting Familiar with the System

Before setting up your system, you should become familiar with the system's features, such as the location of your system's front and rear panel switches, indicators and connectors, etc. Note that this section describes the tower-based system controls (switches and indicators) and connectors, which are identical for the rack-mount system.

Front View with Front Door Closed

This figure shows the location of the front system features (tower-based system only).



A – System indicators (See "Front View with Front Door Opened" later in this chapter).

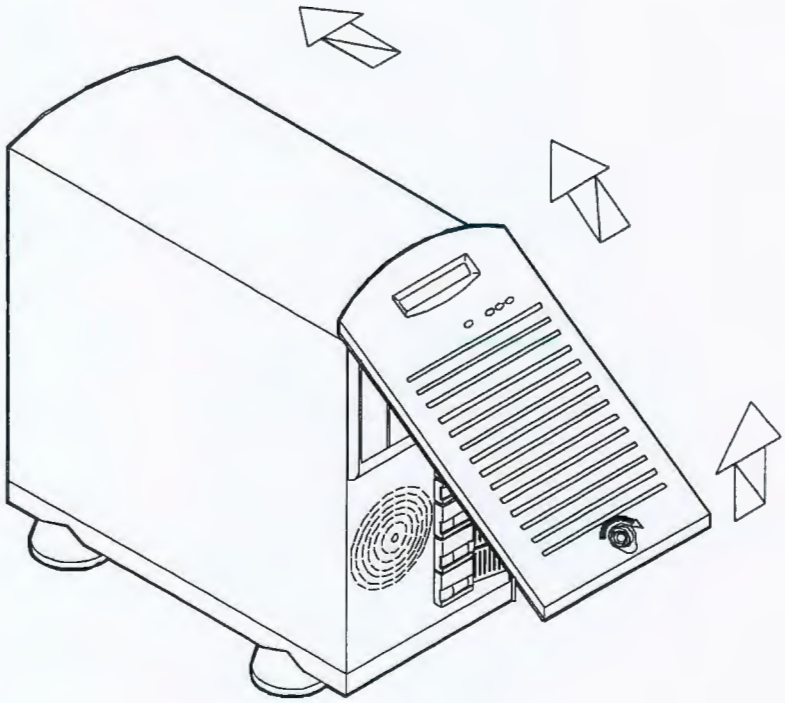
B – Keylock When locked, secures the front door not allowing access to the front system controls.

Front Features

Front View with Front Door Opened

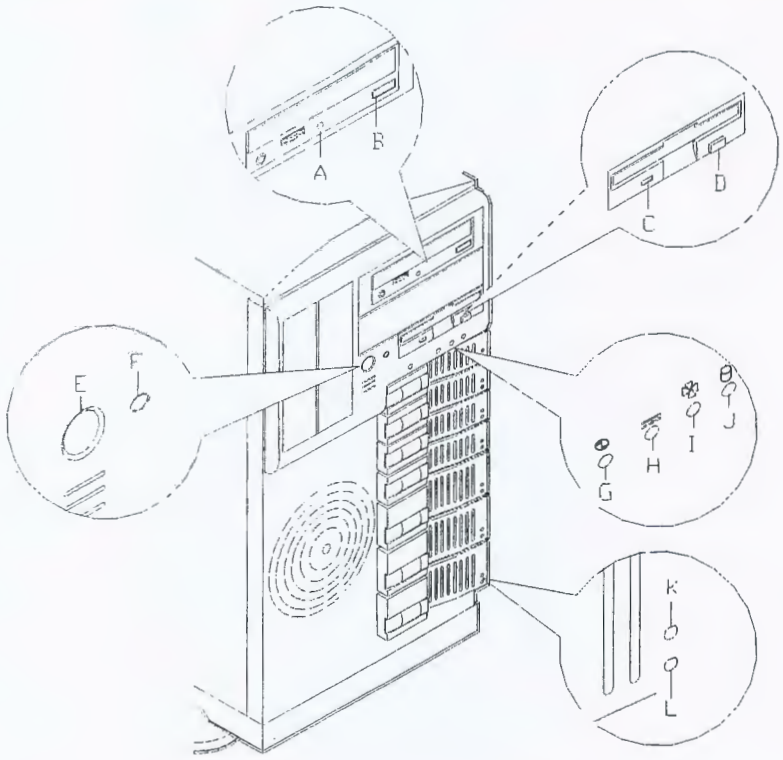
Refer to the following figure and open the front door of the cabinet as follows (tower-based system only).

1. If door is locked, unlock the front door.
2. Pull the bottom of the front door out and tilt up until it is aligned level with the top of the cabinet, then push the door back directly over the top of the cabinet as far as it will go.



Opening the Front Door

This figure shows the location of the front system controls and indicators.

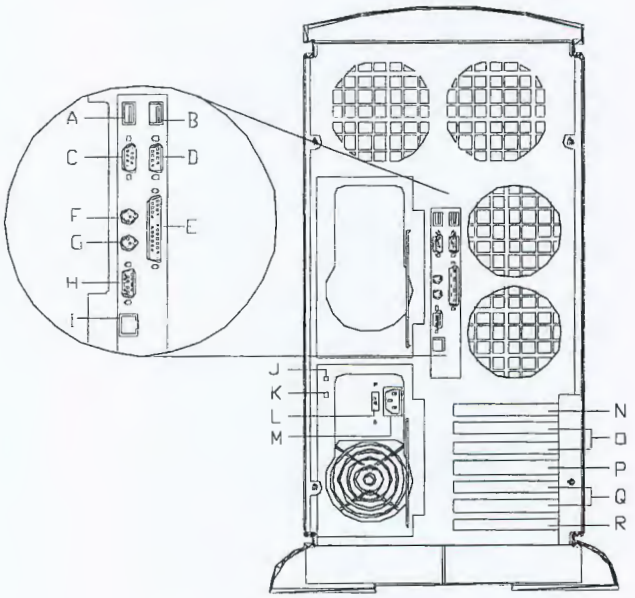


A – Activity light, CD-ROM reader	When lit, CD-ROM reader is in use.
B – Load/eject button, CD-ROM reader	Press to load CD and eject CD.
C – Activity light, 3 ½-inch diskette drive	When lit, diskette is in use.
D – Eject button, 3 ½-inch diskette drive	Press to eject diskette.
E – DC power ON/OFF switch	Press to turn system DC power on or off.
F – Reset switch	Press to reinitialize system.
G – DC power ON/OFF LED	See table "Front System Status Indicator LEDs" that follow.
H – Power alarm	See table "Front System Status Indicator LEDs" that follow.
I – Fan alarm	See table "Front System Status Indicator LEDs" that follow.
J – Array alarm	See table "Front System Status Indicator LEDs" that follow.
K – Disk drive status LED	See table "Front System Status Indicator LEDs" that follow.
L – Disk drive activity LED	See table "Front System Status Indicator LEDs" that follow.

Front System Features and Controls

Rear View

This figure shows the location of the following rear system features and controls.



A – USB2 connector	Second USB connector (black)
B – USB1 connector	First USB connector (black)
C – COM2 port	COM2 serial port 9-pin connector (turquoise)
D – COM1 port	COM1 serial port 9-pin connector (turquoise)
E – Printer port	Parallel port 25-pin connector (burgundy)
F – Keyboard port	PS/2-compatible 6-pin mini-DIN connector (purple)
G – Mouse port	PS/2-compatible 6-pin mini-DIN connector .(green)
H – SVGA connector	SVGA monitor 15-pin connector (blue)
I – LAN connector	RJ-45 Ethernet connector.
J – DC Power fault (amber light)	See table "Power Supply Status Indicator LEDs (Rear Panel)," next
K – Power supply status (green light)	See table "Power Supply Status Indicator LEDs (Rear Panel)," next
L – Line voltage selector switch	Selects AC input power of 115 VAC or 230 VAC.
M – AC input power connector	Supplies AC power to the power supply.
N – 32 bit, 33 MHz PCI Slot	One 32 bit, 33 MHz add-in PCI board slot location.
O – 64 bit, 66 MHz PCI slots	Two 64 bit, 66 MHz add-in PCI board slot locations.
P – 64 bit, 33 MHz PCI slot	One 64 bit, 33 MHz add-in PCI board slot location.
Q – 32 bit, 33 MHz PCI slots	Two 32 bit, 33 MHz add-in PCI board slot locations.
R – Combo PCI/ISA slot	One shared PCI or ISA add-in board slot location.

Rear Features and Controls

Status Indicator LED Descriptions

The status indicator LED descriptions are listed in the following tables.

Front System Status Indicator LEDs

LED	Status	Description	Response
DC Power ON/OFF	Off	DC power OFF	None required (normal)
	ON (Green)	DC power ON	None required (normal)
Power Alarm	Off	No fault	None required (normal)
	ON (Amber)	Failure has occurred in one or more power supplies.	
Fan Alarm	Off	All fans operating normally	None required (normal)
	ON (Amber)	Fan failure	Replace fan in chassis or replace power supply with failed fan
Array Alarm	Off	Always OFF unless RAID is installed	None required (normal)
	ON (Amber)	Array fault	Replace disk drive with amber light.

Power Supply Status Indicator LEDs (Rear Panel)

LED	Status	Description	Response
Power Supply Status	Off	AC Power not available	None required (normal)
	ON (Green)	AC Power supplied to power supply	None required (normal)
DC Power Fault*	Off	No alarms	None required (normal)
	On (Amber)	AC Power disconnected, not installed, or power supply failed	Verify AC power is ON, reconnect AC power, or replace power supply.

* Only active if two power supplies are installed.

Note: The Disk Drive Status Indicator LEDs are active only when a RAID board is installed.

Front Disk Drive Status Indicator LEDs

LED	Status	Description	Response
Disk Drive Activity	Off	Not accessing disk drive	None required (normal)
	ON (Green)	Accessing disk drive	None required (normal)
Disk Drive Status	Off	No alarms	None required (normal)
	ON (Amber)	(See the "Disk Drive Status Conditions" table that follows.)	

Disk Drive Status Conditions

Condition	LED
No Error	Off
Faulty or Rebuild Stopped	Steady ON
Rebuild	Slow Blink for approximately one second
Identify	Fast Blink for approximately three seconds
Predicted Fault	Four fast blinks, pause (repeats)

Making Connections

If your system normally operates without a video display or keyboard (for example, as a network server), you must install a video display and keyboard to configure the system. You may remove them after running the BIOS Setup Utility. For information on running the BIOS Setup Utility, refer to Chapter 3 "Configuring Your System" of this User's Guide.

Refer to the previous figure (Rear Features and Controls) and connect your keyboard, monitor, and mouse. Connect any external peripheral devices such as a printer or modem by following the instructions included with these devices.

⚠ CAUTION

Damage to the system may result if the keyboard/mouse cable is inserted or removed when power is applied to the system.

Inserting a telephone line connector into a LAN board RJ-45 port may result in personal injury and equipment damage.

Setting the Line Voltage

The system contains an ATX 300 watt power supply that is switch-selectable for 115 or 230 VAC at an operating frequency of 50/60Hz. The power supply voltage selection switch is factory set to 115Vac for systems shipped to North America; it is set to 230Vac for systems shipped in Europe. Line source voltages between 200 and 240 VAC are acceptable when the power supply input voltage is set to 230 VAC.

⚠ CAUTION

Before you plug the system power cord into an AC outlet, ensure the input line voltage setting for the power supply is correct.

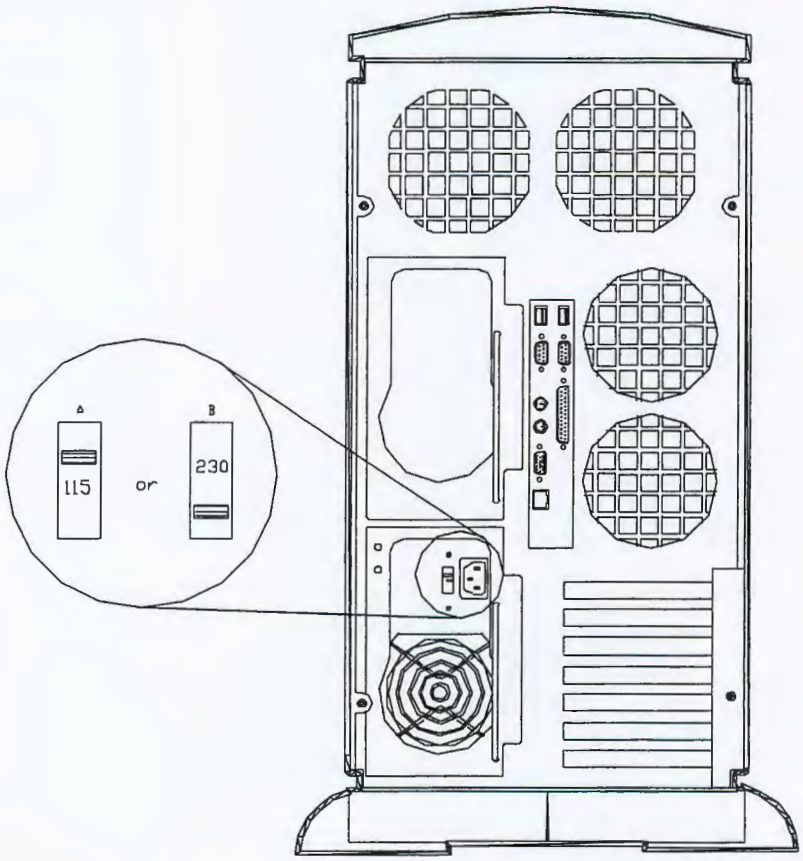
To use the system with line source voltages between 200 and 240 VAC, the line voltage selector switch on the power supply must be set to 230. If you set the switch to the 115 VAC position, the power supply will be damaged when you plug in your system.

When two power supplies are installed in the system both power supplies must have their line voltage selector switch set to the same voltage.

If you need to change the line voltage setting, perform the following steps.

Note: If you are setting up your system for the first time, the power cord is not connected to the rear panel of your system.

1. Unplug the AC power cord from the back of the chassis.
2. Insert the tip of a small screwdriver or ballpoint pen into the depression on the line voltage selector.
3. Slide the selector switch to 115 VAC or to 230 VAC (line source voltage range: 220 to 240 VAC).



A – Voltage selector switch set to 115 VAC **B** – Voltage selector switch set to 230 VAC

Setting the Line Voltage

Connecting the Power Cord(s)

Plug the female end of the AC power cord into the input receptacle on the rear of the power supply cage. Plug the male end of the power cord into a NEMA 5-15R outlet for 100-120 VAC or NEMA 6-15R outlet for 200-240 VAC.

If the power cord(s) supplied with the system is not compatible with the AC wall outlet in your region, obtain a suitable power cord that meets the following criteria.

- The power cord must be rated for the available AC voltage and have a current rating that is at least 125% of the current rating of the system.
- The power cord connector that plugs into the wall outlet must be terminated in a grounding-type male plug designed for use in your region. It must have certification marks showing certification by an agency acceptable in your region.

- The power cord connector that plugs into the system must be an IEC-type CEE-22 female connector.
- The power cord must be less than 1.8 meters (6.0 feet) long.

After the power cord is plugged in confirm that the power status lamp on the power unit is lit. If the lamp is off, a failure occurred in the power unit, see *Power Supply Status Indicator LEDs (Rear Panel)* earlier in this chapter.

When connecting the power cord to a power control unit such as an UPS, confirm that the power control unit is powered off. Connecting the power cord while power is supplied to the power control unit might cause a failure.

To automatically turn on/off the system via the AC-LINK function when a power cord is connected to an UPS, follow the BIOS configuration instructions in Chapter 3 to change the internal settings of the server.

⚠ WARNING

Your system shipped with a power cord for each power supply. Do not attempt to modify or use the supplied AC power cord if it is not the exact type required.

⚠ CAUTION

When two power supplies are installed in the system the power plug from each of the power supplies must be plugged into the same common ground power outlets.

Powering On Your System

Power on your system as follows.

1. Make sure all external devices, such as a video display, keyboard, and mouse have been connected, and the power cords are connected.
2. Power on the video display and any other external devices.
3. Press the push-button power on/off switch on the front panel. Verify that the system power-on LED is lit.

Note: When you first plug in the AC power cord, wait approximately 10 seconds before pressing the power on/off switch on the front panel.

After a few seconds your system begins the internal Power-On Self Tests (POST). POST automatically checks the system board, CPU module, memory, keyboard, and most installed peripheral devices.

⚠ CAUTION

Always allow POST to complete before powering down your system.

If you have problems powering on your system, refer to *Problem Solving* in Chapter 5 of this user's guide.

After you have successfully powered on your system, insert the EXPRESSBUILDER CD-ROM into the CD-ROM device, reboot the system and follow the screen prompts to run EXPRESSBUILDER.

3

Configuring Your System

- Configuring Your System
- BIOS Setup Utility
- Adaptec SCSI Utility
- Configuring the RAID Controller
- Configuring System Board Jumpers

Configuring Your System

Configuration and setup utilities are used to change your system configuration. You can configure your system, as well as option boards you may add to your system, using the BIOS Setup Utility. Several unique system parameters are configured using the BIOS Setup, which is stored in the system FLASH memory.

The Adaptec Configuration Utility detects the SCSI host adapters on the system board. Use this utility if you need to configure the two SCSI controllers in your system or to perform a SCSI disk format or verify disk operation on the SCSI disk drives. The Adaptec Configuration Utility is also used to configure any SCSI removable media devices installed in your system.

If your system has been factory configured, the BIOS Setup or Adaptec Configuration Utility do not need to be run unless you want to change the password or security features, add certain types of option boards or devices, or upgrade your system board.

This chapter also provides information on several system configuration parameters that are set by jumpers on the system board. However, these parameters do not usually require change.

Use the EXPRESSBUILDER CD-ROM to create the device driver diskettes.

BIOS Setup Utility

The BIOS Setup Utility is used to change system configuration parameters. The utility is resident in the system FLASH memory and does not require a diskette or an operating system present to run.

Using the BIOS Setup Utility

You access the BIOS Setup utility when you turn on or reboot your system. To run the BIOS Setup Utility, perform the following procedure:

1. Power-on or reboot the system. "Press <F2> to enter SETUP" displays.
2. Press **F2**. The BIOS Setup Utility starts and the Main Menu is displayed. The menu bar at the top of the Main Menu lists the following selections:

Menu	Use
Main	Use this menu for basic system configuration.
Advanced	Use this menu for setting the Advanced Features available on your system.
Security	Use this menu to set User and Supervisor Passwords and the Backup and Virus-Check reminders.
System Hardware	Use this menu for configuring unique Server features.
Boot	Use this menu to configure Boot Device priority.
Exit	Exits the current menu.

Use the arrow keys to select a menu or an item on a displayed menu. Press the value keys (listed in the table below) to cycle through the allowable values for the selected field. Use the Exit menu's "Save Values" selection to save the current values on all the menus.

To display a submenu, position the cursor on a selection that has a submenu and press **Enter**. An arrow precedes selections with submenus.

Refer to the following table for information on the keys that you use with BIOS Setup. These keys are also listed at the bottom of the Setup menu.

Key	Function in Setup Menu
F1 or Alt-H	Get Help about an item.
ESC	Exit the current menu and return to the previous menu.
Left or right arrow keys	Move between menus.
Up or down arrow keys	Move cursor up and down. The cursor moves only to the settings that you can change.
HOME or END	Move cursor to top or bottom of window.
PAGE UP or PAGE DOWN	Move cursor to next or previous page.
F5 or -	Select the previous value for the field.
F6 or + or SPACE	Select the next value for the field.
F9	Load default configuration values for this menu.
F10	Save configuration values and exit.
ENTER	Execute command or Select ➨ submenu.

BIOS Setup Configuration Settings

The BIOS Setup Configurations tables show the default settings for the BIOS Setup Utility and provides a place for you to record any changes you make to these settings. Recommended values are bold in the following tables.

Main Menu

Feature	Choices or Display Only	Description	Your Setting
Processor Type	————————	(Display Only). Shows the type of processor installed.	
Processor Speed	XXX	(Display Only). Indicates the processor speed.	
Cache RAM	XXX KB	(Display Only). Indicates the cache RAM size.	
System Memory	XXX KB	(Display Only). Indicates the total capacity of the basic memory.	
Extended Memory	XXXXXX KB	(Display Only). Indicates the total capacity of the extended memory.	
Language	**English (US)** French, German Spanish, Italian	Selects which language BIOS displays. Note: This feature *immediately* changes to the language BIOS selected.	
BIOS Version	————————	(Display Only). Indicates the version of the system BIOS.	
System Time	HH:MM:SS	Sets the system time (hour, minutes, seconds, on 24 hour clock).	
System Date	MM/DD/YYYY	Sets the system date (month, day, year).	
Diskette A	1.44/1.25 MB 3.5"	Selects the diskette type. Note that 1.25 MB, 3.5 inch references a 1024 byte/sector Japanese media format. To support this type of media format requires a 3.5 inch 3-mode diskette drive.	

Advanced Menu

Feature	Description	Your Setting
Advanced	Refer to Advanced Submenu.	
Memory Reconfiguration	Refer to Memory Reconfiguration Submenu.	
CPU Reconfiguration	Refer to CPU Reconfiguration Submenu.	
Peripheral Configuration	Refer to Peripheral Reconfiguration Submenu.	
Monitoring Configuration	Refer to Monitoring Configuration Submenu. It sets POST Monitoring and Boot Monitoring.	
PCI Device	Refer to PCI Device Submenu.	
Option ROM	Refer to Option ROM Submenu. It Disables/Enables the Option ROM BIOS on the PCI Bus.	
ISA Device	Refer to ISA Device Submenu.	
Numlock	Refer to Numlock Submenu. It selects Keyboard Options.	

Advanced Submenu

Feature	Choices or Display Only	Description	Your Setting
Installed O/S	**Other** PnP O/S	Select the operating system installed on your system that will be used most of the time. Note: An incorrect setting can cause some operating systems to display unexpected behavior.	
Reset Configuration Data	**No** Yes	Select Yes if you want to clear the Extended System Configuration Data (ESCD) area.	
Boot-time Diagnostic Screen	**Disabled** Enabled	Disables or enables display of the diagnostic screen during boot instead of the NEC logo. The Boot-time diagnostic screen is automatically enabled if redirection or RomPilot is enabled.	
RomPilot Support	**Disabled** Enabled	Disables or enables RomPilot support. The Boot-time diagnostic screen is enabled if RomPilot is enabled. (See Appendix B for more details.)	

