

Ultra™ Enterprise™ 6000/5000/4000 Systems Manual



The Network Is the Computer™

Sun Microsystems Computer Company

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Part No.: 802-3845-11
Revision A, November 1996

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Preface

The *Ultra™ Enterprise™ 6000/5000/4000 Systems Manual* is for the qualified service-trained maintenance provider.

How This Book Is Organized

Information in this manual is organized in five parts:

Part 1 - "Product Description," provides an overview of the Enterprise 6000/5000/4000 server systems, safety precautions, and tools information.

Part 2 - "System Components," provides descriptions and installation and removal instructions for boards and components, power supplies, and internal storage devices.

Part 3 - "Troubleshooting," contains fault isolation information and flow charts to help locate system hardware problems.

Part 4 - "Service Information," explains how to prepare the system for service and how to access subassemblies.

Part 5 - "Appendixes," provides additional reference information such as product specifications, illustrated parts breakdown, connector pinouts, and other material of interest to qualified service-trained maintenance providers.

UNIX Commands

This document may not include specific software commands or procedures. Instead, it may name software tasks and refer you to operating system documentation or the handbook that was shipped with your new hardware.

The type of information that you might need to use references for includes:

- Shutting down the system
- Booting the system
- Configuring devices
- Other basic software procedures

See one or more of the following:

- *Solaris 2.x Handbook for SMCC Peripherals* contains Solaris™ 2.x software commands.
- On-line AnswerBook™ for the complete set of documentation supporting the Solaris 2.x software environment.
- Other software documentation and *Platform Notes* that you received with your system.

Typographic Conventions

The following table describes the typographic changes used in this book.

Typeface or Symbol	Meaning	Example
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. machine_name% You have mail.
AaBbCc123	What you type, contrasted with on-screen computer output	<pre>machine_name% su Password:</pre>
<i>AaBbCc123</i>	Command-line placeholder: replace with a real name or value	To delete a file, type <code>rm filename</code> .
<i>AaBbCc123</i>	Book titles, new words or terms, or words to be emphasized	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be root to do this.

Shell Prompts

The following table shows the default system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

Shell	Prompt
C shell	machine_name%
C shell superuser	machine_name#
Bourne shell and Korn shell	\$
Bourne shell and Korn shell superuser	#

Related Documents

The following documents contain topics that relate to the information in *Ultra Enterprise 6000/5000/4000 Systems Manual*.

Application	Title	Part Number
Safety/EMI	<i>Ultra Enterprise Server Cabinet Regulatory Compliance Manual</i>	802-3846
Installation	<i>Ultra Enterprise 6000/5000/4000 Systems Installation Guide</i>	802-3844
Software	<i>SMCC SPARC Hardware Platform Guide</i>	802-5341
	<i>Solstice SyMON User's Guide</i>	802-5355
Options	<i>Expansion Cabinet Installation and Service Manual</i>	802-6084
	<i>Enterprise Systems Boards Installation Guide</i>	802-5030
	<i>UltraSPARC Module Installation Guide</i>	802-5031
	<i>Enterprise Systems Memory Modules Installation Guide</i>	802-5032
	<i>Enterprise Systems Peripheral Power Supply Installation Guide</i>	802-5033
	<i>Enterprise Systems Power/Cooling Module Installation Guide</i>	802-6244
	<i>Ultra Enterprise Cabinet Floor Brackets Mounting Guide</i>	802-7543
	<i>Ultra Enterprise Caster Base Installation Guide</i>	802-5034

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Luxembourg	32-2-720-09-09	32-2-725-88-50
Germany	01-30-81-61-91	01-30-81-61-92
The Netherlands	06-022-34-45	06-022-34-46
Sweden	020-79-57-26	020-79-57-27
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Notes, Cautions, and Warnings



Warning – This equipment contains lethal voltage. Accidental contact with centerplane, card cage, and drive areas can result in serious injury or death.



Caution – Improper handling by unqualified personnel can cause serious damage to this equipment. Unqualified personnel who tamper with this equipment may be held liable for any resultant damage to the equipment.

Individuals who remove any outer panels or open covers to access this equipment must observe all safety precautions and ensure compliance with skill level requirements, certification, and all applicable local and national laws.

Procedures contained in this document must be performed by qualified service-trained maintenance providers.