Memory Reconfiguration Submenu

Feature	Choices or Display Only	Description	Your Setting
DIMM #1 Status (slot 0)	Normal*	(Display Only)	
DIMM #2 Status (slot 1)	Normal*	(Display Only)	
DIMM #3 Status (slot 2)	Normal*	(Display Only)	
DIMM #4 Status (slot 3)	Normal*	(Display Only)	
Clear DIMM Errors	Press **Enter**	Clears the DIMM group error status information.	
DIMM Error Pause	**Enabled** Disabled	The POST operation pauses if a DIMM error occurs.	

*Possible Values: Normal, None, or Error (DIMM Row Error).

CPU Reconfiguration Submenu

Feature	Choices or Display Only	Description	Your Setting
CPU #1 Status	Normal*	(Display Only)	
CPU #2 Status	Normal*	(Display Only)	
Clear CPU Errors	Press **Enter**	Clears the CPU error information.	
CPU Error Pause	**Enabled** Disabled	The POST operation pauses if a CPU error occurs.	

*Possible Values: Normal, None, or Error (DIMM Row Error).

Peripheral Configuration Submenu

Feature	Choices or Display Only	Description	Your Setting
Serial Port 1: (COM 1)	Disabled 3F8, IRQ3 **3F8, IRQ4** 2F8, IRQ3 2F8, IRQ4 3E8, IRQ3 3E8, IRQ4 2E8, IRQ3 2E8, IRQ4 Auto	Disables serial port 1 or selects the base address and interrupt (IRQ) for serial port 1.	
Serial Port 2: (COM 2)	Disabled 3F8, IRQ3 3F8, IRQ4 **2F8, IRQ3** 2F8, IRQ4 3E8, IRQ3 3E8, IRQ4 2E8, IRQ3 2E8, IRQ4 Auto	Disables serial port 2 or selects the base address and interrupt (IRQ) for serial port 2.	
Parallel Port	Disabled 378, IRQ5 **378, IRQ7** 278, IRQ5 278, IRQ7 3BC, IRQ5 3BC, IRQ7 Auto	Disables the parallel port or selects the base address and interrupt (IRQ) for the Parallel port.	
Parallel Mode	Output only **Bi-directional** EPP ECP, DMA1 ECP, DMA3	Selects the parallel port operation mode.	
Diskette Controller	Disabled **Enabled**	Configure using these options: (Disabled) No configuration. (Enabled) User configuration	
Mouse	Disabled Enabled **Auto Detect**	*Disabled* prevents any installed PS/2 mouse from functioning, but frees up IRQ12. *Enabled* forces the PS/2 mouse port to be enabled regardless if a mouse is present. *Auto Detect* enables the PS/2 mouse only if present. *OS Controlled* is displayed only if the OS controls the mouse.	
SCSI Controller	Disabled **Enabled**	Disables or enables on-board SCSI controller.	
LAN Controller	Disabled **Enabled**	Disables or enables on-board LAN controller.	
USB Controller	**Disabled** Enabled	Disables or enables on-board USB controller.	

Monitoring Configuration Submenu

Feature	Choices or Display Only	Description	Your Setting
POST Monitoring	Disabled OptROM-END **POST-END**	Selects the point where the POST monitoring checkpoint is.	
Boot Monitoring	**Disabled** Enabled	Disable or enable the boot monitoring feature.	

PCI Device Submenu

Feature	Choices or Display Only	Description	Your Setting
PCI IRQ1 — PCI IRQ14	Disabled **Auto Select** IRQ3 IRQ4 IRQ5 IRQ6 IRQ7 IRQ9 IRQ10 IRQ11 IRQ12	PCI devices use hardware interrupts called IRQs. A PCI device cannot use IRQs already in use by ISA devices. Use"Auto" only if no ISA legacy cards are installed.	

Option ROM Submenu

Feature	Choices or Display Only	Description	Your Setting
Onboard SCSI	**Enabled** Disabled	Disables/Enables the mapping of the onboard SCSI BIOS.	
Onboard LAN	**Enabled** Disabled	Disables/Enables the mapping of the onboard LAN BIOS	
PCI Slot 1	**Enabled** Disabled	Initializes Device Expansion ROM	
PCI Slot 2	**Enabled** Disabled	Initializes Device Expansion ROM	
PCI Slot 3	**Enabled** Disabled	Initializes Device Expansion ROM	
PCI Slot 4	**Enabled** Disabled	Initializes Device Expansion ROM	
PCI Slot 5	**Enabled** Disabled	Initializes Device Expansion ROM	
PCI Slot 6	**Enabled** Disabled	Initializes Device Expansion ROM	
PCI Slot 7	**Enabled** Disabled	Initializes Device Expansion ROM	

ISA Device Submenu

Feature	Choices or Display Only	Description	Your Setting
IRQ #1	**None** IRQ3 IRQ4 IRQ5 IRQ6 IRQ7 IRQ9 IRQ10 IRQ11 IRQ12	Reserves specific IRQs for use by legacy ISA devices.	
IRQ #2	Same as above.		
DMA Channel #1	**None** DMA 0 DMA 1 DMA 2 DMA 3 DMA 4 DMA 5 DMA 6 DMA 7	Reserves specific DMA channels for use by legacy ISA devices.	
DMA Channel #2	Same as above.		
I/O Port Address #1	0	Select I/O port base address. Reserved 16 byte. (110 - 3F0, 0 = None)	
I/O Port Address #2	0	Same as above.	
I/O Port Address #3	0	Same as above.	
I/O Port Address #4	0	Same as above.	
Memory Size	**None** 16 32 48 64 80 96	Reserves specific memory for use by legacy ISA devices.	
Memory Address	**None** C800h CC00h D000h D400h D800h DC00h	Select memory base address.	

Numlock Submenu

Feature	Choices or Display Only	Description	Your Setting
Numlock	Auto **On** OFF	Selects the power-on state for Numlock.	
Key Click	**Disabled** Enabled	Disables or enables keyclick.	
Keyboard Auto-repeat Rate	2/sec 6/sec **10/sec** 13.3/sec 18.5/sec 21.8/sec 26.7/sec 30/sec	Selects key repeat rate.	
Keyboard Auto-repeat Delay	0.25 sec 0.5 sec 0.75 sec **1 sec**	Selects delay before key repeat.	

Security Menu

> **Note:** Enabling the Supervisor Password field requires a password for entering Setup. The passwords are not case sensitive.

Feature	Choices or Display Only	Description	Your Setting
Supervisor Password is	**Clear**	Status only, user cannot modify. Once set, this can be disabled by setting it to a null string, or by clearing password jumper on system board (see System Board Jumpers in this Chapter).	
User Password is	**Clear**	Status only, user cannot modify. Once set, this can be disabled by setting it to a null string, or by clearing password jumper on system board (see System Board Jumpers in this Chapter).	
Set Supervisor Password	Press **Enter**	Supervisor password controls access to the setup utility. When the <Enter> key is pressed, the user is prompted for a password; press ESC key to abort. Once set, this can be disabled by setting it to a null string, or by clearing password jumper on system board (refer to System Board Jumpers in this chapter).	
Set User Password	Press **Enter**	When the <Enter> key is pressed, the user is prompted for a password; press ESC key to abort. Once set, this can be disabled by setting it to a null string, or by clearing password jumper on system board (refer to System Board Jumpers in this chapter).	
Password on Boot	**Disabled** Enabled	Disables or enables password entry on boot.	
Diskette Access Secure Mode	**Everyone** Supervisor	Controls access to diskette drives.	
Power Switch Mask	Masked **Unmasked**	Determines whether power switch is masked or unmasked.	
Option ROM Menu Mask	**Unmasked** Masked	Determines whether Option ROM Menu Mask is masked or unmasked.	
Processor Serial Number	**Disabled** Enabled	Determines whether Processor Serial Number feature is enabled or disabled.	

System Hardware Menu

Feature	Choices or Display Only	Description	Your Setting
Thermal Sensor		Refer to Thermal Sensor Submenu.	
Wake On Events		Refer to Wake On Events Submenu.	
AC Link	Power On **Last State** Stay Off	Determines the mode of AC Link.	
ESM IRQ	Disabled IRQ5 IRQ10 **IRQ11**	Determines routing of the ESM interrupt.	
Error Log Initialization	Press **Enter**	Request to initialize the Error Log now. If *Clear OK*, then display "System Event Log Cleared!" If *Clear NG*, then display "System Event Log Not Cleared!"	
Console Redirection		Additional setup menu to configure console. The Boot-Time diagnostic screen is enabled if redirection is enabled.	

Thermal Sensor Submenu

Feature	Choices or Display Only	Description	Your Setting
Thermal Sensor	**Enabled** Disabled	When enabled determines if the BIOS will disable boot (if temperature is not within a safe range).	
Upper Limit	50	Sets the upper temperature limit in centigrade.	
Lower Limit	5	Sets the lower temperature limit in centigrade.	

Wake On Events Submenu

Feature	Choices or Display Only	Description	Your Setting
Wake On LAN	**Enabled** Disabled	Enables Wake ON LAN support.	
Wake On Ring	**Enabled** Disabled	Enables Wake ON Ring support.	

Console Redirection Submenu

Feature	Choices or Display Only	Description	Your Setting
Serial Port Address	**Disabled** Serial Port 2 (3F8h/IRQ4) Serial Port 2 (2F8h/IRQ3)	If enabled, the console will be redirected to this port. If console redirection is enabled, this address must match the settings of serial port 2.	
Baud Rate	57.6K **19.2K**	Enables the specified baud rate.	
Flow Control	No Flow Control **XON/OFF** CTS/RTS	Enables flow control.	
Console Connection	**Direct** Via Modem	Indicate whether the console is connected directly to the system or a modem is used to connect.	

Boot Menu

Boot Device Priority Submenu

Use the up or down arrow keys to select a device, then press the <+> or <-> keys to move the device higher or lower in the boot priority list.

Boot Device Priority Submenu

Boot Priority	Device	Description	Your Setting
1.	ATAPI CD-ROM Drive	Attempts to boot from an ATAPI CD-ROM drive.	
2.	Diskette Drive	Attempts to boot from a diskette drive.	
3.	Hard Drive	Attempts to boot from a hard drive device.	
4.	Intel UNDI, PXE-2.0 (Build 071)	Attempts to boot from a PXE server.	

Exit Menu

You can make the following selections on the Exit Menu. Select an option using the up or down arrow keys, then press <Enter> to execute the option. Pressing <Esc> does not exit this menu. You must select one of the items from the menu or menu bar to exit.

Exit Menu

Choices	Description
Save Changes and Exit	Exits System Setup after saving all changes to CMOS.
Exit Without Saving Changes	Exits System Setup without saving setup data to CMOS.
Get Default Value	Loads default values for all Setup items.
Load Previous Values	Loads previous values of all Setup items.
Save Changes	Writes all Setup item values to CMOS.

Adaptec SCSI Utility

The Adaptec SCSI Utility detects the SCSI host adapters on the server board.

Use the Adaptec SCSI Utility to:

- Change default values
- Check and/or change SCSI device settings that may conflict with those of other devices in the server

Running the SCSI Utility

You access the Adaptec SCSI Utility when you turn on or reboot your system.

To run the Adaptec SCSI utility, perform the following procedure:

1. Power-on or reboot the system.
2. When this message appears on the video monitor:

   Press Ctrl-A to run SCSI Utility...

3. Press **Ctrl+A** to run this utility. When it appears, choose the host adapter that you want to configure.
4. The SCSI utility starts. When the Adaptec SCSI Utility detects more than one AIC-78xx host adapter, it displays a selection menu listing the bus and device number of each adapter. When the selection menu appears, select the channel you wish to configure as follows:

Bus : Device : Channel	Selected SCSI Adapter
01 : 04 : A*	AIC7899
01 : 04 : B	AIC7899

*Internal SCSI connector.

5. Once you select the adapter, the following screen is displayed:

Menu	Description
Configure/View Host Adapter Settings	Configure host adapter and device settings.
SCSI Disk Utilities	The utility scans the SCSI bus for SCSI devices, reports a description of each device. Run these utilities *before* configuring SCSI devices.

6. If you wish to format a disk, verify disk media, or display a list of devices and their SCSI IDs, select "SCSI Disk Utilities". If you wish to configure the adapter or a device, select "Configure/View Host Adapter Settings".

Adaptec SCSI Utility Configuration Settings

The following keys are active for all Adaptec SCSI Utility screens.

Key	Action
Arrows	Up and down arrows move from one parameter to another within a screen.
ENTER	Displays options for a configurable parameter. Selects an option.
ESC	Moves back to previous screen or parameter or EXIT if at the Main menu.
F5	Switches between color and monochrome.
F6	Resets to host adapter defaults.

The following table shows the normal settings for the Adaptec SCSI Utility and provides a place for you to record any changes you make to these settings.

Adaptec SCSI Utility Setup Configurations

OPTION	RECOMMENDED SETTING OR DISPLAY ONLY	YOUR CONFIGURATION
SCSI Bus Interface Definitions		
Host Adapter SCSI ID	7	
SCSI Parity Checking	Enabled	
Host Adapter SCSI Termination	Enabled	
Additional Options		
Boot Device Options	Press Enter for menu	
Boot Channel	A First	
Boot SCSI ID	0	
Boot LUN Number	0	
SCSI Device Configuration	Press Enter for menu	
Sync Transfer Rate (MB/Sec)	160	
Initiate Wide Negotiation	Yes	
Enable Disconnection	Yes	
Send Start Unit Command	Yes	
Enable Write Back Cache	No	
BIOS Multiple LUN Support	No [1]	
Include in BIOS Scan	Yes [1]	
Advanced Configuration Options	Press Enter for menu.	
Plug and Play SCAM Support	Disabled	
Reset SCSI Bus at IC Initialization	Enabled	

[1] No effect if BIOS is disabled.

Adaptec SCSI Utility Setup Configurations (Continued)

OPTION	RECOMMENDED SETTING OR DISPLAY ONLY	YOUR CONFIGURATION
Display <Ctrl-A> Messages During BIOS Initialization	Enabled	
Extended BIOS Translation for DOS Drives >1 GByte	Enabled	
Verbose/Silent Mode	Verbose	
Host Adapter BIOS (Configuration Utility Reserves BIOS Space)	Enabled[1]	
Domain Validation	Enabled	
Support Removable Disks Under BIOS as Fixed Disks	Disabled[1, 2]	
BIOS Support for Int13 Extensions	Enabled[1]	

[1] No effect if BIOS is disabled.
[2] Do not remove media from a removable media drive if it is under BIOS control.

Exiting Adaptec SCSI Utility

To exit the Adaptec SCSI Utility, press ESC until a message prompts you to exit (if you changed any settings, you are prompted to save the changes before you exit).

Configuring the RAID Controller

The RAID (Redundant Array of Independent Disks) options available for your system are the single channel SecuRAID 110 (Mylex AcceleRAID 150) RAID controller board and the three channel SecuRAID 530 (Mylex eXtremeRAID 1100) RAID controller board, which gives your system the added security of fault tolerance.

If you order a system with a RAID controller, the system is pre-configured at the factory according to the following table.

RAID Configurations

Number of Hard Drives	RAID Level Configured	Hard Drives in Array	Description
1	7	1	**JBOD (RAID 7)** Known as *Just a Bunch of Drives*, JBOD allows the controller to access the drives independently. This configuration has no redundancy and does not use striping.
2	1	2	**Mirroring (RAID 1)** Drives are paired and mirrored. All data is 100% duplicated on an equivalent drive (fully redundant).
3	5	3	**Striping with Parity (RAID 5)** Data is striped across several physical drives. Parity protection is used for data redundancy.
4 or more	5	4 (one standby drive)	**Striping with Parity (RAID 5) with a standby drive** The array consists of three ON-LINE drives and one STANDBY drive. The standby replacement drive, or hot spare, is one of the most important features RAID provides to achieve automatic, non-stop service with a high degree of fault-tolerance.

If you want to change the RAID level or add additional hard disks to the array, use the RAID configuration utility. The RAID configuration utility is included with the RAID controller.

If you are adding the RAID controller to an existing system, the RAID configuration utility allows you to configure your disk array before reinstalling your network operating system. The RAID controllers support various versions of RAID technology (referred to as RAID levels). To use any RAID level, you must configure the RAID controller using the RAID configuration utility prior to installing your Network Operating System. For an explanation of this utility, refer to the documentation on the MYLEX CDROM that was shipped with the RAID controller. It describes RAID technology and provides tips on making your array perform well in your specific application. It also covers array hardware preparation, configuration, and initialization. After completing the steps in the manual, you can install your Network Operating System.

If you want to remotely configure the array (from a PC client); increase array capacity online; or monitor statistics on disk and controller activity, you must install the array manager provided with your RAID subsystem. Increasing array capacity is covered in the user's guide shipped with the option.

Configuring System Board Jumpers

Before You Begin

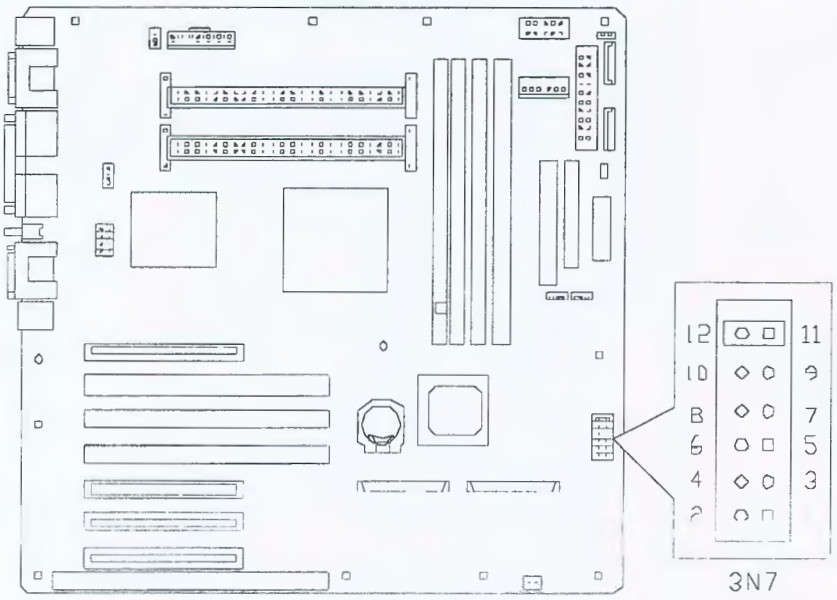
Only a qualified technical person should perform the procedures in this section.

⚠ CAUTION

Electrostatic discharge (ESD) can damage the system board. Modify the system board only at an ESD workstation. Otherwise, wear an antistatic wrist strap attached to chassis ground.

Setting a jumper on system board jumper block 3N7 enables you to set several operating parameters for your system. The jumper is a small plastic-encased conductor (shorting plug) that slips over two jumper pins.

The "System Board Jumpers" figure shows the location of system board jumper block 3N7. All other jumper blocks are preset at the factory and must not be reset. The "Jumper Block 3N7 Jumper Summary" table lists the factory default settings for jumper block 3N7.



System Board Jumper Block 3N7

Jumper Block 3N7 Jumper Summary

Jumper Pin Nos.	Function	Jumper On/Off (default in bold)	What it does at system reset
1 - 2	CMOS clear	**Off, Protect**	Preserves the contents of CMOS.
		On, Erase	Clears CMOS.
3 - 4	Password disable	**Off, Normal**	Preserves the password.
		On, Disable	Disables the password.
5 - 6	Reserved	**Off, Not Used**	Required. Do Not Change.
7 - 8	Reserved	**Off, Not Used**	Required. Do Not Change.
9 - 10	Reserved	**Off, Not Used**	Required. Do Not Change.
11 - 12	Spare	Off, Not Used	
		On, Spare	Provides a spare jumper.

Moving System Board Jumpers

⚠ CAUTION

Before doing the procedures in this section, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before moving the jumpers can result in personal injury and equipment damage.

Observe static precautions. Use an antistatic wrist strap.

To configure the system board options:

1. Power off the system and remove the left panel as described in Chapter 4 of this guide.
2. Check to ensure the system power cord is removed from the back of the system.
3. Locate the position of the jumpers on the system board you are changing. To change a jumper setting, use a pair of needle-nose pliers or your fingers to remove the jumper from its current location. Position the jumper over the two pins for the desired setting and press it onto the pins. Be careful not to bend the pins. Refer to the "System Board Summary" table for system board jumper settings.
4. Install the system cover and power up the system.

Clearing and Changing the Passwords

To clear and change the passwords:

1. Power off the system and remove the left panel as described in Chapter 4 of this guide.
2. Remove the spare jumper from pins 11-12 on jumper block 3N7.
3. Reinstall the spare jumper on pins 3-4 (Password Disable) of jumper block 3N7. Refer to the previous figure "System Board Jumpers" to find the jumper location.
4. Power on the system and while waiting for POST to complete, press the **F2** key to enter BIOS setup. This automatically clears all passwords, provided you exit and save the BIOS setup.
5. Power off the system.
6. Remove the Password Disable jumper from pins 3-4.
7. Replace the panel and power on the system.
8. To specify a new password run the BIOS Setup Utility as described earlier in this chapter.

Clearing CMOS

To clear CMOS:

1. Power off the system and remove the left panel as described in Chapter 4 of this guide.
2. Remove the spare jumper from pins 11-12 on jumper block 3N7.
3. Position the jumper over pins 1-2 on jumper block 3N7.
4. Replace the left panel, connect the power cables, and power on the system.
5. After POST completes, power down the system and remove the left panel.
6. Remove the jumper from pins 1-2 and store the jumper on pins 11-12.
7. Replace the left panel and connect system cables.
8. Power on the system, press **F2** at the prompt to run the BIOS Setup utility, and select "Get Default Values" at the Exit menu.

4

Upgrading Your System

- General Information
- Static Precautions
- Preparing Your System for Upgrade
- Equipment Log
- Opening the Front Door
- Removing a Side Panel
- Installing a Side Panel
- Modifying the System Board
- Option Boards
- Installing a RAID Controller Board
- Hard Disk Drives
- Removable Media Devices
- Installing the Redundant Power Supply

General Information

⚠ WARNING

The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, +5vdc is present on the system board whenever the AC power cords are connected between the system and an AC outlet. Before doing the procedures in this manual, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

⚠ CAUTION

Operating your system with the side panels removed can damage your system components. For proper cooling and airflow, always replace the side panels before powering on your system.

Note: When you first plug in the AC power cord, wait approximately 10 seconds before pressing the power on/off switch on the front panel.

Note: Your system error log will be lost, if your system ac power source is off or disconnected.

Contact your sales representative or dealer for a list of approved optional peripheral devices.

Static Precautions

An electrostatic discharge (ESD) can damage disk drives, option boards, and other components. You can provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground when handling system components.

Electronic devices can be easily damaged by static electricity. To prevent damage, keep them in their protective packaging when they are not installed in your system.

Preparing Your System for Upgrade

Depending on the upgrade, you will need one or more of the following tools:

- Phillips screwdriver (#1 bit and #2 bit)
- Flat-head screwdriver
- Small needle nose pliers
- Pen or pencil
- ESD workstation or antistatic wrist strap (recommended)

Equipment Log

Use the equipment log form located at the end of this guide to record the model and serial number of your system, all installed options, and any other pertinent information specific to your system. You need this information when configuring your system.

Opening the Front Door

To open the front door, see the figure "Front View with Front Door Opened" in Chapter 2.

Removing a Side Panel

To install options in your system, you must remove the side panel on the left side of the system (as viewed from the front). The side panel on the right side of the system (as viewed from the front) is removed when adding removable media devices. The right side panel removes in the same manner as the left side panel.

⚠ CAUTION

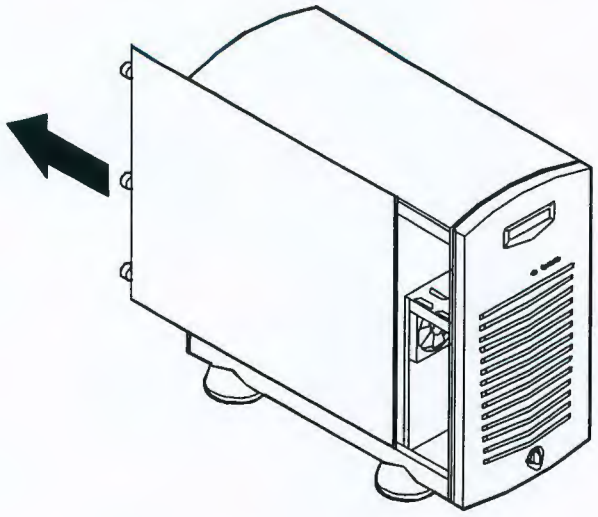
For proper cooling and airflow, do not operate the system with the side panels removed. Always replace the panels before powering on the system.

⚠ WARNING

If you are removing the side panel after the system is set up, you must first power off the system and all external devices and then **unplug** the system power cord.

To remove a side panel:

1. Power off the system and ensure it is disconnected from the ac wall outlet.
2. The side panel is secured to the chassis with three thumbscrews. Loosen the three thumbscrews securing the side panel.
3. Slide the side panel toward the rear of the chassis. This unlocks the locking fingers behind the side panel.
4. Pull the side panel out and away from the chassis.



Removing a System Side Panel

Installing a Side Panel

1. Before replacing a side panel, make sure no tools or loose parts are inside the system chassis.
2. Make sure all option boards are firmly seated in their respective slots and that all interior cables are properly connected.
3. If you are going to lock the panel in place with a padlock, ensure that the padlock lock loop is extended out and aligned with its slot in the panel.
4. Insert the metal tabs on the top and bottom of the side panel into their slots on the chassis. Check that the lock loop is inserted into its slot in the panel.
5. Slide the side panel forward as far as it goes.
6. Tighten the three retaining thumbscrews on each of the two side panels.

Note: If your system is already set up, plug the system back in, reconnect the peripherals, and power on the peripherals and system.

Modifying the System Board

The following sections provide procedures for upgrading and configuring the system board in your system. Topics covered include:

- Replacing the real-time clock battery
- Removing and installing a processor
- Installing or removing DIMMs.

⚠ CAUTION

Electrostatic discharge (ESD) can damage add-in boards and other components; place them on an antistatic surface. Modify the system board only at an ESD workstation. Otherwise, wear an antistatic wrist strap attached to chassis ground.

Replacing the Real-time Clock Battery

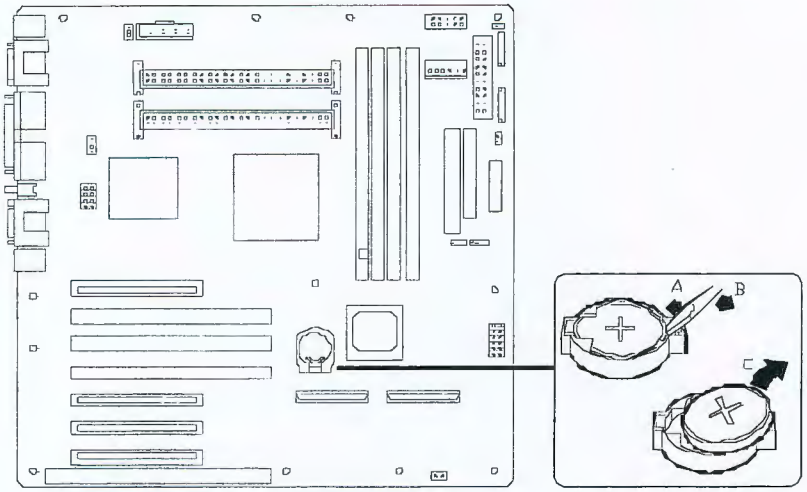
You might need to replace the real-time clock battery because of its life span. The battery (Vendor Part #CR2032) is a commodity part available through many vendors. Notice the plus (+) sign on the battery. Use the sign to correctly position the battery in its socket on the system board.

⚠ CAUTION

Danger of explosion if battery is incorrectly replaced. Replace only with same or equivalent type recommended by manufacturer. Dispose of lithium batteries as required by local ordinance or as normal waste if no local ordinance exists. Do not expose the component to excessive heat or fire. Keep all batteries away from children

⚠ CAUTION

Observe static precautions. Use an antistatic wrist strap.



Replacing the Real-Time Clock Battery

1. Power off the system and remove the left side panel as described earlier in this chapter.
2. If present, remove the protective plastic cover located over the top of the lithium battery socket.
3. Insert the tip of a small flat-bladed screwdriver, or equivalent, opposite the spring clip (A).
4. Gently push down on the screwdriver to lift the battery (B).
5. Remove the battery from its socket (C).
6. Dispose of the battery according to local ordinance.
7. Remove the new lithium battery from its package, and, being careful to observe the correct polarity (plus sign up), insert it in the battery socket.
8. Reinstall the plastic cover over the top of the lithium battery socket.
9. Replace the side panel, plug in the system power cord, and turn on the system.
10. Run the BIOS Setup to restore the configuration settings to the real-time clock.

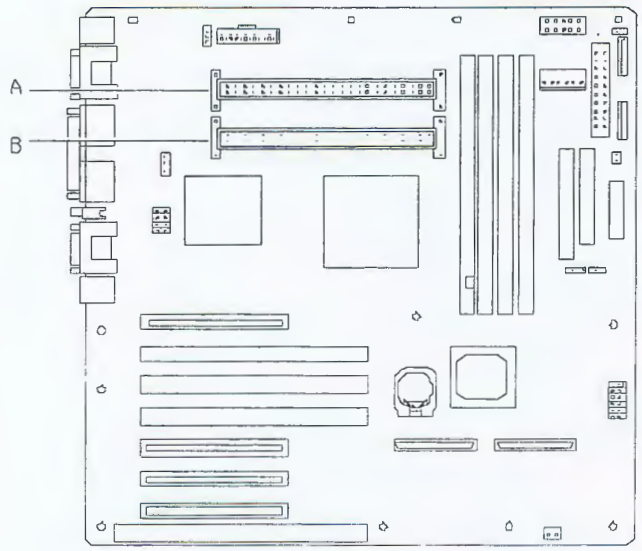
Installing or Removing a Processor or Termination Board

This subsection provides the procedures for installing or removing a Pentium III Xeon processor cartridge or termination board. The cartridge includes the processor core with an integrated 16 KB primary (L1) cache, 256 KB secondary (L2) cache, back cover, and heat sink.

Each processor cartridge installs in a retention module and Slot 2 connector on the system board. For single processor systems, the cartridge is always installed in the primary connector (**A** in the following figure) and a termination board is always installed in the secondary connector (**B** in the following figure). For dual-processor systems, a processor is installed in each Slot 2 connector.

⚠ CAUTION

Electrostatic discharge (ESD) can damage components; place them on an antistatic surface. Modify the system board using an antistatic wrist strap attached to chassis ground.



Locating the Slot 2 Connectors

⚠ WARNING

If the system was just running, the processor and heat sink are hot. To avoid a burn, let the components cool for 10 minutes before continuing.

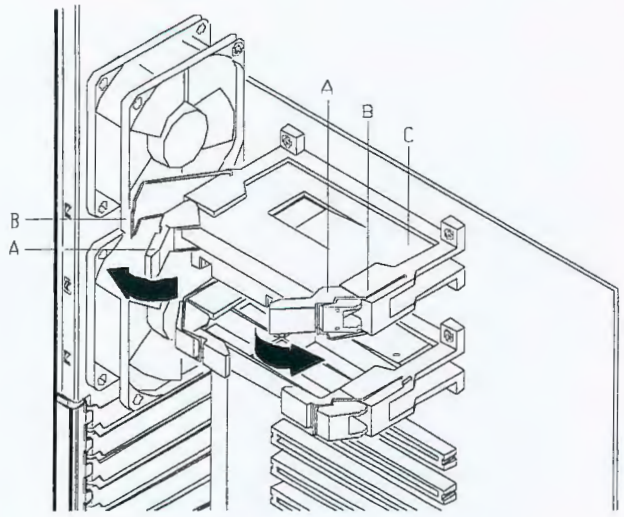
Install or remove a processor cartridge or termination board as follows.

1. Power off the system and remove the left side panel as described earlier in this chapter.

> **⚠ CAUTION**
>
> Observe static precautions. Use an antistatic wrist strap. Hold the processor or termination board only by its edges.

> ***Note:*** All processors must be matched for speed. If replacing a processor, the replacement processor must match the speed and cache size of the processor being replaced.

2. If you are
   - installing a second processor cartridge, remove the termination board and install the second processor per steps 3, 4, and 5.
   - replacing a processor cartridge, remove the old processor cartridge and install the replacement processor cartridge per steps 3, 4, and 5.
   - installing a termination board, see steps 4 and 5.
3. Remove a termination board or processor cartridge as follows.
   - Release the latch and retention lockwire on each end of the device by pulling the latch out from the device (see the following figure).
   - Lift each retention lockwire from its recess in the latch and swivel the lockwire outboard.
   - Fully open the two latches and pull the device out of its retention module and Slot 2 connector.



A – Latch
B – Lockwire
C – Device

Releasing the Latches and Lockwires

- Store the device in an antistatic bag. Keep the device for later use.
- Go to step 4 to install a processor cartridge or termination board.

4. Install a processor cartridge or termination board as follows.

- If installing an optional processor, and the heat sink is not attached, attach it to the processor with the five screws provided in the option kit.
- If installing an optional processor, and it does not have latches, attach one at each end of the cartridge.

  — Latches might be included with the optional processor or you can remove the latches from the termination board.

  — Slightly spread open each latch. Use care to prevent latch breakage.

  — Position the latch so that the two pins on the latch fit into the two pin holes at the corners of the cartridge.

- Open the latches on the cartridge or board and align the device with the retention module and Slot 2 connector.

  — If installing a processor cartridge, align it so that the heat sink faces down.

  — If installing a termination board, align it so that the open side of the circuit board faces up.

- Slide the processor cartridge or termination board into the retention module until resistance is felt.

  — Continue sliding the device into the module until it seats.

  — You should hear three distinct clicks as it seats in the module and connector.

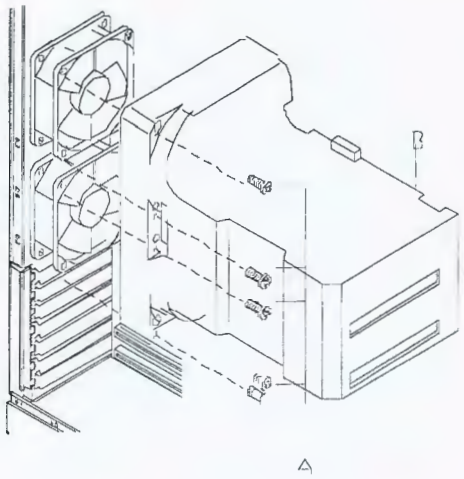
  — Check that the device is firmly seated.

5. Lock the processor cartridge or termination board in place by positioning the retention lockwires over the latches and pushing the latches down.
6. Replace the left side panel; plug in the system power cord(s), and power up the system.

Removing or Installing the Cooling Baffle

If your system has a cooling baffle, remove or install it as follows.

1. Remove the cooling baffle as follows.
   - Locate the two fans inside the chassis, at the rear of the chassis.
   - Remove the two screws from each fan, as shown in the following figure.
   - Remove the baffle.
2. Install the cooling baffle as follows.
   - Align the baffle mounting holes with the fan mounting holes.
   - Fasten the baffle in place with the four fan mounting screws.
   - Replace the left side panel, plug in the power cords(s), and power up the system.

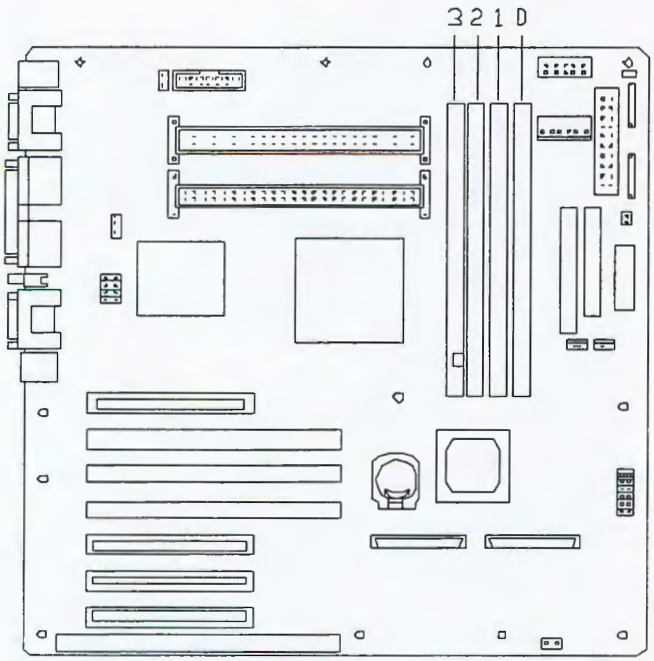


A – Screws **B** – Baffle

Removing or Installing the Cooling Baffle

DIMMs

The system board contains four DIMM sockets labeled 0 through 3. Each socket can hold a single 72-bit DIMM module with 64MB, 128MB, 256MB, 512MB, or 1GB of memory. When all four sockets are populated, the system board supports a maximum of 4 GB of memory with 1GB DIMMs. A DIMM must always be installed in socket 0. When you install additional DIMMs, you must start with the first empty socket next to the DIMMs already installed. When you remove DIMMs, you must start with the highest number occupied DIMM socket on the system board.



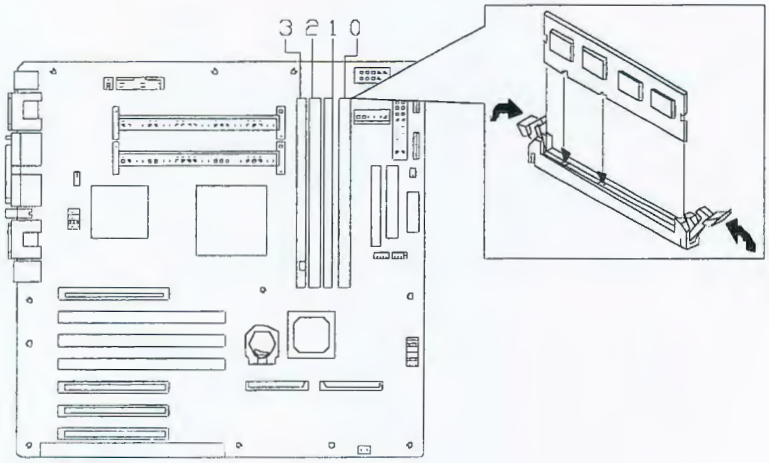
DIMM Locations

1. Power off the system and remove the left side panel as described earlier in this chapter.

⚠ CAUTION

Observe static precautions. Use an antistatic wrist strap.
Hold DIMMs only by their edges.

2. Holding the DIMM module only by the edges, remove it from its antistatic package.
3. Position the DIMM so that the two notches in the bottom edge of the DIMM align with the keyed socket.



Inserting Memory DIMMs

4. Insert the bottom edge of the DIMM into the socket, and press down firmly on the DIMM until it seats correctly.
5. Gently push the plastic ejector levers on the socket ends to the upright position.
6. Repeat the steps to install each DIMM.
7. Replace the left side panel, plug in the system power cord, and turn on the system.

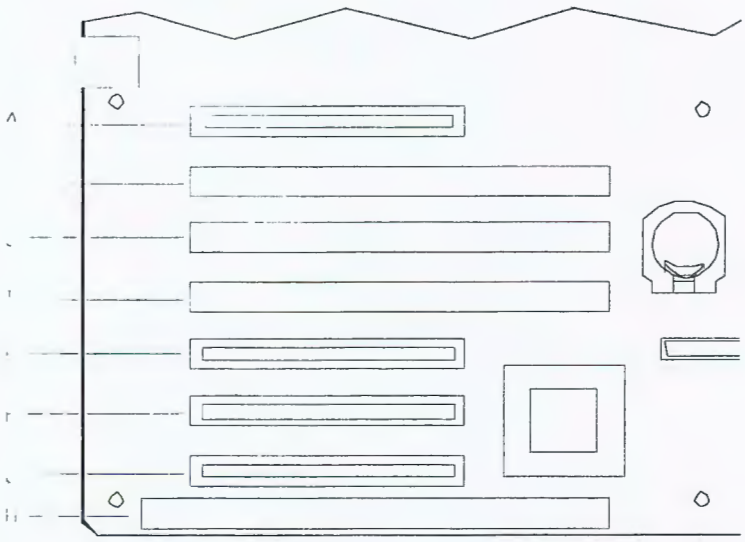
⚠ CAUTION

Use extreme care when removing a DIMM. Too much pressure can damage the socket slot. Apply only enough pressure on the plastic ejector levers to release the DIMM.

1. Power off the system and remove the left side panel as described earlier in this chapter.
2. Gently push the plastic ejector levers out and down to eject a DIMM from its socket.
3. Hold the DIMM only by its edges, being careful not to touch its components or gold edge connectors. Carefully lift it away from the socket, and store it in an antistatic package.
4. Repeat the above steps to remove the remaining DIMMs.
5. Replace the side panel, plug in the system power cord, and turn on the system.

Option Boards

This section describes how to install and remove ISA and PCI option boards. The system board has one ISA bus expansion slot and seven PCI bus expansion slots. The one ISA connector shares a chassis expansion slot with a PCI connector.



A – PCI 1, 32-bit/33 MHz
B – PCI 2, 32- or 64-bit/66 MHz
C – PCI 3, 32- or 64-bit/66 MHz
D – PCI 4, 32- or 64-bit/33 MHz
E – PCI 5, 32-bit/33 MHz
F – PCI 6, 32-bit/33 MHz
G – PCI 7, 32-bit/33 MHz
H – ISA 1, 16-bit/8.33 MHz

PCI and ISA Slot Locations

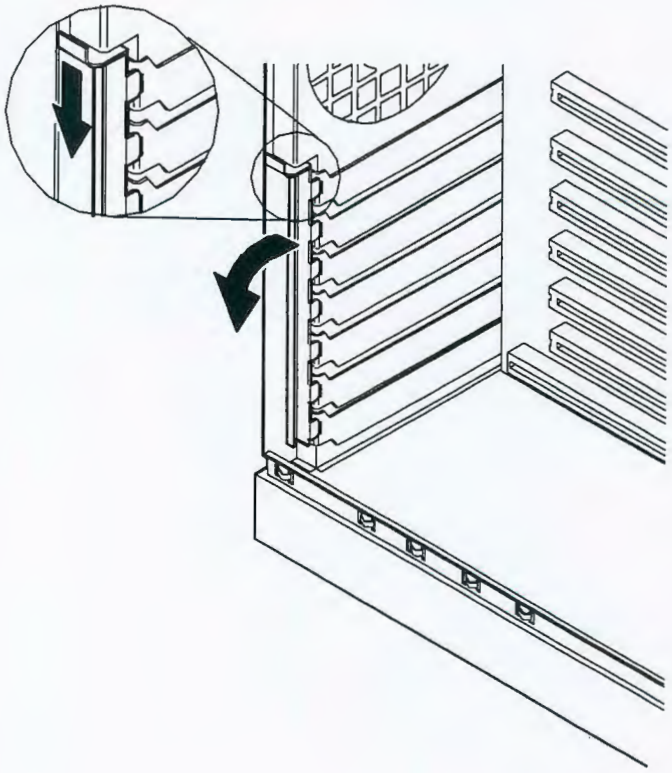
Installation Considerations

Newer adapters, designed for Plug-and-Play systems, are automatically configured by the system without any user intervention. Older ISA adapters must be manually configured as detailed below. Once the manual configuration is complete, the Plug-and-Play adapters are configured around the manually configured adapters without causing any resource conflicts.

ISA adapters can be Plug-and-Play. ISA adapters that are not Plug-and-Play must be manually configured following the instructions supplied with the board. If you are adding a non-Plug and Play ISA option board, run the BIOS Setup utility (press **F2** at the startup screen) before installing the board. For details on running the BIOS Setup utility, refer to Chapter 3 (Configuring Your System).