Note – Before you begin, carefully read each of the procedures in this manual. If you have not performed similar operations on comparable equipment, *do not attempt* to perform these procedures.

Part 1— Product Description

Chapter 1, Product Overview	page 1-1
Chapter 2, Safety Precautions and Tools Requirements	page 2-1



1.1 Standard Features

The Ultra Enterprise 6000/5000/4000 systems are available in two enclosures:

- Enterprise 6000/5000 Data center system cabinet containing either a 16-slot or 8-slot card cage
- Enterprise 4000 Standalone enclosure containing an 8-slot card cage

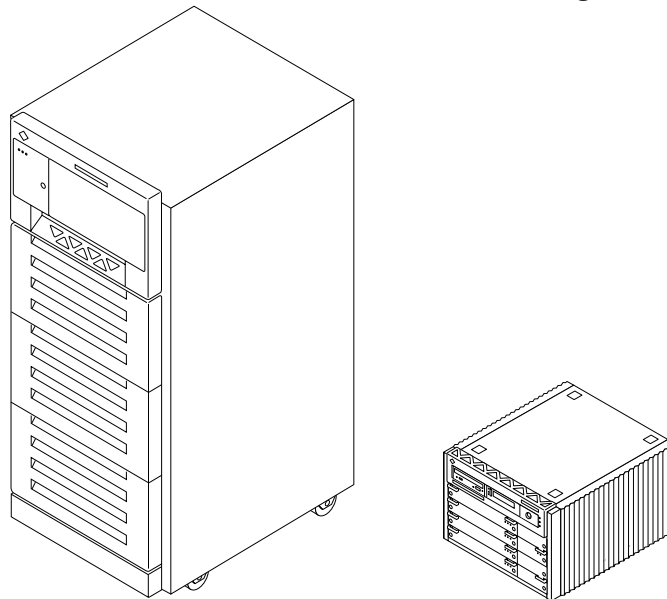


Figure 1-1 Ultra Enterprise Data Center System Cabinet and Standalone Enclosure

The same CPU/Memory board, I/O boards, Disk board, processor modules, memory modules, power supplies, fans, and internal disks are used in both enclosures.

The minimum configuration for the Enterprise 6000/5000 systems is:

- Data center system cabinet (system cabinet)
- 16-slot or 8-slot card cage
- Power/cooling modules (2)
- Quad fan tray
- Clock board
- CPU/Memory board
- UltraSPARC™ module
- Main memory
- I/O board
- Peripheral power supply
- AC power sequencer
- SCSI receptacle for removable media, including the SunCD™ 4 drive

The minimum configuration for the Enterprise 4000 system is:

- 8-slot card cage
- Power/cooling modules (2)
- Fan box
- Clock board
- CPU/Memory board
- UltraSPARC module
- Main memory
- I/O board
- Peripheral power supply
- AC power sequencer
- SCSI receptacle for removable media, including the SunCD 4 drive