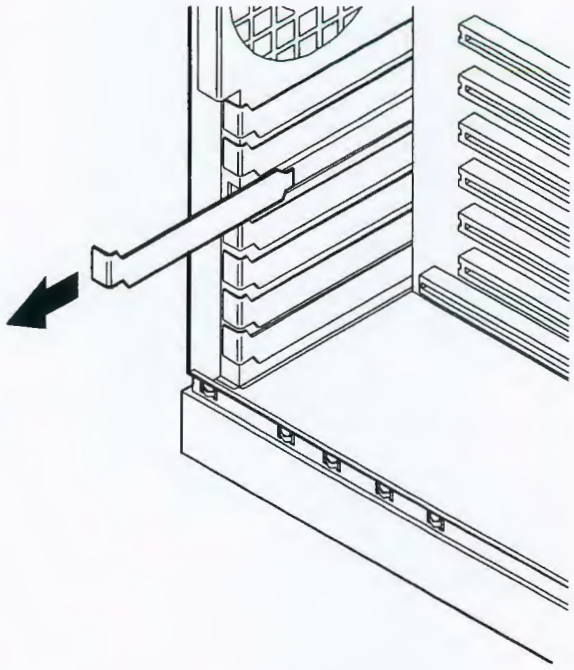
Installing an Option Board

1. Power off the system and remove the left side panel as described earlier in this chapter.
2. Remove and save the expansion slot retainer bar by pressing down on its top snap fastener and pulling the bar out.



Removing the Expansion Slot Retainer Bar

3. Remove and save the expansion slot cover by sliding it straight back and out of the slot.



Removing the Expansion Slot Cover

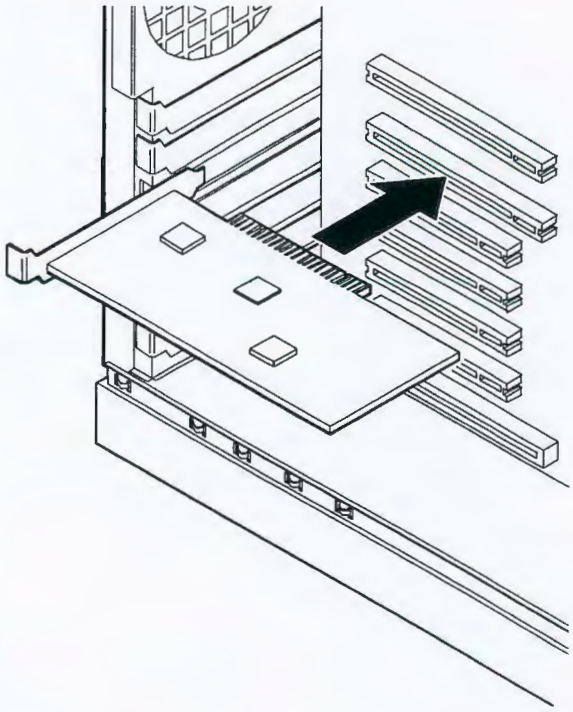
⚠ CAUTION

Observe static precautions. Use an antistatic wrist strap.

4. Remove the option board from its protective wrapper, holding the board only by the edges. Do not touch the board components or the gold connectors.
5. Record the option board serial number in the equipment log.
6. Set any board jumpers or switches as described in the documentation that comes with the option board.
7. Refer to the documentation accompanying the option board for information on whether the board is a PCI or ISA board. Refer to "Option Board Hardware Configurations" table to determine the recommended option board slot assignment and configuration parameters.

Note: If you are adding a non-Plug and Play Legacy ISA option board, run the BIOS Setup utility (press **F2** at the startup screen) before installing the board. For details on running the BIOS Setup utility, refer to Chapter 3 (Configuring Your System).

8. Holding the board by its top edge or upper corners, firmly press the board into an expansion slot on the system board. The tapered foot of the option board retaining bracket must fit into the mating slot in the expansion slot.



Installing an Option Board

9. Align the rounded notch in the option board retaining bracket with the alignment tab in the expansion slot frame.
10. Be sure to push the bracket slot up against the expansion slot frame. If this is not done, the bracket may interfere with an adjacent bracket.
11. Install the previously removed expansion slot retainer bar by pressing its top fastener into the top of the expansion slot frame. The bottom tapered tab of the expansion slot retainer bar fits into the mating slot on the bottom of the expansion slot frame.
12. Connect any external cables (if needed) to the installed option board.
13. Replace the left side panel; plug in the system power cord, and power on the system.

Removing an Option Board

> **Note:** Expansion slot covers must be installed on all vacant slots to maintain the electromagnetic emissions characteristics of the system and to assure proper cooling of the system components.

1. Power off the system and remove the left side panel as described earlier in this chapter.
2. Disconnect any cables attached to the option board you are removing.
3. Remove and save the expansion slot retainer bar by pressing down on its top fastener and pulling the bar out.
4. Hold the board at each end and carefully rock it back and forth until the edge connectors pull free. Make sure that you do not scrape the board against other components.
5. Remove the board from the expansion slot and place it in an antistatic wrapper. If you are replacing a board, go to "Installing an Option Board" earlier in this chapter, otherwise continue.
6. Install an expansion slot cover over the vacant slot.
7. Install the previously removed expansion slot retainer bar by pressing its top fastener into the lock plate at the top of the expansion slot frame. The bottom tapered tab of the expansion slot retainer bar fits into the mating slot on the bottom of the expansion slot frame.
8. Replace the left side panel; plug in the system power cords, and power on the system.
9. If you removed a non-Plug-and-Play ISA option board, run the BIOS Setup utility (press **F2** at the startup screen) to configure the system as described in Chapter 3, "Configuring Your System."

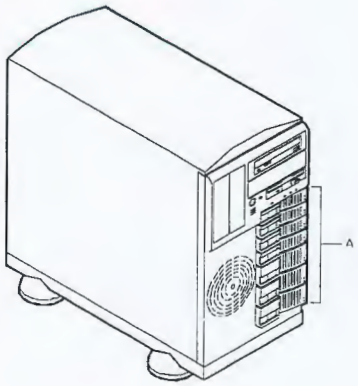
Installing a RAID Controller Board

Use this procedure to install a RAID controller board.

1. Install the RAID controller board into any PCI slot on the system board. See "Installing an Option Board" earlier in this chapter.
2. Cable the RAID controller board as described below (see "System Cabling" in Appendix A):
   - Remove the end of the SCSI interface cable that is plugged into the Ultra-160/M SCSI connector on the system board.
   - Reinstall the end of the SCSI interface cable just removed into the Channel 0 connector on the RAID board.

Hard Disk Drives

Your system supports a variety of SCSI hard disk drives. The SCSI drives must use the industry standard 80-pin Single Connector Attachment (SCA) connector. Contact your sales representative or dealer for a list of approved devices. The internal hard disk drives are located in the SCSI Disk Drive Bays (A).



SCSI Disk Drive Bay Locations

If you are adding or removing a SCSI hard disk device, consider the following.

⚠ CAUTION

Do not hot swap a non-LVD-disk-drive into a LVD-disk-drive only system for it may cause data corruption. The only way a non-LVD-disk-drive can be used with an all LVD-disk-drive system is by first powering down the system, installing the non-LVD-disk-drive, and then powering the system back up.

Note: Installing a non-LVD-disk-drive into an all LVD-disk-drive system causes all the drives to operate in the non-LVD mode.

- The onboard SCSI controller supports Ultra2 (LVD) and Ultra-160/M drives. Hard disk SCSI address assignments are as follows.

Bay	Device	SCSI ID Address
1	First 1.6 inch Hard Disk (Bottom)	0
2	Second 1.6 inch Hard Disk	1
3	Third 1.6 inch Hard Disk	2
4	Fourth 1.0 inch Hard Disk	3
5	Fifth 1.0 inch Hard Disk	4
6	Sixth 1.0 inch Hard Disk	5
7	Seventh 1.0 inch Hard Disk (Top)	6

Installing or Swapping a Hard Disk Drive in a Hot-Swap Bay

This procedure describes installing a new drive or swapping out a faulty drive from one of the seven hot-swap SCSI disk drive bays. The 3 1/2-inch SCSI drives must use the industry standard 80-pin Single Connector Attachment (SCA) connector. Each drive must be installed in a drive carrier.

Note: To order a disk with a carrier, contact your sales representative or dealer.

- If installing new drives, follow an installation scheme starting with the bottom drive. Fill the bays bottom to top.
- If an individual SCSI drive fault LED (yellow light) is on steadily, this indicates that the drive has been flagged as faulty by the RAID controller. Follow the procedure described in this section to remove the faulty drive and swap in a good one.

Note: ESD can damage disk drives, boards, and other parts. This system can withstand normal levels of environmental ESD while you are hot-swapping SCSI hard drives. However, we recommend that you do all procedures in this chapter only at an ESD workstation or provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground (any unpainted metal surface) on your system when handling parts.

⚠ CAUTION

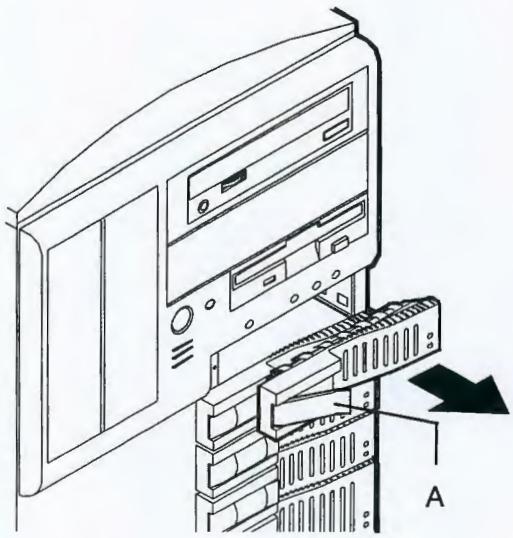
Drive manufacturers caution against moving a disk drive that is still spinning because of possible damage to the drive.

Installing or Swapping a Hard Disk Drive

1. Open the front door as described earlier in this chapter.
2. If installing a hard disk drive in a disk carrier for the first time, perform the following procedures:
   - Pull the handle (A) out of the hard disk drive bay panel and remove it from the SCSI hard disk drive bay.

     Note: The hard disk drive bay panel is no longer needed.

   - Go to step 5.



Removing the Hard Disk Drive Bay Panel

3. If swapping a hard disk drive, remove its carrier from the SCSI hard disk drive bay by performing the following procedures:

⚠ CAUTION

Depending on the drive fault, the drive may be still spinning when you remove it. Follow the next steps exactly when removing drives.

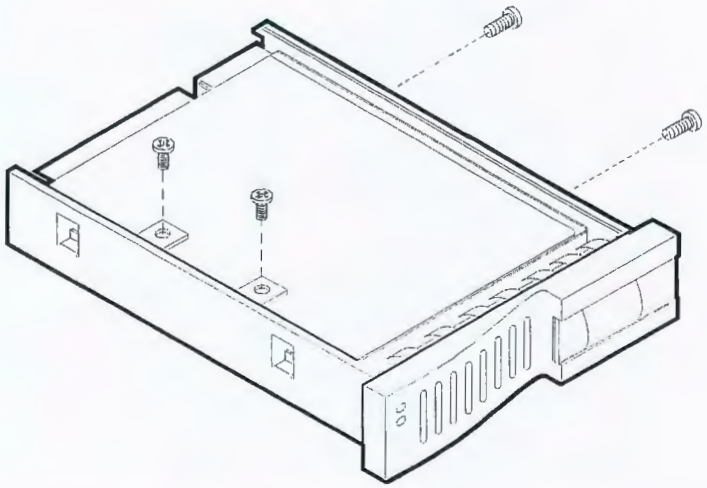
   - Pull the hard disk drive carrier's handle out.
   - Pull the faulty disk drive out of the bay by its outside edges far enough to disengage the drive connector from the backplane. Wait 30 seconds until the drive spins down.
   - Remove the hard disk drive carrier from the drive bay.

4. Remove the hard disk drive from its carrier by removing the four screws. See the figure "Securing the Drive in the Carrier."
5. Remove the new drive from its protective wrapper, and place on an antistatic surface.

⚠ CAUTION

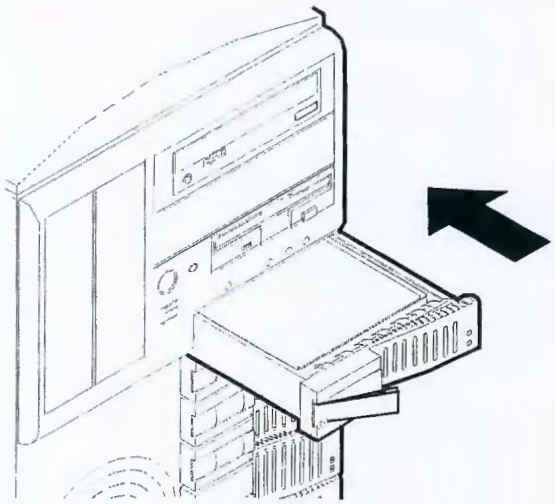
Observe static precautions. Use an antistatic wrist strap.

6. Record the drive model and serial numbers in the equipment log.
7. Install the drive in the drive carrier. See the figure "Securing the Drive in the Carrier."
   - Place the drive on the carrier, with its connector facing the back of the carrier.
   - Turn the drive and carrier over and secure the drive in the carrier with the four screws supplied with the disk drive.



Securing the Drive in the Carrier

8. Install the drive carrier with drive into the bay (see Figure "Installing a Disk Carrier into the Bay") as follows.
   - Open the drive carrier handle.
   - Align the drive carrier with the bay guide rails.
   - Slide the drive carrier into the bay until it docks with the SCSI backplane connector.
   - Push on the carrier until the drive is completely seated into the SCSI backplane connector, and the carrier handle is flush with the front of the carrier.
   - Close the drive carrier handle.

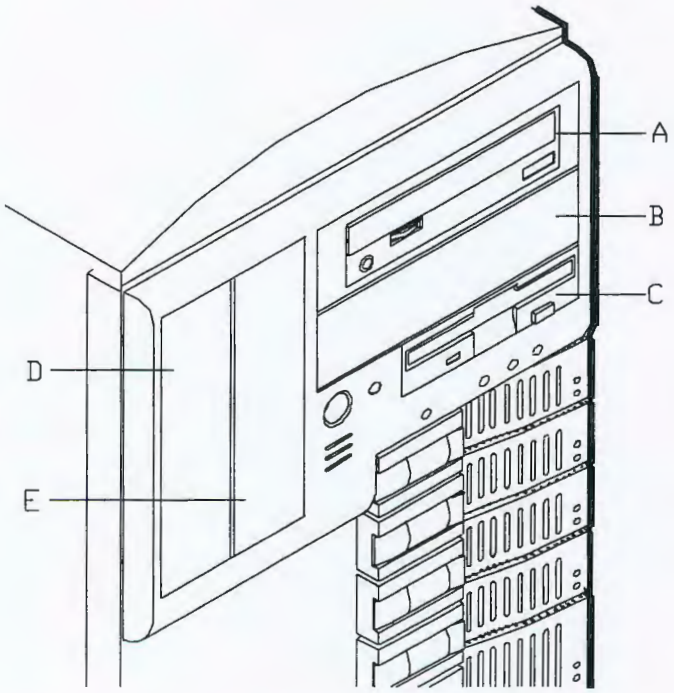


Installing a Disk Carrier into the Bay

9. Close the front door on the system. If necessary, configure the system as described in Chapter 3 "Configuring Your System".

Removable Media Devices

A variety of IDE and SCSI removable media devices can be installed in peripheral bays A, B, C, D, and E. An IDE CD-ROM is always mounted in bay A of the tower system or bay D of the rack system. A 3.5-inch diskette drive is always mounted in bay C. Other devices should be installed in the first available bay from the top (bay B of the tower system or bay E of the rack system). Contact your sales representative or dealer for a list of approved devices.



Locating the Removable Media Devices

If you are adding or removing an IDE removable media device, consider the following:

- The system board contains a single channel IDE controller. The IDE channel supports two IDE devices. Your system includes the IDE interface cable.
- Cable Sense (CS) device configuration is not supported.
- Your system includes a two-connector IDE cable connecting the CD-ROM to the system board primary IDE connector. The CD-ROM that comes with your system is set as the master device. A second IDE connector is available to connect a slave IDE removable media device.
- If only one device is on an IDE channel connector it must be set as the master device.

If adding or removing a SCSI removable media device, consider the following.

- The system board supports an Ultra2 SCSI channel connector that may be used to attach the removable media devices. This SCSI channel supports up to four SCSI devices.
- When installing narrow SCSI devices use a 68 pin to 50 pin converter obtained from your supplier.
- The 68 pin multi mode terminator must be installed as the last device on the Ultra2 SCSI interface cable in order to terminate the SCSI bus properly.
- The optional SCSI tape drive address assignment is 2.

Installing a 5.25-Inch Media Device

⚠ CAUTION

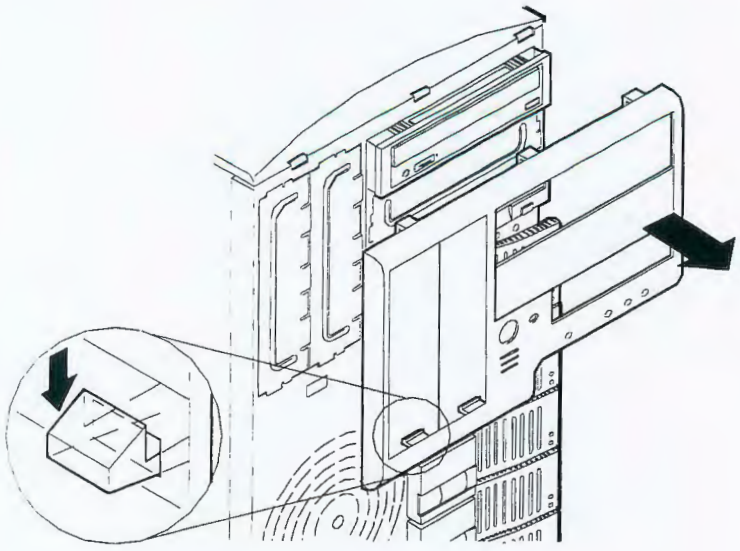
CD-ROM devices contain a laser system and are classified as CLASS 1 LASER PRODUCTS. To use these devices, thoroughly read the documentation provided by the CD-ROM manufacturer, and keep the documentation for future reference. In case of any trouble with a CD-ROM, please contact your nearest service representative. To prevent direct exposure to the laser beam, do not try to open the enclosure. Use of controls or adjustments or performance of procedures other than those specified in the CD-ROM manufacturer's documentation may result in hazardous radiation exposure

1. Power off the system, unplug the system power cords, and remove the appropriate side panel depending upon the bay you are installing the media device in and as described earlier in this chapter.
2. Open the front door as described earlier in this chapter.

⚠ CAUTION

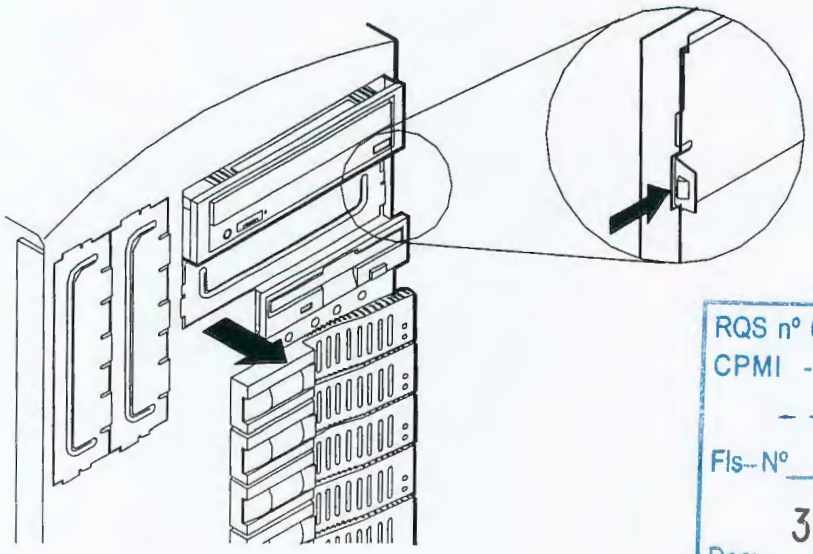
Observe static precautions. Use an antistatic wrist strap.

3. Carefully remove the front system bezel by releasing its two plastic snap tabs on the back of the bezel and pulling it out (see the following figure).



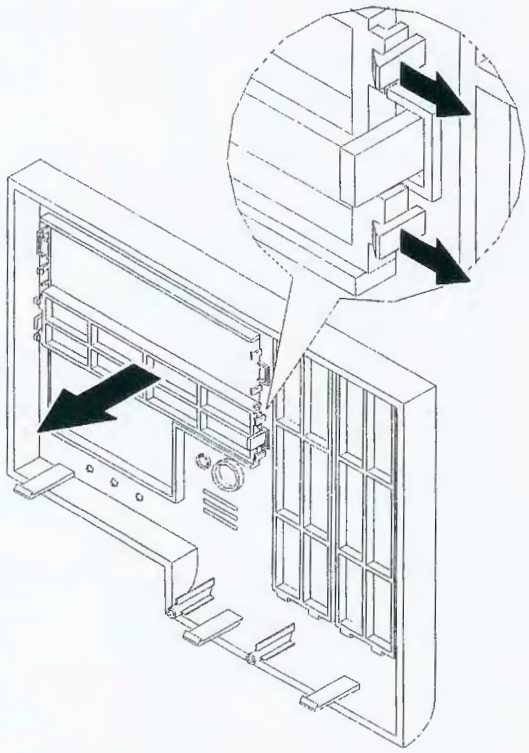
Removing the Front System Bezel

4. Remove the EMI metal shield covering the bay where you are installing a media device, as shown below. The metal shield is removed by pulling on the tabs at the top and bottom of the metal shield.



Removing an EMI Metal Shield

5. Remove the filler panel from the system bezel corresponding to the bay where you are installing a media device, as shown below. The filler panel is released by pressing the plastic snap tabs located on the back of the system bezel. Save the panel for reinstallation.

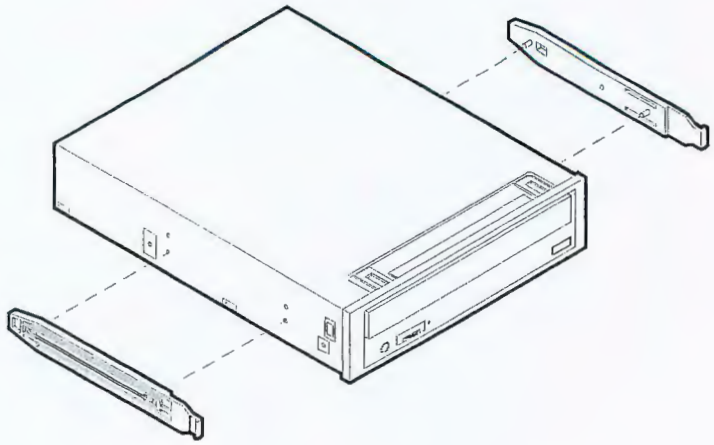


Removing a Filler Panel

6. Remove the device from its protective wrapper and place it on an antistatic surface. Record the drive model and serial number in the equipment log.
7. Set any drive jumpers or switches before you install the drive. See the documentation that comes with the device for jumper or switch information.

> ***Note:*** If the drive comes with drive rails, do not use them. Remove any rails already attached.

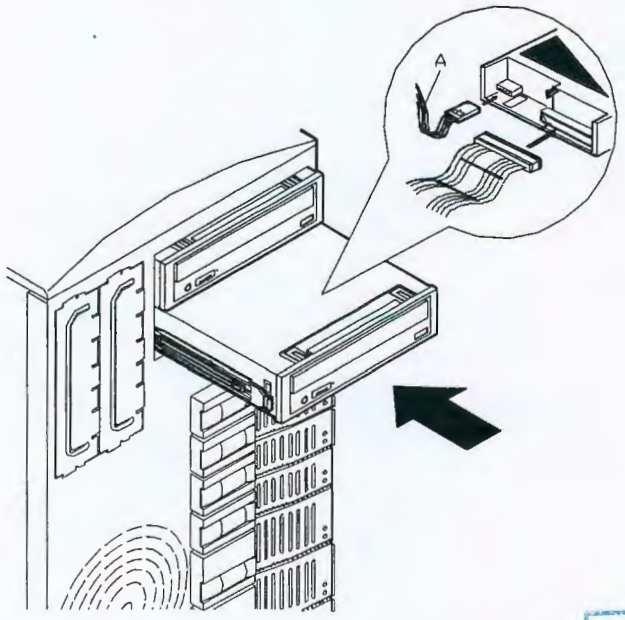
8. Attach the device side rails supplied with the system, as shown in the following figure.



Attaching the Device Side Rails

9. Install the media device into the bay as follows:

- Move any cables in the bay out of the way.
- Align the rails on the media device with the supports in the bay.
- Slide the device into the bay until it locks in place.

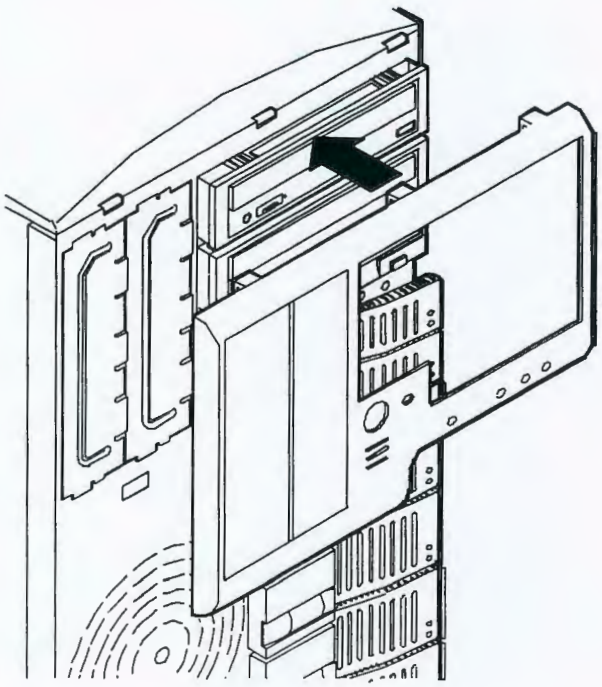


Installing a Removable Media Device

10. Connect the interface and power cables to the device as follows (see the preceding figure).
    - If you are installing a 5 1/4-inch tape drive or other IDE device, align and connect the drive signal cable and the system power cable to their connectors. The cable connector for the 5 1/4-inch device is keyed to fit only in the correct position. The red edge of the cable goes to pin 1 on the cable connector. Align the red edge of the connector with pin 1 (notched end) on the drive connector.
    - If you are installing a SCSI device, connect the SCSI cable and system power cable. Be sure to align the SCSI cable connector with the device connector.

11. Carefully reinstall the front system bezel by inserting its top plastic tabs into the chassis top tab slots and then pushing its bottom portion straight in against the chassis (see Figure below).

12. Close the front door, reinstall the side panel, and power on the system.



Installing the Front System Bezel

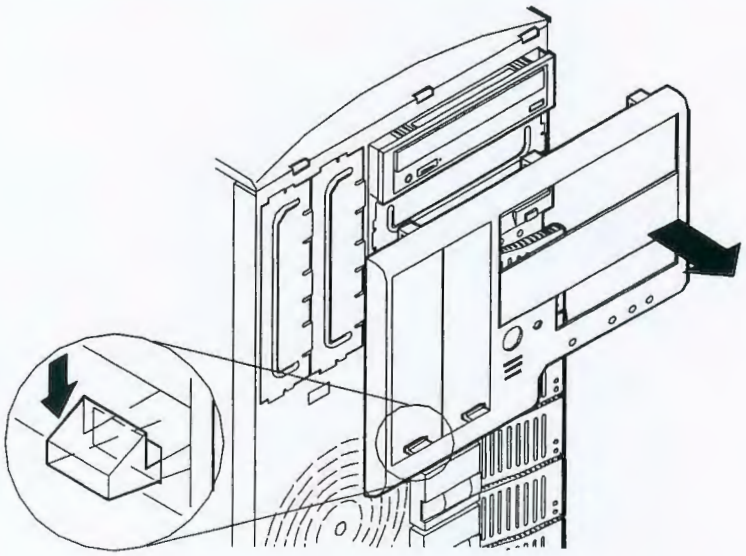
Removing a 5.25-Inch Device

1. Power off the system, unplug the system power cords, and remove the appropriate side panel depending upon the bay you are removing the media device from and as described earlier in this chapter.
2. Open the front door as described earlier in this chapter.
3. Observe static precautions. Use an antistatic wrist strap.

⚠ CAUTION

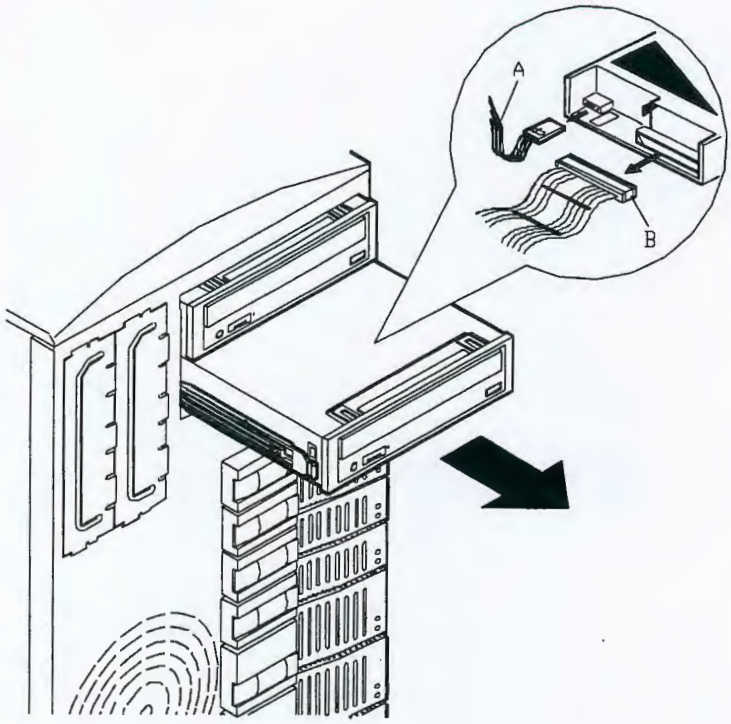
Observe static precautions. Use an antistatic wrist strap.

4. Carefully remove the front system bezel by releasing its two plastic snap tabs on the back of the bezel and pulling it out (see the following figure).



Removing the Front System Bezel

5. Disconnect the power cable (A) and ribbon data cable (B) from the device you are removing.



Removing a Removable Media Device

6. Remove the device from the peripheral bay by pushing in on its drive rail clips and then by pulling the device completely out of the bay (see the above figure).
7. Install an EMI metal shield over the bay area where you removed the peripheral device. The EMI shield is secured by snapping it into place.
8. Install a filler panel in the open area of the system bezel corresponding to the bay where the media device was removed.
9. Replace the side panel and front panel, and power on the system.
10. Remove the drive serial number from the equipment log.

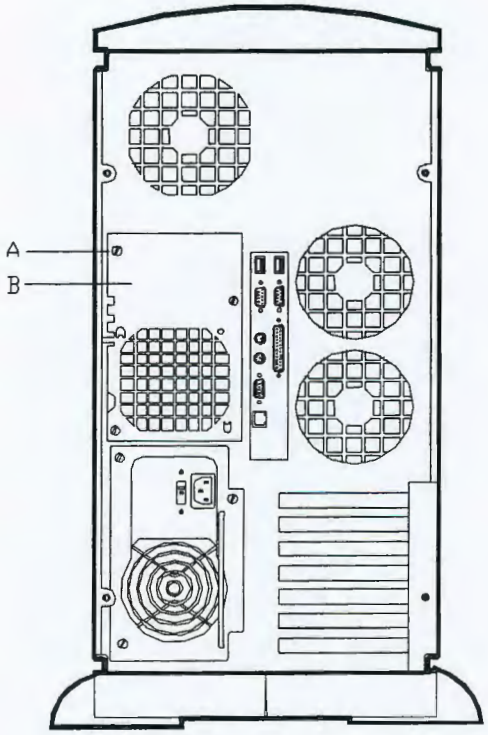
Installing the Redundant Power Supply

This section describes how to install the redundant power supply. With a second power supply installed, the server will have power system redundancy that allows the server to operate with a single power supply failure.

Follow the procedures below to install the redundant power supply:

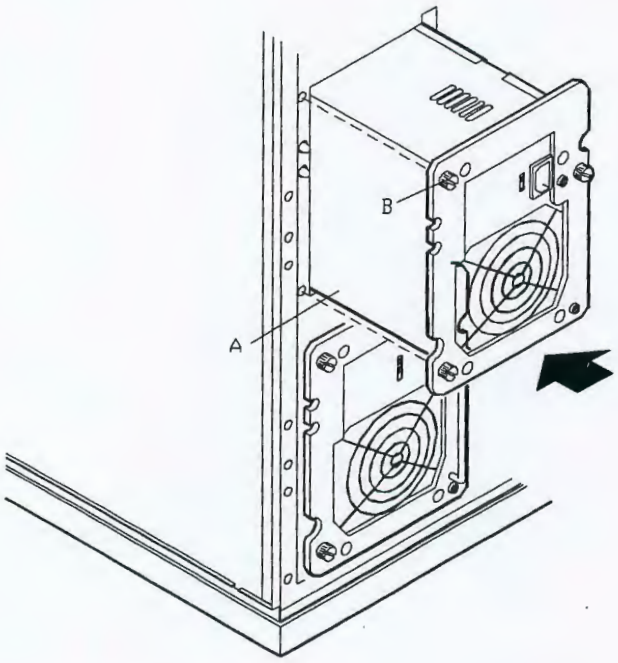
1. Power off the server and unplug the ac power cord on the bottom power supply at the rear of the server.
2. Loosen the three thumbscrews (A) securing the blank panel (B) covering the unoccupied top power supply bay and remove the panel, see the following figure.

> **Note:** The blank panel is no longer needed.



Removing the Blank Panel

3. Slide the new redundant power supply (A) into the top power supply bay until it is fully seated and secure with its three thumbscrews (B), see the following figure.

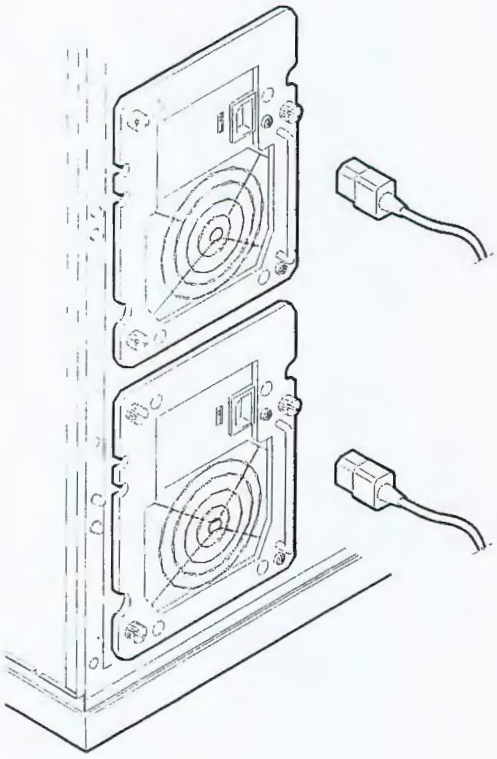


Installing the Redundant Power Supply

4. Slide the selector switch on the back of the new redundant power supply to 115 VAC or to 230 VAC. Refer to Chapter 2, "Setting the Line Voltage" for additional information.

> ***Note:*** Ensure that the new redundant power supply ac power selector switch setting is identical to the setting on the standard power supply located in the bottom power supply bay.

5. Connect an ac power cord from each of the power supplies to an ac power outlet, see the following figure. Refer to "Connecting the Power Cord(s)" in Chapter 2 of this User's Guide.



Plugging in the AC Power Cords

5

Problem Solving

- Problem Solving
- Static Precautions
- Troubleshooting Checklists
- Diagnostic Testing
- Specific Problems and Corrective Actions
- Problems with the Network
- Plug and Play Installation Tips
- BIOS User's Information
- How to Identify BIOS and BMC Revision Levels

Problem Solving

This chapter helps you identify and solve problems that might occur during system installation or while using your system. The first section of this chapter tells you how to reset your system in the event of problems. The next few sections provide troubleshooting checklists and procedural steps that help you isolate specific system problems. The last section includes BIOS, system, and disk status user information.

⚠ WARNING

The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, +5vdc is present on the system board whenever the AC power cord is connected between the system and an AC outlet. Before doing the procedures in this manual, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

⚠ CAUTION

Operating your system with the side panels removed can damage your system components. For proper cooling and airflow, always replace the side panels before powering on your system.

Static Precautions

An electrostatic discharge (ESD) can damage disk drives, option boards, and other components. You can provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground when handling system components.

Electronic devices can be easily damaged by static electricity. To prevent damage, keep them in their protective packaging when they are not installed in your system.

Troubleshooting Checklists

The following subsections provide troubleshooting checklists for problems that occur at initial system startup, when you run new application software, and after the system hardware and software were running correctly.

Initial System Startup

Incorrect installation or configuration usually causes problems that occur at initial system startup. Hardware failure is a less frequent cause. If you have problems during initial system startup, check the following:

- Are the system power cords properly connected to the system and plugged into a NEMA 5-15R outlet (100-120 Vac) or a NEMA 6-15R outlet (200-240 Vac)?
- Is AC power available at the wall outlet?
- Is the power on/off push-button switch on the front panel in the ON position (power on LED should be lit)?
- Are all cables correctly connected and secured?
- Are all the PCI/ISA option boards fully seated in their connector slots on the system board?
- Are all jumpers and switch settings on option boards and peripheral devices correct? If applicable, ensure that there are no conflicts; for example, two option boards sharing the same interrupt.
- Are the processors fully seated in their slots on the system board? Refer to the "Upgrades and Options" chapter for installation instructions?
- Are all DIMMs fully seated and installed correctly? Refer to the "Upgrades and Options" chapter for installation instructions?
- Are all option boards and disk drives installed correctly? Refer to the "Upgrades and Options" chapter.
- Is the system hard disk drive properly formatted or defined?
- Is the operating system properly loaded? Refer to the operating system documentation.
- Are all drivers properly installed? For information about installing drivers, refer to your Network Operating System Configuration Guide.
- Are the configuration settings in BIOS Setup and the Adaptec SCSI Utility correct? For information about running these utilities, refer to the "Configuring Your System" chapter.

If the above items are all correct, but the problem reoccurs, refer to "Additional Troubleshooting Procedures" in this chapter.

Running New Application Software

Problems that occur when you run new application software are usually related to the software. Faulty equipment is much less likely, especially if other software runs correctly. If you have problems while running new application software, check the following:

- Does the system meet the minimum hardware requirements for the software? Refer to the software documentation.
- Is the software an authorized copy? Unauthorized copies often do not work. Obtain an authorized copy of the software.
- If you are running the software from a diskette, is it a good copy?
- If you are running the software from a hard disk drive, is the software correctly installed? Where all necessary procedures followed and files installed?
- If you are running the software from a CD-ROM disk is the disk scratched or dirty?
- Are the correct device drivers installed?
- Is the software correctly configured for the system?
- Are you using the software correctly?
- If other software runs correctly on the system, contact your vendor about the failing software.

If the problems persist with the software, contact the software vendor's customer service representative.

After System Has Been Running Correctly

Problems that occur after the system hardware and software were running correctly often indicate equipment failure. However, many situations that are easy to correct can also cause such problems. If you have problems after the system has been running correctly, check the following.

- If you are running the software from a diskette or CD-ROM, try a new copy of the software.
- If you are running the software from a hard disk drive, try running it from a floppy. If the software runs correctly, there may be a problem with the copy on the hard disk. Reinstall the software on the hard disk drive and try running it again. Make sure all the necessary files are installed.
- If the problem recurs, you may need to reformat the hard disk drive. The hard disk drive, the drive controller, or the system board may be defective.
- If the problems are intermittent, there may be a loose cable, dirt in the keyboard (if keyboard input is incorrect), a marginal power supply, or other random component failures.
- If you suspect that a transient voltage spike, power outage, or brownout might have occurred, reload the software and try running it again. Symptoms of voltage spikes include a flickering video display, unexpected system reboots, and the system not responding to user commands.

> ***Note:*** Voltage spikes can corrupt or destroy data files on the drive. If you are experiencing voltage spikes on the power line, install a surge suppresser between the power outlet and the system power cord.

If the problem recurs after you have checked and corrected all of the above items, refer to "Diagnostic Testing" in this chapter.

Diagnostic Testing

This section provides a more detailed approach to diagnostic testing and identification of a problem and locating its source.

Error Checking

Each time you turn on the system, POST (Power-On-Self-Test) runs automatically and checks the system boards, processors, memory, keyboard, and most installed peripheral devices.

If POST finds an error, it displays an error message. Refer to the *Error Message* section in this chapter for an explanation of each error message.

Troubleshooting Guide

Use the following troubleshooting procedures to help you identify a problem. These general procedures lead you through the following:

- Preparing the system for diagnostic testing
- Monitoring POST while it is running
- Verifying proper operation of key system LEDs
- Confirming loading of the operating system.

Preparing the System for Diagnostic Testing

To prepare the system for diagnostic testing, perform the following:

> **Note:** Before disconnecting any peripheral cables from the system, turn off the system and any external peripheral devices. Failure to do so can cause permanent damage to the system and/or the peripheral devices.

1. Turn off the system and all external peripheral devices. Disconnect all devices from the system except the keyboard and video monitor.
2. Make sure the system power cords are plugged into a properly grounded AC outlet.
3. Make sure your video display monitor and keyboard are correctly connected to the system. Turn on the video monitor. Set its brightness and contrast controls to at least two-thirds of their maximum ranges (refer to the documentation supplied with your video display monitor).
4. If the operating system normally loads from the hard disk drive, make sure there is no diskette in drive A. Otherwise, place a diskette containing the operating system files in drive A.
5. Turn on the system. If the power indicator LED does not light, refer to "Power Light Does Not Light" found later in this chapter.

Each time you turn on the system, the Power-On Self-Test (POST) runs automatically and checks the system board, processor board, memory, keyboard, and most installed peripheral devices.

During the memory test, POST displays the amount of memory that it is able to access and test. Depending on the amount of memory, it may take several minutes to complete the memory test.

Press **F2** to enter SETUP. If you do not press **F2**, the above message remains for a few seconds and the boot process continues.

If POST finds an error, it displays an error message and, in case there is a problem with the display, it emits a series of long and short beeps. Write down any beep code emitted. This information is useful to your service representative.

Refer to the "BIOS User's Information" section in this chapter for a list of items to check for each error code and for an explanation of the error beep codes.

The POST Tests table at the end of this chapter lists keys active during POST and provides a description of errors that may occur.

The BIOS indicates errors by writing an error code to the PS/2-standard logging area in the Extended BIOS Data Area, and by displaying a message on the screen, which is sometimes preceded by the POST Error Code. The error code is logged to the Event Logging area.

Report any error code to your service representative.

POST Keys and Errors

Action/Message	Description
If POST Beeps Before Video Appears	Initialization failed before video initialized. Most beep code errors are fatal; initialization cannot continue. Refer to the section "BIOS User's Information" in this chapter.
If Monitor Displays Error	Note error; press **F1** to continue boot or **F2** to enter Setup. Refer to the section "BIOS User's Information" in this chapter.
To Enter Setup	Setup changes specific options, then writes to CMOS, NVRAM. Press **F2** during initialization to run Setup. If you do not press **F2**, the boot process continues.
Enter BOOT Diskette	If prompted, insert the boot diskette.