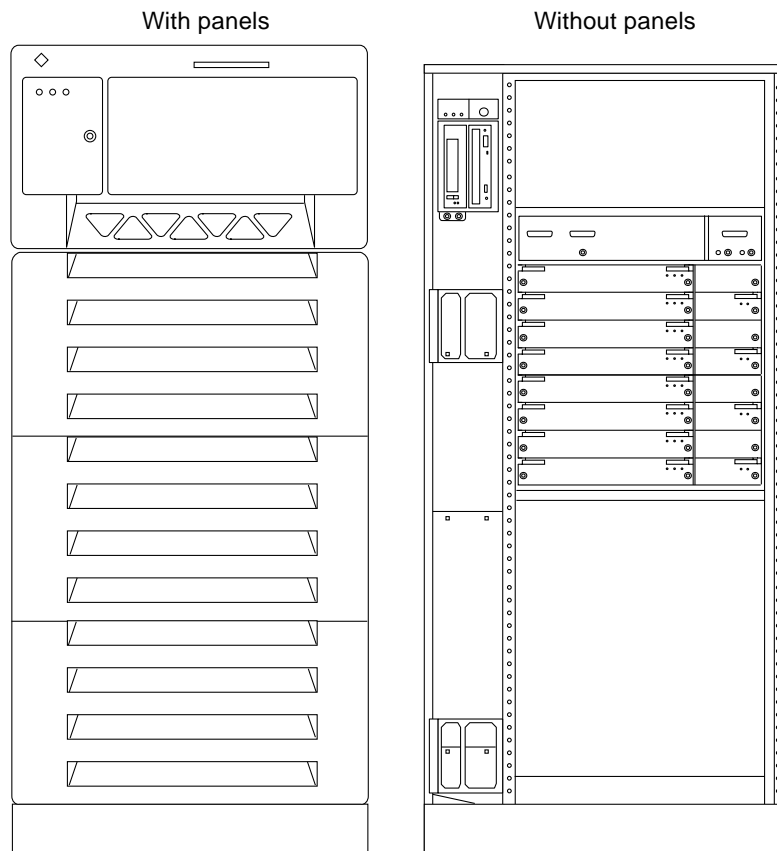


Figure 1-2 Enterprise 6000/5000 System Cabinet (Front View)

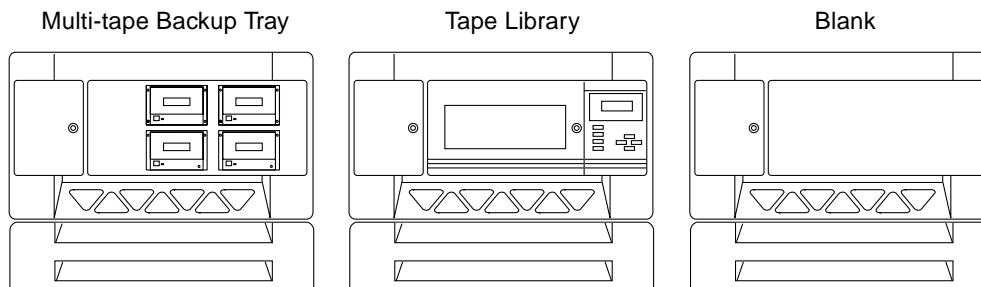


Figure 1-3 Bezels for Cabinet System - Three Examples

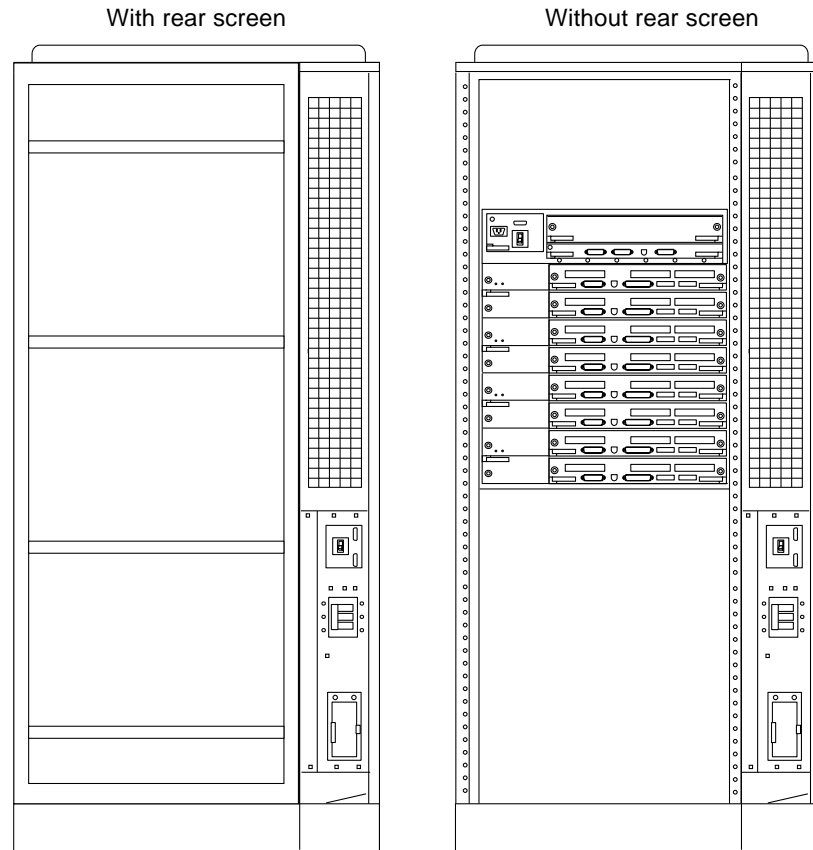


Figure 1-4 Enterprise 6000/5000 System Cabinet (Rear View)