Verifying Proper Operation of Key System Indicators

As POST determines the system configuration, it tests for the presence of each mass storage device installed in the system. As each device is checked, its activity indicator should turn on briefly. Check for the following:

- Does the diskette drive activity indicator turn on briefly? If not, refer to "Diskette Drive Activity Indicator Does Not Light" in this chapter.
- If there is a hard disk drive or SCSI devices installed in the system, does the hard disk drive activity indicator turn on briefly? If not, refer to "Hard Disk Drive Activity Indicator Does Not Light" in this chapter.

Confirming Loading of the Operating System

Once the system boots up, the operating system prompt appears on the screen. The prompt varies according to the operating system. If the operating system prompt does not appear, refer to "Problems with Application Software" found later in this chapter.

Specific Problems and Corrective Actions

This section provides possible solutions for the following specific problems.

- Power LED does not light
- No beep or incorrect beep pattern
- No characters appear on screen
- Characters on the screen appear distorted or incorrect
- System cooling fan does not rotate
- Diskette drive activity LED does not light
- Hard disk drive activity LED does not light
- CD-ROM drive activity LED does not light
- Problems with application software
- The startup prompt "Press <F2> key if you want to run Setup" does not appear on the screen.
- The bootable CD-ROM is not detected.

Try the solutions in the order given. If you cannot correct the problem, contact your service representative for assistance.

Power LED Does Not Light

Check the following:

- Is the system operating normally? If so, the power LED is probably defective.
- Are there other problems with the system? If so, check the items listed under System Cooling Fans Do Not Rotate.

Incorrect or No Beep Code

Check the following:

- Is the speaker cable connected to the system board?

If the system operates normally, but there was no beep, the speaker may be defective, contact your service representative for assistance.

Record the beep code emitted by POST, and see the "Messages and Beep Codes" section found later in this chapter.

No Characters Appear on Screen

Check the following:

- Is the keyboard working? Check to see if the **Num Lock** light is functioning.
- Is the video display monitor plugged in and turned on?
- Are the brightness and contrast controls on the video monitor properly adjusted?
- Are the video monitor switch settings correct?
- Is the video monitor signal cable properly installed?
- Is the onboard video controller enabled?

If you are using a video controller board, verify that the video controller board is fully seated in the system board connector.

If there are still no characters on the screen after you reboot the system, contact your service representative or authorized dealer for assistance.

POST emits one long beep and two short beeps pattern to indicate a possible problem with the video display controller. If you do not receive a beep pattern and characters do not display, the video display or video controller may have failed. Contact your service representative or authorized dealer for assistance.

Characters are Distorted or Incorrect

Check the following:

- Are the brightness and contrast controls properly adjusted on the video display? Refer to the documentation supplied with your video display.
- Are the video monitor's signal and power cables properly installed?
- If the problem persists, the video monitor may be faulty or it may be the incorrect type. Contact your service representative for assistance.

System Cooling Fans Do Not Rotate

> **Note:** The system has a cooling fan module (containing three fans) behind the hard disk drives. There are also three fans one directly in front of and two directly behind the system board and another cooling fan that is an integral part of each power supply. There are no serviceable components inside the power supply. If the power supply is opened, the manufacturer's warranty is voided.

Check the following:

- Is AC power available at the wall outlet?
- Are the system power cords properly connected to the power supplies and the AC wall outlets?
- Are the power connectors for the cooling fans connected? See the "Monitor Matrix" table in Appendix C.
- Is the front panel power on indicator lit?

If the switches and connections are correct and the power outlet is functioning, the power supply has probably failed. Contact your service representative for assistance.

Diskette Drive Activity LED Does Not Light

Check the following:

- Are the diskette drive's power and signal cables properly installed?
- Is the diskette drive properly configured?
- Is the diskette drive activity light always on? If so, the signal cable may be plugged in incorrectly.

If you are using the onboard diskette drive controller, use BIOS Setup to make sure that the diskette drive controller is set to Enabled. For information about running BIOS Setup, refer to the "Configuring Your System" chapter.

If the problem persists, there may be a problem with the diskette drive, system board, or drive signal cable. Contact your service representative for assistance.

CD-ROM Drive Activity Light Does Not Light

Check the following:

- Is the power and signal cable to the CD-ROM drive properly installed?
- Are all relevant switches and jumpers on the drive set correctly?
- Is the drive properly configured?
- Is the onboard IDE controller enabled?

Problems with Application Software

If you have problems with application software, perform the following:

- Verify that the software is properly configured for the system. Refer to the software installation and operation documentation for instructions on setting up and using the software.
- Verify a different copy of the software to see if the problem is with the copy that you are using.
- Make sure all cables are installed correctly.
- Verify that the system board jumpers are set correctly. Refer to the "Configuring Your System" chapter for jumper settings.
- If other software runs correctly on the system, contact your vendor about the failing software.

If the problem persists, contact the software vendor's customer service representative for assistance.

Bootable CD-ROM Is Not Detected

Check the following:

- Is the BIOS set to allow the CD-ROM to be the first bootable device? Check your BIOS Setup (F2) configuration.

Problems with the Network

Diagnostics pass, but the connection fails:

- Make sure the network cable is securely attached.

The controller stopped working when an add-in adapter was installed:

- Make sure the cable is connected to the port from the onboard network controller.
- Make sure the other adapter supports shared interrupts. Also, make sure your operating system supports shared interrupts; OS/2 does not.
- Try reseating the add-in adapter.

The add-in adapter stopped working without apparent cause.

- Try reseating the adapter first; then try a different slot if necessary.
- The network driver files may be corrupt or deleted. Delete and then reinstall the drivers.
- Run the diagnostics.

Plug and Play Installation Tips

Some common PCI tips are listed here.

- Reserve interrupts (IRQs) and/or memory addresses specifically for an ISA adapter. This prevents PCI cards from trying to use the same settings an ISA card is using. Use the BIOS Setup Utility to keep track of ISA adapter resources.
- Certain drivers may require interrupts that are not shared with other PCI drivers. The BIOS Setup Utility can be used to adjust the interrupt numbers for PCI devices. For certain drivers, it may be necessary to alter settings so that interrupts are not shared.

BIOS User's Information

This section describes the various screen messages and beep codes of the system BIOS. The BIOS indicates errors by writing an error code to the PS/2-standard logging area in the Extended BIOS Data Area, and by displaying a message on the screen, which is sometimes preceded by the POST Error Code. The error code also logs to the Event Log area.

POST Error Codes and Messages

Whenever a recoverable error occurs during POST, BIOS displays a message on the video display screen and causes the speaker to beep as the message appears. BIOS also issues a beep code (one long tone followed by two short tones) during POST if the video configuration fails or if an external ROM module does not a checksum of zero. The "POST Error Codes and Messages" table is a list of the error codes and messages written at the start of each POST test. The "POST Error Beep Codes" table is a list of beep codes issued for each POST test.

POST Error Codes and Messages

Code	Error Message
0200	Failure Fixed Disk
0210	Stuck Key
0211	Keyboard error
0212	Keyboard Controller Failed
0213	Keyboard locked - Unlock key switch
0220	Monitor type does not match CMOS - Run SETUP
0230	System RAM Failed at offset
0231	Shadow RAM Failed at offset
0232	Extended RAM Failed at address line
0233	Memory type mixing detected
0234	Single-bit ECC error
0235	Multiple-bit ECC error occurred
0250	System battery is dead - Replace and run SETUP
0251	System CMOS checksum bad - Default configuration used
0260	System timer error
0270	Real time clock error
0271	Check date and time
02B0	Diskette drive A error
02B2	Incorrect Drive A type - run SETUP
02D0	System cache error - Cache disabled
0B1B	PCI System Error on Bus/Device/Function
0B1C	PCI Parity Error on Bus/Device/Function
0B30	CPU 1 Fan Alarm occurred
0B31	CPU 2 Fan Alarm occurred
0B32	Chassis Fan Alarm occurred
0B33	Power Unit Fan 1 Alarm occurred
0B34	Power Unit Fan 2 Alarm occurred
0B46	ESMINT not configured
0B50	CPU #1 with error taken off line
0B51	CPU #2 with error taken off line
0B5F	Forced to use CPU with error
0B60	DIMM group #1 has been disabled
0B61	DIMM group #2 has been disabled

POST Error Codes and Messages (Continued)

Code	Error Message
0B62	DIMM group #3 has been disabled
0B63	DIMM group #4 has been disabled
0B6F	DIMM group with error is enabled
0B70	The error occurred during temperature sensor reading
0B71	System Temperature out of range
0B74	The error occurred during voltage sensor reading
0B75	System Voltage out of range
0B7C	The error occurred during fan sensor reading
0B80	BMC Memory Test Failed
0B81	BMC Firmware Code Area CRC check failed
0B82	BMC core hardware failure
0B83	BMC IBF or OBF check failed
0B90	BMC Platform Information Area Corrupted
0B91	BMC update firmware corrupted
0B92	Internal Use Area of BMC FRU corrupted
0B93	BMC SDR Repository empty
0B94	IPMB signal lines do not respond
0B95	BMC FRU device failure
0B96	BMC SDR Repository failure
0B97	BMC SEL device failure
0BB0	SMBIOS - SROM data read error
0BB1	SMBIOS - SROM data checksum bad
0BD0	1st SMBus device address not acknowledged
0BD1	1st SMBus device Error detected
0BD2	1st SMBus timeout
0C00	RomPilot reports error number xx
None	Expansion ROM not initialized
None	Invalid System Configuration Data
None	System Configuration Data Read error
None	Resource Conflict
None	System Configuration Data Write Source
None	NOTICE: Your System Redundant Power Supply is not configured
None	WARNING:IRQ not configured

Post Error Beep Codes

Beeps	Error	Cause	Recommended Action
1-2-2-3	ROM Checksum Error	—	Change system board
1-3-1-1	DRAM Refresh Test Error	—	Change memory DIMM's
1-3-1-3	Keyboard Controller Test Error	—	Change system board
1-3-3-1	Memory Not Detected	No memory.	Verify DIMM installation.
		Can not write to memory	Change memory DIMM's
	Memory Capacity Check Error	No memory.	Verify DIMM installation.
		Can not write to memory	Change memory DIMM's
1-3-4-1	DRAM Address Test Error	Memory address signal failure	Change DIMM or M/B
1-3-4-3	DRAM Test low byte Error	Memory data signal failure (low)	Change DIMM or M/B
1-4-1-1	DRAM Test high byte Error	Memory data signal failure (high)	Change DIMM or M/B
1-4-3-3	All Memory Group Errors	—	—
2-1-2-3	BIOS ROM Copy-Write Test Error	Error with Shadow RAM	Change system board
2-2-3-1	Unexpected Interrupt Test Error	Unexpected interrupt	Change CPU or system board
2-3-1-3	All Memory Group Errors	Memory address signal failure	Change DIMM or M/B
3-3-1-4	Memory Not Detected	—	—
1-2	Option ROM Initialization Error	Failure to initialize Option ROM BIOS	Change system board or option board
1-2	Video configuration fails	Failure to initialize VGA BIOS	Change option video board or system board
1-2	OPTION ROM Checksum Error	Failure to initialize Option BIOS	Change M/B or option board

How to Identify BIOS and BMC Revision Levels

To help you identify your system's current BIOS and BMC revision levels, refer to the following subsections.

BIOS Revision Level Identification

During system Power-On Self Test (POST), which runs automatically when your system is powered on, your system monitor displays several messages, one of which identifies the BIOS revision level currently loaded on your system, see the example below.

> ***Note:*** Press the **Esc** key to see the diagnostic messages.

Example: BIOS Revision Level

Phoenix BIOS 4.0 Release 6.0.250A

In the example above, BIOS 6.0.250A is the current BIOS revision level loaded on your system.

> ***Note:*** The BIOS Revision Level stated in the example may not reflect the actual BIOS setting in your system.

BMC Revision Level Identification

During system Power-On Self Test (POST), which runs automatically when your system is powered on, system diagnostics are run. Following the memory test diagnostic, several messages will appear informing you that the mouse was detected and system configuration data updated, when you see these messages the BMC messages are displayed next.

> ***Note:*** Press the **Esc** key to see the diagnostic messages.

To identify your system's current BMC revision level, see the example below.

Example: BMC Messages

Base Board Management Controller

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Device ID	**:01**	**Device Revision**	**:00**
IPMI Version	**:1.0**	**Firmware Revision**	**:00.60**

Self Test Result :

In the example above, Firmware Revision 00.60 is the current BMC revision level loaded on your system.

> ***Note:*** The Firmware Revision Level stated in the example may not reflect the actual BMC revision level setting in your system.

A

System Cabling

- System Cabling
- Before You Begin
- Static Precautions
- Standard Configuration
- RAID Configuration

System Cabling

This appendix contains information and procedures on cabling configurations used in your system.

The cabling configurations include:

- Standard Configuration
- RAID Configuration.

Before You Begin

⚠ WARNING

The DC push-button on/off switch on the front panel does not turn off the system AC power. Also, +5vdc is present on the system board whenever the AC power cords are connected between the system and an AC outlet. Before doing the procedures in this manual, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.

Static Precautions

An electrostatic discharge (ESD) can damage disk drives, option boards, and other components. You can provide ESD protection by wearing an antistatic wrist strap attached to chassis ground when handling system components.

Electronic devices can be easily damaged by static electricity. To prevent damage, keep them in their protective packaging when they are not installed in your system.

Standard Configuration

Your system is cabled using a single channel on-board IDE Controller and dual channel on-board Adaptec 7899 SCSI Controller.

The on-board IDE controller supports the standard internally mounted CD-ROM as its master device. If only one device is on a channel connector it must be set as the master device.

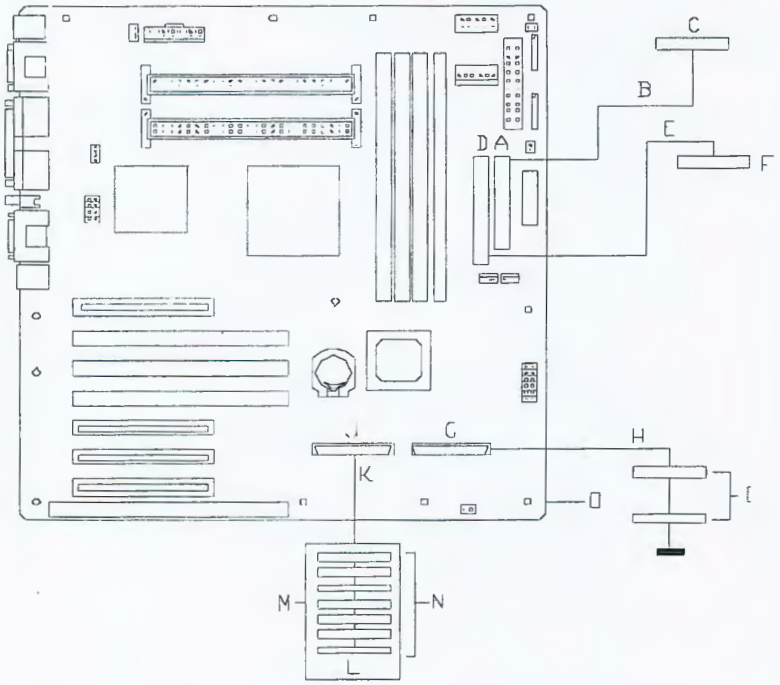
The AIC 7899 contains two independent SCSI channels that share a single PCI bus master interface. Each channel is capable of operations using either 8- or 16-bit SCSI providing 160 MB/s (Ultra-160/M) or 80 MB/s (Wide Ultra2) throughput. As implemented on the system board controller A attaches to an Ultra-160/M SCSI backplane that supports up to seven 160/M SCA drives. Controller B can be used to support SCSI devices in the removable media bays. A 68 pin to 50 pin converter is also available to be used when installing SCSI narrow devices.

A 3.5-inch diskette drive is also installed in all systems and interfaces separately to the system board.

Referring to the Figure below, a 68-pin Ultra-160/M SCSI interface cable (K) is connected to the SCSI connector (J) on the middle right edge of the system board. This cable connects to the rear of the hard disk drive's SCSI backplane (L).

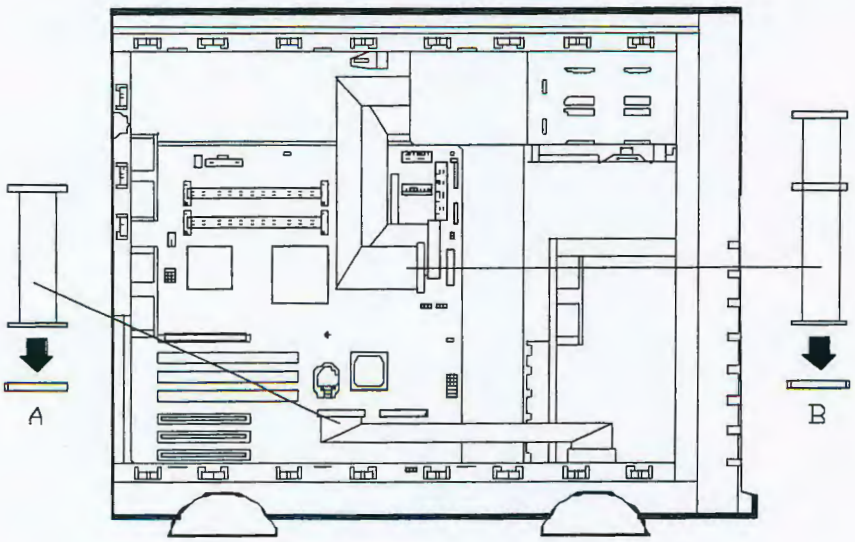
The IDE interface cable (E) is connected to the IDE connector (D) towards the middle right edge of the system board. This cable connects to the rear of the internally mounted CD-ROM drive (F).

Optional internally mounted SCSI removable media devices (I) may be connected to the SCSI controller connector (G).



A – Diskette drive connector
B – Diskette interface cable
C – Diskette drive
D – IDE connector
E – IDE interface cable
F – IDE CD-ROM drive
G – Ultra2 SCSI connector (68 pin)
H – Ultra2 SCSI interface cable
I – Optional SCSI removable media devices
J – Ultra-160/M SCSI connector (68 pin)
K – Ultra-160/M SCSI interface cable
L – Seven SCSI disk drive bays
M – SCSI backplane
N – SCSI hard disk drives
O – System board

Standard System Cable Configuration



A – Ultra-160/M SCSI cable (68 pins) **B** – IDE cable (40 pins)

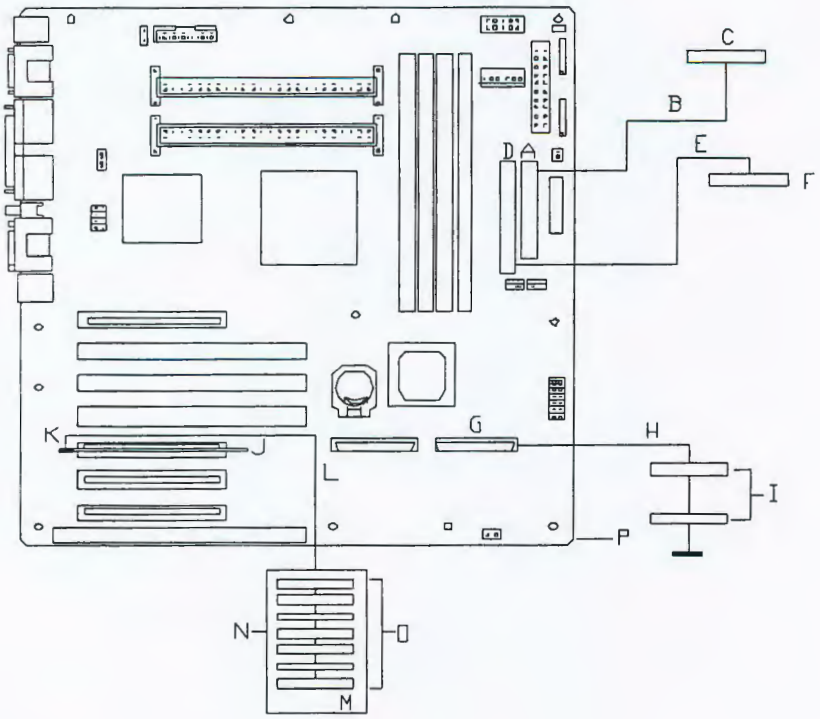
Standard System Cable Routing

RAID Configuration

The RAID options available for your system provide your system with the added security of fault tolerance.

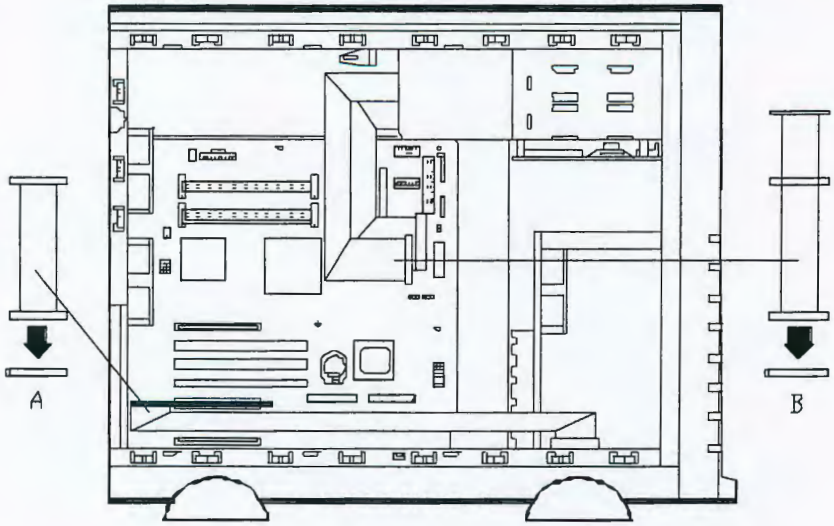
If you order a system with a RAID controller, the system is pre-cabled at the factory (see "RAID System Cabling Configuration" figures below.)

If you are adding a RAID controller you must install, cable, and configure the controller. Refer to "Installing a RAID Controller Board" in Chapter 4.