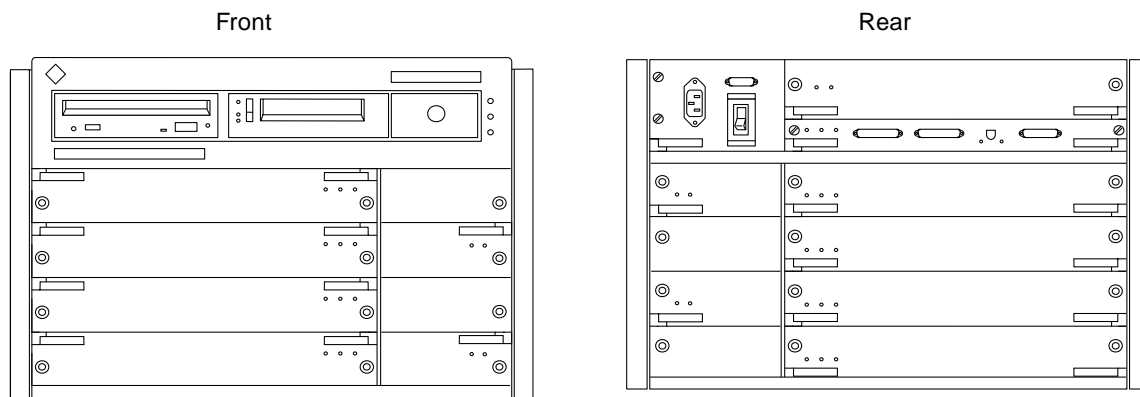


Figure 1-5 Enterprise 4000 System

1.2 Basic Definitions

Ultra Enterprise server systems use a centerplane. Electrical traces embedded in the centerplane serve both the front and rear sides of the centerplane; therefore, the orientation of the sockets on the rear of the centerplane is opposite the orientation of sockets on the front of the centerplane.

Boards in the front of the card cage are installed component side down, and boards in the rear of the card cage are installed component side up. Similarly, the orientation of the power/cooling modules installed in the rear of the system chassis is opposite the orientation of power/cooling modules in the front of the system chassis.

Since boards, modules, and power/cooling modules may be located on either side of the Enterprise server chassis centerplane, the terms “front,” “rear,” “right,” and “left” are defined in Table 1-1.

Table 1-1 Definitions of Terms

Server Orientation

Front	Keyswitch location
Rear	AC power switch and cable location

Power/Cooling Module, Board, and UltraSPARC Module Orientation

Front	Edge nearest you as you face the unit installed in a system
Right	Side to your right as you face the front of the installed unit
Left	Side to your left as you face the front of the installed unit

1.3 Internal Options

Table 1-2 Internal Options for the Ultra Enterprise Server Systems

Option	Enterprise 6000	Enterprise 5000/4000	Comments
CPU/Memory boards, SBus I/O boards, and Graphics I/O boards	16 <i>total</i> per system	8 <i>total</i> per system	Each slot can accept any of these three types of boards: CPU/Memory board, SBus I/O board, and Graphics I/O board. Combinations can vary. One CPU/Memory board becomes the system master automatically. Jumper changes are not needed. For easier I/O boards cabling, CPU/Memory boards can be installed in the front and I/O boards in the rear of the Enterprise system.
Disk boards	2 per system (<i>must</i> use slot 15 if only 1 is installed)	4 per system	Can be installed <i>only</i> in slot 14 and slot 15 in the Enterprise 6000 system. For easier Disk boards cabling, CPU/Memory boards can be installed in the front and Disk boards in the rear of the Enterprise system.
UltraSPARC modules	30	14	0-2 modules on each CPU/Memory board.
Memory modules	0, 8, or 16 SIMMs per CPU/Memory board	0, 8, or 16 SIMMs per CPU/Memory board	SIMM sizes are 8, 32, or 128 Mbyte DRAM. Do not mix sizes within the same bank. Add 8 SIMMs at a time. Install SIMMs in all bank 0 sockets first on each CPU/Memory board, from the lowest slot to the highest. Once bank 0 is full, install remaining SIMMs in bank 1 sockets in the same order.
SBus cards	15 per system	7 per system	0-3 cards per SBus I/O board, 0-2 cards per Graphics I/O board.
Graphics (UPA) cards	4 per system	4 per system	0-1 card per Graphics I/O board.
SCSI tray	CD-ROM and tape drive	CD-ROM and tape drive	SCSI tray takes removable-media drives only. One SunCD 4 is standard equipment per system. One optional tape drive is supported in the SCSI tray.
Disk tray	The Enterprise 6000 system cabinet can hold 0-3 trays; the Enterprise 5000 system cabinet can hold 0-4. The expansion cabinet can hold 1-8 trays; each disk tray holds up to six 5 1/4-inch form factor disk drives. Refer to documentation that comes with the disk trays and expansion cabinet.		
Multi-tape tray or tape library	The Enterprise 6000/5000 system cabinet can hold 1 multi-tape backup tray or tape library. The expansion cabinet can hold 1 or 2 multi-tape trays or tape libraries. Tape trays hold up to four 8 mm tape drives. Refer to documentation that comes with the tape trays and expansion cabinet.		

Safety Precautions and Tools Requirements



2.1 Safety Precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Never push objects of any kind through openings in the equipment as they may touch dangerous voltage points or short out components that could result in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

To protect both yourself and the equipment, observe the following precautions:

Table 2-1 Safety Precautions

Item	Problem	Precaution
Wrist or foot strap	ESD	Wear a conductive wrist strap or foot strap when handling printed circuit boards.

Table 2-1 Safety Precautions (Continued)

Item	Problem	Precaution
ESD mat	ESD	An approved ESD mat provides protection from static damage when used with a wrist strap or foot strap. The mat also cushions and protects small parts that are attached to printed circuit boards.
Cover panels	System damage and overheating	Re-install all cabinet cover panels after performing any service work on the system.
Card cage slot filler panels and load boards	System damage and overheating	Make sure all empty board slots have a filler panel installed. NOTE: You must use load boards instead of filler panels in the 16-slot Enterprise 6000 system card cage.

2.2 Symbols

The following symbols mean:



WARNING

Hazardous voltages are present. To reduce the risk of electrical shock and danger to personal health, follow the instructions.



WARNING

Risk of personal injury. To reduce the risk, follow the instructions.



CAUTION

Risk of equipment damage. To reduce the risk, follow the instructions.



SURFACE

CAUTION: Hot surfaces. Avoid contact. Surfaces are hot and may cause personal injury if touched.













AC

A terminal to which alternating current or voltage may be applied.



ON

The principal and stand-by switches are in the ON position; the system is powered on.

	OFF	The principal switch is in the OFF position.
	STAND-BY	The system is in standby mode and the operating system is halted. The circuit breaker can be turned off.
	DIAGNOSTICS	System is powered on. If system is rebooted, POST will display extended diagnostic messages.
	CYCLING	System or board is operating normally.
	LOCKED	Board: 1/4-turn access slot is locked. System: running in secure mode and will not respond to commands from the console. The key can be removed.
	UNLOCKED	Board 1/4-turn access slot is unlocked.
	POWER	Board is receiving DC power.
	SERVICE	System has detected a hardware failure.
	PROTECTIVE EARTH	Earth ground.
	CHASSIS	Frame or chassis ground.



FUSE REPLACEMENT MARKING

For continued protection against risk of fire and electric shock, replace **ONLY** with fuse of the same type and rating.

Ensure that the voltage and frequency of the power outlet to be used matches the electrical rating labels on the equipment.

Wear antistatic wrist straps when handling any magnetic storage devices, CPU/Memory boards, or other printed circuit boards.

Use only properly grounded power outlets as described in Section 1.3, "Preparing the Electrical Circuits," in the *Ultra Enterprise 6000/5000/4000 Systems Installation Guide*, part number 802-3844.



Caution – DO NOT make mechanical or electrical modifications to the cabinet. Sun Microsystems™ is not responsible for regulatory compliance of modified cabinets.



Caution – The chassis AC power cord must remain plugged in to ensure a proper ground.