A – Diskette drive connector
B – Diskette interface cable
C – Diskette drive
D – IDE connector
E – IDE interface cable
F – IDE CD-ROM drive
G – Ultra2 SCSI connector (68 pin)
H – Ultra2 SCSI interface cable
I – Optional SCSI removable media devices
J – RAID controller
K – Ultra-160/M SCSI connector (68 pin)
L – Ultra-160/M SCSI interface cable
M – Seven SCSI disk drive bays
N – SCSI hard disk drives
O – SCSI backplane
P – System board

RAID System Cable Configuration



A – Ultra-160/M SCSI cable (68 pins) **B** – IDE cable (40 pins)

RAID System Cable Routing

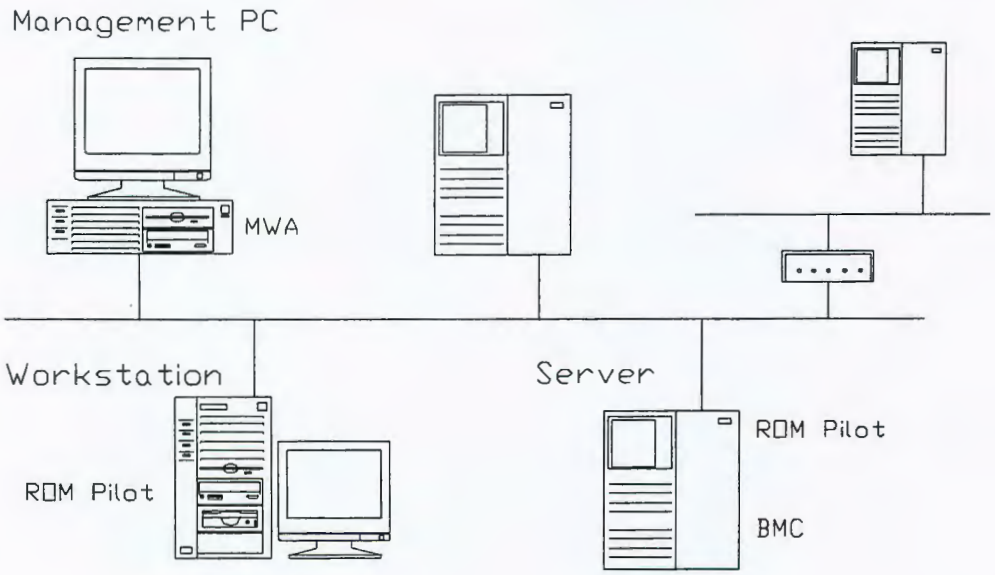
B

Management Workstation Application

- Overview
- MWA System Requirements
- Installing MWA
- MWA Main Window
- Using MWA
- Dialog Boxes
- Troubleshooting

Overview

Management Workstation Application (MWA) is an application used for remote server management in a network environment. The managed server may be remotely accessed from a management PC (the computer in which ESMPRO™ operates). MWA is a pre-boot management application in that the managed server is accessed prior to loading the server operating system.



The following server operations are available from a management PC running MWA software:

- **Remote console control.** This function enables you to see the screen of a server from the console of the management PC and to key in data to the server from the keyboard of the management PC
- **Remote drive access.** This function enables a server to access a floppy disk drive on the management PC. A server can also be booted from the floppy disk on the management PC.
- **SOS recovery.** If a SOS message is received from a server, MWA receives the fault information and sends the necessary instructions to the server for recovery.
- **Alert to ESMPRO™** . If MWA receives an alert message from a server, it sends this message to ESMPRO™ AlertManager.
- **Power cycling**. This function enables powering the server OFF and ON.
- **Reset control.** This function enables reset of the server.
- **Event Log retrieval.** All event log data recorded in the server is retrieved by the management PC.

Remote Console

Remote console enables the user to view the screen of a server or key in data to the server from the keyboard of the management PC as if operating the keyboard of the server. When a server is connected to MWA, the remote console function allows the server screen to display in the server window.

Remote Drive

Remote drive allows a server to access the diskette drive on the management PC or a FD image file as if it were the drive on the server.

> **Note:** A FD image file is copied and saved from a floppy disk. This file can be used instead of a floppy disk as a remote drive for a server.

A server can also be booted from a floppy disk on the management PC. When the remote drive function is in use, [RD] is displayed at the title bar of the server window. In this case diskette drive A on a server is allocated as a remote drive. Therefore, the floppy disk drive of the server itself cannot be used while the remote drive function is in use.

MWA System Requirements

This section outlines the management PC requirements necessary for using MWA.

Operating Systems

- Windows 95 / Windows 98 / Windows NT 4.0 or later
- More than 3MB of free RAM
- More than 5MB of disk space
- ESMPRO Version 3.22 or later.
- TCP/IP Network.

Managed Server

- Servers managed by MWA must support the RomPilot extended BIOS.

Installing MWA

To use MWA several procedures must be performed to configure the managed server and the management PC. For ease of installation these procedures should be performed in the order presented in the following sections. Installation procedures include procedures to be performed at the server and at the management PC.

Server Procedures

- Create a server system generation diskette (SG) containing essential server networking information.
- Run the BIOS Setup Utility making the changes to BIOS necessary for server acceptance of MWA support.

Management PC Procedures

- Install MWA software on the management PC.
- Configure and register SG information within MWA at the management PC.

Creating a Server System Generation Diskette (SG)

For the management PC to connect with a server, server system generation (SG) information must be configured and registered on MWA software running on the management PC.

In this procedure you will create a diskette containing your server's SG information. In the following section, you will register the SG information with MWA.

1. Prepare a floppy disk, formatted with MS-DOS.
2. Insert the EXPRESSBUILDER CD in the server's CD-ROM drive, and boot the server from the CD. The EXPRESSBUILDER menu displays.
3. Select **Custom Setup**.
4. Select **System Management**.
5. Select **Network Setup**. The Network setup program starts.
6. Insert the floppy disk prepared in step 1 into the server's diskette drive and press the **ESC** key.

7. Set the SG information as follows. (The items with * marks must be entered.)

   - Computer Name*
     Enter the server name.
   - IP Address*
     Enter the IP address of the server.
   - Subnet Mask*
     Enter the subnet mask of the server.
   - Default Gateway*
     Enter the IP address of the default gateway on the network.
   - Management PC (1)(3)'s IP*
     Enter the IP address of the management PC with MWA installed. (1)(3) shows priority.
   - Pass-phrase*
     Enter the pass-phrase that is used for communication between server - RomPilot and management PC - MWA.
   - Community Name (SMC supported servers)
     Enter a key for authentication used between server SMC and management PC - MWA (community name for SNMP trap). Default value is public.
   - Magic Number (SMC supported servers)
     Enter code key that is used between server - SMC and management PC - MWA.
   - Recovery Mode (SMC supported servers)
     Select automatic or manual.
     If automatic is selected, SMC automatically executes recovery processing when a fault occurs. It will be accepted as an instruction from MWA.
   - SOS Alert (SMC supported servers)
     Select SOS Alert enabled or disabled.
     If disabled is selected, SMC will not send an SOS message to MWA when a fault occurs.

8. Select **Save Setting**. SG information is saved on the floppy disk. You will need this floppy disk (called the SG information FD) to register the server on the management PC MWA.

Note: For details on Network setup, see EXPRESSBUILDER online help.

Configuring Server BIOS Setup

To use MWA, you must configure the server's BIOS with three specific settings enabled. These settings take place in Advanced Menu and the Hardware Menu of the BIOS Setup. (Refer to Chapter 3, "Configuring Your System," for BIOS Setup information.) The following table shows the settings that must be enabled to use MWA.

Settings

Menu Parameter Name	Required Setting for MWA
ADVANCED MENU	
Advanced Press **Enter** for menu.	
ROMPilot Support	Enabled
Peripheral Configuration Press **Enter** for menu.	
LAN controller	Enabled
SYSTEM HARDWARE MENU	
Wake On LAN	Enabled

Installing MWA on the Management PC

To Install MWA on the management PC perform the following procedure.

1. Start Windows95 / Windows 98 / or Windows NT on the management PC.
2. Insert the EXPRESSBUILDER CD into the PC CD-ROM drive.
3. Using Explorer, execute "setup.exe" in MWA folder of the CD-ROM. MWA installer will start.
4. Follow MWA installer instructions.

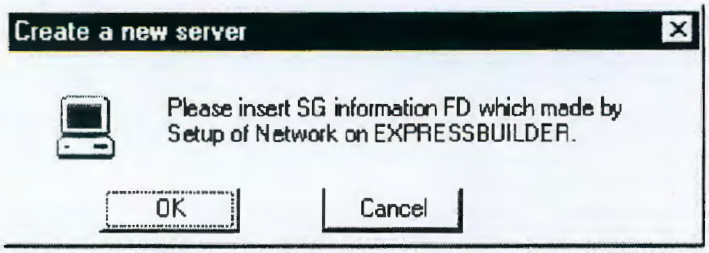
> ***Note:*** MWA will be registered in the Startup folder after installation, and started automatically when an OS start (Log in) is initiated.

Registering SG Information on MWA

In order for MWA to connect with a server, the server system generation information (SG) must be set and registered on MWA.

In this procedure SG information is registered on MWA from the server System Generation diskette (SG) created in the section *Creating a Server System Generation diskette (SG).*

1. Run MWA on the management PC and select the New SG command from File menu. The *Create a New Server* dialog box displays.



2. Insert the SG Information floppy disk into the management PC diskette drive.
3. Select OK. Server SG information is registered on MWA.

MWA Main Window

The MWA main window provides a graphical user interface (GUI) to access server control operations and to launch the management plug-ins. At the top of the GUI is the menu and tool bar. These provide the options to initiate plug-ins and other support features. A status bar at the bottom displays connection information like server name, line status, and mode.

Toolbar

The tool bar buttons of MWA main window combine server control and management plug-in options available from the Connect and Action menus as follows.

Open - The Open command opens a server window for a specified server.

Connect - The Connect command connects a current server.

Disconnect - The Disconnect command disconnects a current server.

Pause POST - The "Pause POST" command will pause to the server in the middle of POST if selected when the current server is executing POST.

To resume POST, select the Go to End of POST command, the Go (MWA mode) command, or the Go (No MWA mode) command.

Go to End of POST - The "Go to End of POST" command will pause the server at the end of POST if selected when the current server is executing POST.

To resume booting, select MWA mode command or the No MWA mode command.

MWA mode - When MWA mode command is selected when POST is paused, the server resumes POST and executes booting in MWA mode.

No MWA mode - If the No MWA mode command is selected when POST is paused, the server resumes POST and executes booting in No MWA mode.

Main Menu

MWA Main menu has the following menus.

File

- New SG: registers server system generation (SG) information. This command requires the SG information floppy disk described in mwa_sg_svr.. Registering SG Information on MWA. When this command is selected, the Create a new server dialog box displays. Insert the floppy disk and click the OK button. If the IP address in a new server SG information exists in an old server SG information; the old information is updated. Once the registration has been completed, the server SG information is saved as (IP address).rp file. MWA can be connected only to servers registered using the New SG command.
- Open: opens a server window for a specified server. The Open a Server dialog box lists SG-registered servers on MWA. Select a server to operate.
- Close: closes the active server window and disconnects the server.
- Delete: deletes the SG information for the selected server.
- Write back SG: saves server SG information on a floppy disk. The SG information can be set again using the floppy disk. When this command is selected, the Write back a server dialog box displays. Insert a formatted floppy disk and select the OK button. Then, select a server from the server list. SG information for only one server can be saved on a floppy disk because the server SG information for all files is saved under the same name.
- Properties: displays or set properties for the current server. If no servers are in operation, the Select a Server dialog box opens. Select a server to change its properties. In the Server Properties dialog box, view or set necessary information.
- Defaults: allows you to view and set basic properties for all servers in the Default Server Properties dialog box. If [Use Default Settings] is checked in the Server Properties dialog box, server properties are set to the values specified in the Default Server Properties dialog box.
- Configure: changes MWA configuration in the Configure dialog box. Timer counts for no response detected. After connecting to a server, MWA sometimes cannot receive any response from the server because the server is busy. If the server responds within specified timer count, MWA does not close communication. Increase the timer count if you expect the server to be busy for a long time. The default is 300 seconds.
- Server Monitor: enables or disables the monitor for servers. The server monitor continually monitors server status using PING or RPC even when MWA is not connected to the servers. The status of the current server is displayed in the status bar. When the server monitor is enabled, a check mark appears next to the menu item.

- Exit: terminates MWA and closes the connections to all servers.

View

- Toolbar: displays or hides the toolbar. The toolbar includes buttons for some of the most common commands in MWA, such as the Open command. When the toolbar is displayed, a check mark appears next to the menu item.
- Status Bar: displays or hides the status bar. The status bar describes the action to be executed by the selected menu item or depressed toolbar button, and information on the current server. When the status bar is displayed, a check mark appears next to the menu item.
- Summary: opens or closes the Server Summary dialog box. The Server Summary dialog box displays the IP addresses, server names, and current statuses of all the SG-registered servers on MWA. When the Server Summary dialog box is open, a check mark appears next to the menu item.
- History Log: opens or closes the History Log dialog box. The History Log dialog box displays server communications, operator commands, and other events in chronological order. When the Delete button is selected, the Delete Logged Messages dialog box displays. The operator can delete all or part of the log. When the History Log dialog box is open, a check mark appears next to the menu item.

Reset/Reboot

- Cold Reset: executes a cold reset on a current server.
- Warm Reset: command executes a warm reset on a current server. Some types of servers have been set such that a cold reset is executed by the Warm Reset command. For details, refer to the users guide for the managed machine.
- Wake-up: activates a server whose power is off. The Wake-Up command is executed normally under the following conditions. MWA knows the server MAC address as the server has been connected with MWA more than once. OS was terminated normally the last time server was active.
- Pause at Next Connect: specifies whether to pause POST when a current server is connected the next time. When pause is set, a check mark appears next to the menu item. Note that this setting is valid only when the server is connected the next time and not for later connections.

Data

- CMOS: displays the CMOS data of a current server in the Data dialog box. The data can be read only when the server is paused at the end of POST.
- ESCD: displays the ESCD data of a current server in the Data dialog box.
- DMI: displays the DMI data of a current server in the Data dialog box. The data can be read only when the server is paused at the end of POST.
- PCI: When the Read button is selected in the PCI Information dialog box, the PCI information of a current server is displayed. The information includes a bus number, a device number and a function number of each device name and so on.

Window

- Cascade: command arranges the opened windows in an overlapping fashion.
- Tile: arranges the opened windows in a non-overlapping fashion.
- Arrange Icons: arranges icons for minimized windows at the bottom of the main window. If there is an open window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this window.
- Server Window Names 1,2: MWA displays a list of currently opened server windows at the bottom of the Window menu. A check mark appears in front of the current server window name. Select a server window to activate.

Pop-Up Menus

Clicking the right mouse button in a server window displays a Pop-up menu. From this menu, you can execute main commands on the current server.

- Connect command: connects the current server to the management PC. Once the server has been connected, [Connected] is displayed in the title bar and the server screen displays in the server window.
- Disconnect command: closes the connection to a current server. Once the server has been disconnected, [Not Connected] is displayed in the title bar.
- Change Remote Drive command: temporarily changes the remote drive of a current server. This command can be executed only when a remote drive is in use. Set the necessary information in the Temporary Change to Remote Drive dialog box. This command does not update the server properties. The setting becomes invalid when the server is disconnected.HIDD_CHGDISK
- Pause POST command: pauses the server in the middle of POST when the current server is executing POST. To resume POST, select the Go to End of POST command, then select Go (MWA mode) command, or the Go (No MWA mode) command.HID_GO_ENDPOST
- Go to End of POST command: pauses the server at the end of POST when the current server is executing POST. To resume booting, select the Go (MWA mode) command or the Go (No MWA mode) command.
- Go (MWA mode) command: when the Go (MWA mode) command is selected when POST is paused, the server resumes POST and executes booting in MWA mode.
- Go (No MWA mode) command: If the Go (No MWA mode) command is selected when POST is paused, the server resumes POST and executes booting in No MWA mode.
- Restore Final Screen command: displays the remote console screen as it appeared immediately before the server was disconnected. This command becomes valid after the server is disconnected.
- Clear Screen command: clears the remote console display. This command becomes valid after the server is disconnected.
- Server Summary Pop-up menu: Position the cursor on a server record in the Server Summary dialog box and click the right button to display the Server Summary Pop-up menu. From this menu, can execute main commands on the server.

Using MWA

Opening a Server Window

To remotely access a managed server from the management PC using MWA, you must open a server management window for the server. You can then issue commands to the server and make various settings though this window.

There are two ways to open a server window:

- **Using a command.** Select Open from the File menu. The Select a Server dialog box displays. Select the server you want to remotely access.
- **Automatic connection.** If a server is set for automatic connection, MWA opens a server window and connects to the server when a notification is received from the server. Refer to *Connection and Disconnection* in the next section.

Connecting and Disconnecting the Server

MWA is a pre-boot management application. MWA can be connected to a server only from the time the server is powered on or reset until the operating system is booted in the server. Once a server is connected, the remote control function displays the server screen in the server window at the management PC. Most MWA functions can be executed only when a server is connected.

Connect to a server as follows:

- **Connect command.** Select Connect from the Pop-up menu in the server window.
- **Setting automatic connection.** Select Properties from the Pop-up menu in the server window. The Server Properties dialog box displays. Check [Activate] for RESET or POST Error alert on the Alert page. After this setting is made, MWA will automatically connect to the server each time a specified alert is reported from the server.

Disconnect a server from the management PC using one of the following commands:

- **Disconnect command.** Select Disconnect from the Pop-up menu in the server window.
- **Close command.** Close from the File menu closes the active server window and closes the connection to the server.
- **Exit command.** Exit from the File menu terminates MWA and closes the connections to all servers.
- **Server reset or reboot.** When a server is reset, its connection to MWA is closed. If automatic connection is set for the server, the server is connected again.

Using a Remote Drive

When a remote drive is in use, [RD] displays in the title bar of the server window. To connect to a remote drive, perform the following steps:

1. Select Properties from the Pop-up menu in the server window to open the Server Properties dialog box. Select the Remote Drive page.
2. At the Remote Drive page, select the remote drive to use. Select [Floppy A:] or [FD Image File]. If [FD Image File] is selected, enter the file name of the FD image. The FD image file should be created in advance.

> **Note:** If [Read Only] is checked, a FD image file can be used in some servers.

To change the remote drive FD image file:

1. Select the Change Remote Drive command from the Pop-up menu in the server window. The Temporary Change to Remote Drive dialog box opens.
2. Select [Floppy A:] or [FD Image File]. If [FD Image File] is selected, enter a file name.

> **Note:** If [Read Only] is checked, a FD image file can be used in some servers.

> **Note:** The Server must be reset after a remote drive is used in the server.

Setting and Clearing Server Pause

MWA can pause server processing during or at the end of the server Power On Self Test (POST.)

Set a server pause as follows:

- **Pause command.** During server POST, select Pause POST from the Pop-up menu in the server window. The server pauses immediately. When the Go to End of POST command is executed, the server pauses again after completing the POST.
- **Pause at Next Connect command.** To set pause at the next server connection, select the Pause at Next Connect command from the Pop-up menu in the server window. When pause is set, a check mark appears next to the menu item.
- **Pause at POST error command.** Select Properties from the Pop-up menu in the server window to open the Server Properties dialog box. Check [Activate] for POST error alert on the Alert page. When MWA receives this alert message from the server, MWA connects to the server and the server POST pauses.

Clear a server pause to resume processing as follows:

- **Go command.** To resume server processing, select the Go (MWA mode) command or the Go (No MWA mode) command from the Pop-up menu in the server window.

A server pause is also cleared in the following ways:

- Time-out reset
- If there is no communication between MWA and a disconnected server for five minutes or longer, the server is automatically reset.

Recovering from an SOS

If a fault is detected, a server that includes a system management controller (SMC), SMC transmits an SOS message to the management PC. When this SOS message is received, MWA opens an SOS Receive dialog box to display the SMC event log and other information.

The server recovery method depends on the recovery mode of each server.

- **Automatic recovery mode.** If an SOS message is received from a server, MWA displays the server information in an SOS Receive dialog box but does not accept a server recovery instruction from the operator. The server automatically executes recovery processing, such as reset.
- **Manual recovery mode.** If an SOS message is received from a server, MWA displays the server information in an SOS Receive dialog box and waits for a server recovery instruction from the user. Make an appropriate instruction in the dialog box.

Note: If SOS Alert is disabled in [Setup of Network] in the server, the server does not send SOS message to MWA.

Alerting ESMPRO™

If MWA receives an alert message from a server, it sends this message to ESMPRO™ AlertManager. Alert types from MWA to ESMPRO are as follows.

- Alerts from the server RomPilot

  System Reset

  *POST stalled (Reset by POST stalled)

  *SMI stalled (Reset by SMI stalled)

  *Boot failed (Reset by boot failed)

  POST end (Booting)

  POST error

  Security breach attempted

- Alert from the server System Management Controller (SMC)

  Sensor limit alarm

  CPU missing

  POST stalled

  SMI handler alarm

  SMI handler stall

* Not supported by some server models.

Dialog Boxes

Select a Server Dialog Box

The Select a server dialog box displays a list of SG-registered servers on MWA.

Server Properties Dialog Box

From the Server Properties dialog box you can view and set properties for the current server. The contents of the server properties are as follows:

- **ID page.** Provides server identification information, such as a server name, an IP address, a MAC address, and a UUID.
- **Alert page.** Sets MWA operation for each type of alert which comes from a server.
- **[Sound] is checked.** MWA beeps when an alert is received from a server. The server window of the server becomes active.

- **[Activate] is checked.** When an alert is received from a server, the window of the server becomes active. If [Activate] is checked for RESET or POST Error alert, MWA attempts to connect to the server. If [Use Default Settings] is checked, this property is set to the values set by the Defaults command.
- **Remote Drive page.** A remote drive can be set for a server.
- **[None] is check.** A remote drive is disabled. Server's local drive can be used.
- **[Floppy A:] is checked.** A floppy disk drive on the management PC becomes a remote drive for the server.
- **[FD Image File:] is checked.** A specified FD image file in the management PC becomes a remote drive for the server. If an image file is set as a remote drive, click the Create/Copy Image File button to display the Create/Copy Image File dialog box. From there you can create an image file or copy one to a floppy disk. If [Read Only] is checked, one FD image file can be used by more than one server. If [Use Default Settings] is checked, this property is set to the value set by the Defaults command.