2.3 Tools Required

This list represents the minimum of tools and test equipment you will need:

- Screwdriver, slotted, 3/16 inch
- Screwdriver, Phillips #2
- Screwdriver, Phillips #1
- Hex driver, M-4
- Hex driver, 3/16 inch
- Hex driver, 9 mm
- Wrench, 13 mm
- DIP/IC extraction tool
- ESD mat
- Grounding wrist strap
- Needlenose pliers
- Hex driver, 3/32

Part 2— System Components

Chapter 3, CPU/Memory Board	page 3-1
Chapter 4, I/O Boards	page 4-1
Chapter 5, Disk Board	page 5-1
Chapter 6, Clock Board	page 6-1
Chapter 7, Power Supplies	page 7-1
Chapter 8, Internal SCSI and Storage Devices	page 8-1



CPU/Memory Boards and Components



To protect both yourself and the equipment, make sure you follow precautions in Chapter 2, “Safety Precautions and Tools Requirements.”

<i>Safety Precautions</i>	<i>page 2-1</i>
<i>Handling Boards and Assemblies</i>	<i>page 3-2</i>
<i>Filler Panels and Load Boards</i>	<i>page 3-3</i>
<i>Hot-Plug Feature</i>	<i>page 3-4</i>
<i>CPU/Memory Boards</i>	<i>page 3-5</i>
<i>UltraSPARC Modules</i>	<i>page 3-14</i>
<i>Memory Modules (SIMMs)</i>	<i>page 3-19</i>
<i>Connectors</i>	<i>page G-2</i>

For your protection, also observe the following safety precautions when setting up your equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Never push objects of any kind through openings in the equipment as they may touch dangerous voltage points or short out components that could result in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

3.1 Handling Boards and Assemblies



Caution – The chassis AC power cord must remain connected to ensure a proper ground.



Caution – The CPU/Memory boards, modules, and cards have surface-mount components that can be broken by flexing the boards.

To minimize the amount of board flexing, observe the following precautions:

- Hold the board only by the edges near the middle of the board, where the board stiffener is located. Do not hold the board *only* at the ends.
- When removing the board from an antistatic bag, keep the board vertical until you lay it on the Sun ESD mat.
- Do not place the board on a hard surface. Use a cushioned antistatic mat. The board connectors and components have very thin pins that bend easily.
- Do not use an oscilloscope probe on the components. The soldered pins are easily damaged or shorted by the probe point.
- Transport the board in an antistatic bag.
- Be careful of small parts located on the component side of the board.
- Be careful not to drag boards across surfaces as board components are easily damaged.



Caution – The heatsinks on the board can be damaged by incorrect handling. Do not touch the heatsinks while installing or removing the board. Hold the board only by the edges. If a heatsink is loose or broken, obtain a replacement board.



Caution – When inserting a board into slot 4 or slot 10 of a 16-slot card cage, lift the board slightly to avoid damage to the centerplane connectors.



Caution – The heatsinks on the board can be damaged by improper packaging. When storing or shipping the board, ensure that the heatsinks have sufficient protection.

3.2 Filler Panels and Load Boards

All empty board slots in Enterprise systems must have either a filler panel or a load board installed.

- Empty slots in Enterprise 5000 and 4000 systems must have a filler panel installed. See Figure 3-1.
- Empty slots in Enterprise 6000 systems must have a load board installed. See Figure 3-2.

Load boards and filler panels are inserted into a board slot with the springfingers facing down if inserted in the front of the system; the springfingers face up if inserted in the rear of the system.