Default Server Properties Dialog Box

From the Default Server Properties dialog box you can view and set basic properties of all servers. If [Use Default Settings] in the Server Properties dialog box is checked, the server property is set to the values set by the Defaults command.

- **Alert page.** Set MWA operation for each type of alert from a server.
- **[Sound] check.** MWA beeps when an alert is received from a server. The server window of the server becomes active.
- **[Activate] check.** When an alert is received from a server, the window of the server becomes active. If [Activate] is checked for RESET or POST Error alert, MWA attempts to connect to the server.
- **Remote Drive page.** A remote drive can be set for servers.
- **[None] check.** A remote drive is disabled. Server's local drive can be used.
- **[Floppy A:] check.** A floppy disk drive on the management PC becomes a remote drive for the server.
- **[FD Image File:] check.** A specified FD image file in the management PC becomes a remote drive for the server. If a FD image file is set as a remote drive, click the Create/Copy FD Image File button to display the Create/Copy FD Image File dialog box where you can create an FD image file or copy one to a floppy disk. If [Read Only] is checked, one FD image file can be used on multi servers.

Create/Copy FD Image File Dialog Box

The Create/Copy FD Image File dialog box is used to create a FD image file as a remote drive or to copy the contents of a FD image file onto a floppy disk. Select an operation to execute.

Server Summary Dialog Box

The Server Summary dialog box lists IP addresses, server names, and current status of all the SG-registered servers on MWA. This dialog box also allows the following operations:

- **Activating a server window.** Double-click on a server record to open and activate the server window for the server.
- **Executing a command on the server.** Click the right-mouse button on a server record to display the Server Summary Pop-up menu. From this menu, you can execute main commands, such as Open, Connect, and Properties on the server.

Delete Logged Messages Dialog Box

The Delete Logged Messages Dialog Box sets conditions for deleting logged messages from the history log.

- **Delete history timed at xx/xx/xx xx:xx:xx and earlier.** If a logged message is selected in the History Log dialog box, a condition for deletion can be set for messages of the same date and time and earlier. The condition becomes invalid after deletion.

  If [Server xxx:xxx:xxx:xxx only] is checked, only the messages of the specified server are deleted.

  If [General (Non-server) messages only] is checked, the messages not dependent on the server, such as Started MWA, are deleted.

  If [All messages] is checked, all the messages at the specified date and time and earlier are deleted.

- **Automatically Delete messages.** These conditions of deletion are stored and remain valid.

  If [Keep only messages less than xx days old] is checked, messages within the specified number of days from the current day are kept and other messages are deleted automatically.

  If [Keep only the xx most recent messages] is checked, the specified number of recent messages are kept and other messages are deleted automatically.

  This Automatic Deleting process is executed when the OK button is selected in the dialog box, MWA is started, and MWA is exited.

Data Dialog Box

The Data dialog box displays the CMOS, ESCD, or DMI data of a server. This dialog box also allows the following operations.

- **Compare Current Data.** The previously acquired data of the current server is compared with the present data of the server, the previously acquired data of another server, or file data.

  To compare with the data of another server, select a server in the Select a server dialog box. If an error is detected by this comparison, the Data Differences dialog box displays the compared data.

- **Read Data from Server.** The present data of the current server is acquired and displayed. The Save As button is used to save the acquired data in a file.

Temporary Change to Remote Drive Dialog Box

The Temporary Change to Remote Drive dialog box changes a remote drive for a server temporarily.

If [Floppy A:] is checked, a floppy disk drive on MWA-active management PC becomes a remote drive for the server.

If [FD Image File:] is checked, a specified FD image file in the management PC becomes a remote drive for the server.

If [Read Only] is checked, one FD image file can be used by more than one server. Since no FD image file can be created or copied in this dialog box, create a file using the Defaults command or the Properties command in advance.word_imagefile

SOS Receive Dialog Box

If a fault is detected, a server that includes the system management controller (SMC) transmits a SOS message to the management PC. When this SOS message is received, MWA opens the SOS Receive dialog box to display the server information. If the server is in Manual Recovery Mode, MWA requests the operator for the server recovery method. When MWA communicates an inquiry to the server, [Connecting] is displayed in the title bar. You can do nothing in the dialog box while the message is displayed. Wait until the message is cleared.

It is only when the OS cannot run normally due to a fault in the server that you can control the server from this dialog box. If the server is already recovered, the server cannot be operated from MWA.

Contents and functions of the dialog box are as follows:

- **Server**: The dialog box displays the name and the IP address of the server that issued the SOS message, as well as the firmware version of the SMC on the server and the recovery mode of the server. If the recovery mode is Automatic, the server is automatically reset for recovery after this dialog box displays. The server cannot be controlled from MWA.
- **Message**: The dialog box displays the SOS message received from a server on the first line. The display box also displays the SMC event log of the server sequentially from the latest data up to when the SOS occurred.
- **Server last status:** The dialog box displays the LCD contents immediately before the SOS message transmission, the POST code of the last boot processing, and the current power status (DC).
- **Server control:** The operator can send recovery instructions to a server. The buttons are explained below. If a button operation causes an error, take the appropriate action on the server that sent the SOS message.

  Power cycle: Use this button to turn the server off and on again. The dialog box closes after the normal execution of server control is confirmed.

  Reset: Use this button to reset a server. The dialog box closes after the normal execution of server control is confirmed.

  Power on: Use this button to turn a server on. The dialog box closes after the normal execution of server control is confirmed.

  Power off: Use this button to turn a server off.

  SMI dump: The dump switch of a server is turned on. This function is valid only for a server whose power is on. Some types of servers may not support this function. If this function is not supported, the operation ends in an error.

Get log all: All the SMC event log data recorded in a server is acquired sequentially from the oldest one and displayed by activating the Windows standard editor WordPad. Since it takes time to make an inquiry to the server, [Connecting] is displayed in the title bar. The operator can do nothing in the dialog box while the message is displayed.

Troubleshooting

This section briefly explains problems and mistakes that may occur during MWA operations.

Problem: The Select a server dialog box does not display server information.

Probable Cause: Server SG information is not registered or the information has been lost. Register the server SG information again.

Problem: MWA cannot be operated after the reset command was executed.

Probable Cause: When some reset commands are issued, MWA waits for a response and cannot perform other operations. Wait for a while.

Problem: The Read button cannot be selected in the Data dialog box.

Probable Cause: Data read from a server is restricted as follows:

The server is connected.

CMOS data and DMI data can be read at the end of POST. Stop server processing at the end of POST by selecting the Pause POST command and the Go to End of POST command from the Pop-up menu in the server window.

Problem: A remote drive cannot be used.

Probable Cause: See *Using a Remote Drive*.

Problem: Booting from a remote drive failed.

Probable Cause: Check the following:

The remote drive is set correctly.

The remote drive is a floppy disk (or a FD image file) from which MS-DOS can be booted.

The priority of the boot device of the server is a floppy disk.

Problem: The server window does not display a server screen.

Probable Cause: A graphic server screen may not be displayed correctly in the server window. The window display becomes normal when the server returns to an MS-DOS screen.

Problem: Characters are corrupted when the server window displays a server screen.

Probable Cause: If MS-DOS is booted in a language other than English, MWA cannot display the messages for this language in the server correctly. Boot MS-DOS in English mode.

Probable Cause: If the server is displaying a graphic screen, MWA may not be able to display the screen correctly.

Problem: When an MS-DOS program is activated in English mode, the server displays corrupted characters.

Probable Cause: If MS-DOS in the server is in English mode, MWA remote console correctly displays messages from the MS-DOS programs in the server. However, the server cannot display messages for other language correctly.

Problem: OS cannot be booted from the server disk.

Probable Cause: When the remote drive is set on MWA, the server is booted from the remote drive. Cancel the remote drive setting and reset the server.

Problem: The floppy disk drive on the server cannot be used.

Probable Cause: When the remote drive is set on MWA, drive A: on the server is assigned remote drive on the management PC. Cancel the remote drive setting and reset the server.

Problem: MWA cannot connect to the server.

Probable Cause: Check each item in Step 7 of *Creating a Server System Generation Diskette*.

C

System Status Hardware Information

System Status Hardware Information

This appendix helps you identify and find a system status hardware item indicated by a software monitoring component.

The software monitoring component as it is related to the hardware system status item is listed in the following table:

Software Monitoring Component/Hardware System Status Item

Software Monitoring Component	Hardware System Status Item
ESMPRO Server Management	View status based on polling the machine

Not all items can be monitored with every software component. Monitoring capability relates to how the software component interacts with system hardware. ESMPRO interacts with all hardware components. In this system, the SCSI Accessed Fault-Tolerant Enclosure (SAF-TE) interface board is connected to the SCSI backplane. (See .the figure "System Chassis (Right Side View)" under "System Overview" in Chapter 1 of this guide.)

The "Monitor Matrix" table below shows a component relating to selected status item. This table also relates the terminology used by the software component to the system hardware.

Monitor Matrix

Item	ESMPRO	Item Location	Board Marking
Chassis front fan	Chassis front fan	Baseboard	P20
Chassis upper rear fan	Chassis upper rear fan	Baseboard	P10
Chassis lower rear fan	Chassis lower rear fan	Baseboard	P21
Internal disk fan – upper	Internal upper disk (SAF-TE)	SCSI-BP	J2
Internal disk fan – middle	Middle	SCSI-BP	J1
.nternal disk fan – lower	Lower	SCSI-BP	J3
Intrusion switch - front	Chassis cover	SCSI-BP	J6
Interlock switch - left side (front view)	N/A	SCSI-BP	J5 pins 1, 2
Interlock switch - right side (front view)	N/A	SCSI-BP	J5 pins 3, 4
(1)Power Supply fan	(1) Power (SAF-TE)	P. S. (Bottom)	N/A
(2)Power Supply fan	(2) Power (SAF-TE)	P.S. (Top)	N/A

SCSI-BP = SCSI Backplane

Glossary

A

AC

(Alternating Current) The type of current available in wall outlets. All computers must convert alternating current to direct current to operate. See also DC.

address

A label, name, or number that identifies a location in computer memory.

ASCII

(American Standard Code for Information Interchange) A standard number assigned to each of the alphanumeric characters and keyboard control code keys to enable the transfer of information between different types of computers and peripherals.

B

backplane slot

A connector on the backplane board in desktop computers and expansion boxes that allows you to install circuit cards.

backup

A copy of data for safe-keeping. The data is copied from computer memory or disk to a floppy disk, magnetic tape, or other media.

backup battery

The battery in your computer that maintains the real-time clock and the configuration information when the computer's power is removed.

base memory

An area of memory between 0 and 640 kilobytes.

baud rate

The speed with which data is transmitted during serial communication. The computer's operating system and software program must be configured for the same baud rate as the communication device, such as a serial printer. See also bps.

BIOS

(Basic Input/Output System) A program stored in flash EPROM or ROM that controls the keyboard, disk drives, video monitor, and other devices. See also flash EPROM, EPROM, and ROM.

bit

Derived from BInary digiT, a bit is the smallest unit of information a computer handles. See also byte.

BMC
(Baseboard Management Controller) Contains all of the server management functions. One major function of the BMC is to monitor system management events and log their occurrence in the System Event Log (SEL).

boot
The process of loading the operating system into memory.

bps
(bits per second) The number of bits transferred in one second during serial communication, such as modem transmission.

byte
A group of eight bits.

C

cache memory
A very fast, limited portion of RAM set aside for temporary storage of data for direct access by the microprocessor.

CD-ROM drive
(Compact Disk ROM drive) A type of mass storage device that reads information from a compact disk.

Centronics port
An industry standard parallel port. See also parallel port.

CGA
(Color Graphics Adapter) A type of video display system that provides low-resolution text and graphics on TTL monochrome and color monitors.

CMOS
(Complimentary Metal-Oxide Semiconductor) A type of low-power integrated circuit used in computers. See also TTL.

COM1 or COM2
The name you can assign a serial port to set or change its address. See also serial port.

command
An instruction that directs the computer to perform a particular operation.

configuration
The way in which a computer is set up to operate. Some configurable options include CPU speed, serial port designation, and memory allocation.

CPU
(Central Processing Unit) See microprocessor.

CRT
(Cathode-Ray Tube) The type of video display used in monitors for desktop computers.

D

DC
(Direct Current) The type of current available in the rechargeable battery packs used in portable computers. See also AC.

default
The factory setting your computer uses unless you instruct it otherwise. For example, when powering up, the computer will boot from the default drive.

density
The capacity of information (bytes) that can be packed onto a storage device, such as a floppy disk.

device driver
A software program that a computer must use to recognize and operate certain hardware, such as a mouse or a video monitor.

disk drive
A device that stores data on a hard or floppy disk. A floppy disk drive requires a floppy disk to be inserted; a hard disk drive has a permanently encased hard disk.

DOS
(Disk Operating System) See operating system.

DRAM
(Dynamic RAM) See RAM.

E

ECC
(Error Checking and Correction) A method of detecting and correcting errors.

EEPROM
(Electrically Erasable Programmable Read-Only Memory) A type of memory device that stores password and configuration information.

EGA
(Enhanced Graphics Adapter) A type of video display system that provides medium-resolution text and graphics on TTL monochrome, color, and enhanced color monitors.

EMP
The Emergency Management Port (EMP) provides an interface to the console manager. This interface allows remote server management via a modem or direct connection.

EMS
(Expanded Memory Specification) A method of accessing memory beyond the 640K limit of DOS by exchanging data in and out of main memory at high speeds. Some software requires EMS to operate.

EPROM
(Erasable Programmable Read-Only Memory) A type of memory device that is usually used to store system BIOS code. This code can be erased with ultraviolet light, but is not lost when the computer is powered off. See also flash EPROM and ROM.

expansion slot
See backplane slot.

extended memory
The protected memory above 1M that is directly accessible by the microprocessor through certain utilities and operating systems.

F

flash EPROM
A type of memory device that is usually used to store system BIOS code. This code can be replaced with updated code from a floppy disk, but is not lost when the computer is powered off. See also EPROM and ROM.

floppy disk drive
See disk drive.

format
The process used to organize a hard or floppy disk into sectors so it can accept data. Formatting destroys all previous data on the disk.

FRB
(Fault Resilient Boot) Is a server management feature. FRB attempts to boot a system using the alternate processor or DIMM when a failure is detected in the primary processor or DIMM.

G

(Gigabyte)
1,073,741,824 bytes. See also byte.

H

hard disk drive
See disk drive.

hardware
The physical parts of your computer, including the keyboard, monitor, disk drives, cables, and circuit cards.

hot swap
A method used to insert or remove SCSI disk drives into or from an operating bus. This method is typically used in RAID subsystems. When used in non-RAID subsystems the operating system must typically be restarted.

I

IC
(Integrated Circuit) An electronic device that contains miniaturized circuitry.

IDE
(Integrated Drive Electronics) A type of hard disk drive with the control circuitry located inside the disk drive rather than on a drive controller card.

interface.
A connection between the computer and a peripheral device that enables them to exchange data. See also parallel port and serial port.

ISA
(Industry Standard Architecture) An industry standard for computers and circuit cards that transfer 16 bits of data at a time.

J

jumper
A small electrical connector used for configuration on some computer hardware.

K

(Kilobyte)
1,024 bytes. See also byte.

L

LAN
(Local Area Network) A group of computers linked together within a limited area to exchange information.

LCD
(Liquid Crystal Display) The type of video display used in portable computers.

LED
(Light-Emitting Diode) A small electronic device that glows when current flows through it.

LPT1 or LPT2
The name you can assign a parallel port to specify its address. See also parallel port.

LVD
Super-fast Ultra 2 SCSI Low Voltage Differential (LVD) Parallel SCSI Interface. A new SCSI interface that provides greater I/O bandwidth, device connectivity, data reliability, and longer cable lengths for Ultra2 SCSI hard disk drives. Note that in order to achieve LVD performance all devices including cable, controller, and drive must support LVD.

M

(Megabyte)
1,048,576 bytes. See also byte.

memory
The circuitry in your computer that stores data and programs. See also EMS, extended memory, RAM, and ROM.

microprocessor
The integrated circuit that processes data and controls the basic functions of the computer.

modem
A device used to exchange information with other computers over telephone or data lines.

module
A circuit board that plugs into a dedicated connector on the system board in your computer.

mouse
A small input device that you guide on a flat surface to control the cursor movement and operation of the computer when using certain software programs.

N

NVRAM
(Nonvolatile RAM) A type of RAM that retains its contents even after the computer is powered off. This memory stores EISA configuration information. See also RAM and SRAM.

O

operating system
A set of programs that provides the interface between other software programs and the computer.

P

parallel port
The connector on the back of your computer that allows the transfer of data between the computer and a parallel device, such as a parallel printer.

partition
The process of dividing the storage space on a hard disk into separate areas so that the operating system treats them as separate disk drives.

password
A security feature that prevents an unauthorized user from operating your computer. See also EEPROM.

PCI
Peripheral Component Interconnect. PCI is a high-performance peripherals I/O bus supporting data transfers of up to 528MB per second.

Pentium
A type of microprocessor, with a built-in math coprocessor, cache memory, and memory and bus controllers, that processes and communicates 32 bits of data at a time. This microprocessor also contains power management capabilities.

peripheral
A device connected to and controlled by the computer, such as an external disk drive or a printer.

pixel
The smallest element that is visible on a video display. The resolution of a video display system is measured in pixels.

PnP
(Plug-n-Play) Plug-and-play is the ability to plug a device into a computer and have the computer recognize that the device is there. The user doesn't have to tell the computer.

POST
Power-On-Self-Test.

R

RAM
(Random-Access Memory) A temporary storage area for data and programs. This type of memory must be periodically refreshed to maintain valid data, and is lost when the computer is powered off. See also NVRAM and SRAM.

real-time clock
The IC in your computer that maintains the time and date.

registered SDRAM
A type of SDRAM containing an additional buffer that allows memory to run faster. See also RAM and SDRAM.

ROM
(Read-Only Memory) A type of memory device that usually is used to store system BIOS code. This code cannot be altered and is not lost when the computer is powered off. See also BIOS, EPROM, and flash EPROM.

RS-232C port
An industry standard serial port. See also serial port.

S

SAF-TE
(SCSI Accessed Fault Tolerant Enclosure) A specification for monitoring the state of the drives and enclosure environment (fan, power supply, temperature, etc.) using the SCSI bus to indicate faults.

save
To store information on a floppy disk, hard disk, magnetic tape, or some other permanent storage device.

SCSI
(Small Computer System Interface) An industry standard interface that provides high-speed access to tape drives, hard disk drives, and other peripheral devices.

SDRAM
(Synchronous DRAM) A type of DRAM that runs at faster clock speeds than conventional memory. See also DRAM and registered SDRAM.

SEL
(System Event Log) A record of system management events. The information stored includes the name of the event, the date and time the event occurred and data pertinent to the event. Event data may include POST error codes that reflect hardware errors or software conflicts within the system.

serial communication
Information sent sequentially, one bit at a time.

serial port
The connector on the back of your computer that allows the transfer of data between the computer and a serial device, such as a mouse, a modem, or a serial printer.

setup program
The program that you use to change the configuration of some ISA desktop and notebook computers. This program also contains information about the hardware in the computer.

SMI
(System Management Interrupt).

software
Programs with specific functions, such as word processing, data base management, communications, and operating system.

SRAM
(Static RAM) A temporary storage area for data and programs. This type of memory does not need to be refreshed, but it is lost when the computer is powered off. See also NVRAM and RAM.

SVGA
(Super VGA) A type of video display system that provides very high-resolution text and graphics on analog color monitors.

system board
The main circuit board in your computer. It contains most of the connectors and ports.

T

tape drive
A type of storage device using magnetic tape.

TTL
(Transistor-Transistor Logic) A type of integrated circuit used in computers. See also CMOS.

U

ultra 160/m SCSI
Ultra 160/m is a parallel SCSI interface based on Ultra3 SCSI technology. This interface features data transfer speeds up to 160MB/second (double-edge clocking), cyclical redundancy checking (CRC) providing higher levels of data reliability, and domain validation that detects the configuration of the SCSI bus and automatically tests and adjusts the SCSI bus transfer rate to optimize interoperability. Note that the Ultra 160/m uses the standard Ultra2 LVD cabling and termination, making it backward compatible for easy implementation.

V

VGA
(Video Graphics Array) A type of video display system that provides high-resolution text and graphics on analog color monitors.

W

WOL
(Wake-On-LAN) A feature that provides the ability to remotely wake a sleeping (powered off) system through a network connection.

Equipment Log

Use this equipment log form to record pertinent information about your system. You need some of this information to run the System Setup Utility. Be sure to update the equipment log when you add options.

Record the model and serial numbers of the system components, dates of component removal or replacement, and the name of the vendor from whom the component was purchased. Be sure to record the same information for any components added to the system, such as a power supply, hard disk drives, add-in boards, or printers.

Record the model and serial numbers of the unit and system baseboard. The model and serial numbers of the system unit are recorded on a label attached to the rear of the unit. The serial number of the system board is located along the left side of the board, near the PCI expansion slot covers.

The location of serial numbers on add-in boards, hard disk drives, and external equipment, such as video displays or printers, varies from one manufacturer to another. Literature accompanying these products should illustrate or describe the location of model and serial numbers.

Equipment Log

Component	Manufacturer Name & Model	Serial Number (if available)	Date Installed
Server			
System Board			
Processor 1			
Processor 2			
DIMM Slot 0			
DIMM Slot 1			
DIMM Slot 2			
DIMM Slot 3			
Modem			
Diskette Drive A			
Diskette Drive B			
Tape Drive 1			
Tape Drive 2			
CD-ROM Drive 1			
Hard Disk Drive 1			
Hard Disk Drive 2			
Hard Disk Drive 3			
Hard Disk Drive 4			
Hard Disk Drive 5			
Hard Disk Drive 6			
Hard Disk Drive 7			
ional RAID Controller			
Network Controller 1			
Network Controller 2			
Monitor			
Keyboard			
Mouse			
External Peripheral 1			
External Peripheral 2			
Power Supply			

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