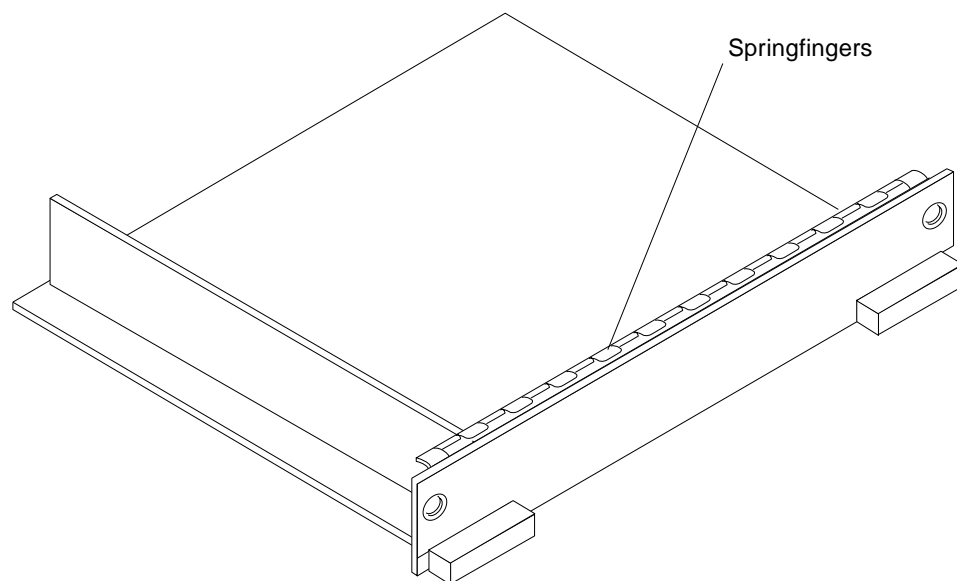


Figure 3-1 Filler Panel (Enterprise 5000/4000 Only)

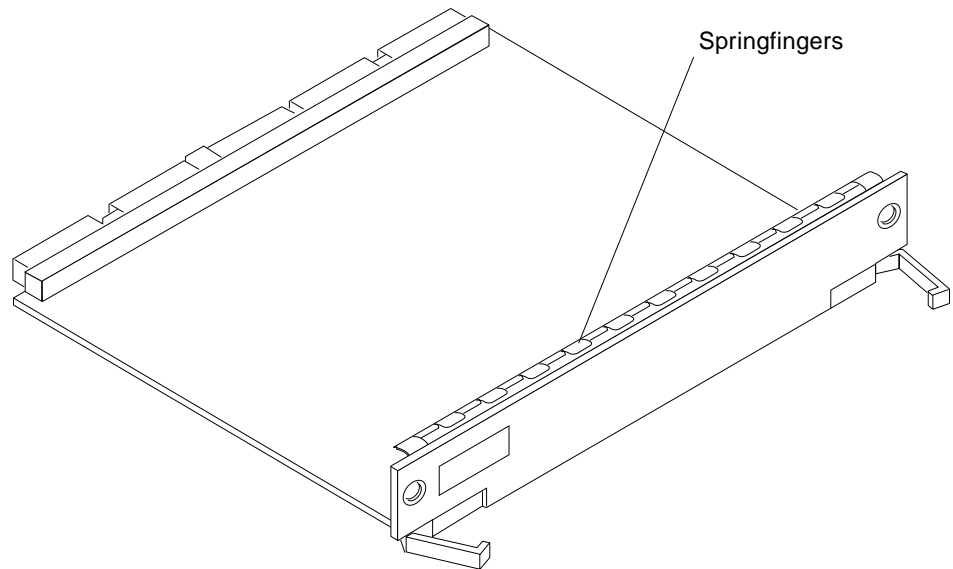


Figure 3-2 Load Board (Enterprise 6000 Systems Only)

3.3 Hot-Plug Feature

Enterprise systems have extensive error detection mechanisms, and an Automatic System Reconfiguration (ASR) feature that enables the system to be rebooted with failed components (such as CPUs, memory, or I/O) disabled. When an error is detected, the system can be reconfigured so that the board containing the failed components is placed in low power mode and is no longer accessible.



Caution – The peripheral power supply provides the precharge voltages required for hot-plug. Do not attempt hot-plug of a system component if the power supply is missing or inoperative. Use `prtdiag(1M)` to determine the status of the peripheral power supply.



Caution – If the message: `NOTICE: Hot Plug not supported in this system is displayed during boot`, do NOT attempt hot-plug in this system or damage to the hardware will occur.

The hot-plug feature enables you to insert a new board into a powered on system, despite the system being “live,” or being supplied with electrical power. When the hot-plug feature is used to add a board to a powered on system, the system will not use the new board until the system is rebooted.

3.4 *CPU/Memory Boards*

Each CPU/Memory board supports up to two UltraSPARC modules and 16 SIMM slots for memory.

Figure 3-3 is a simplified block diagram of the CPU/Memory board. It includes an Address Controller, 8 bit-sliced Data Controllers, a Bootbus Controller, on-board devices (including a Flash PROM, and SRAM), two CPU processor slots, and slots for two memory banks of 8 SIMMs each.

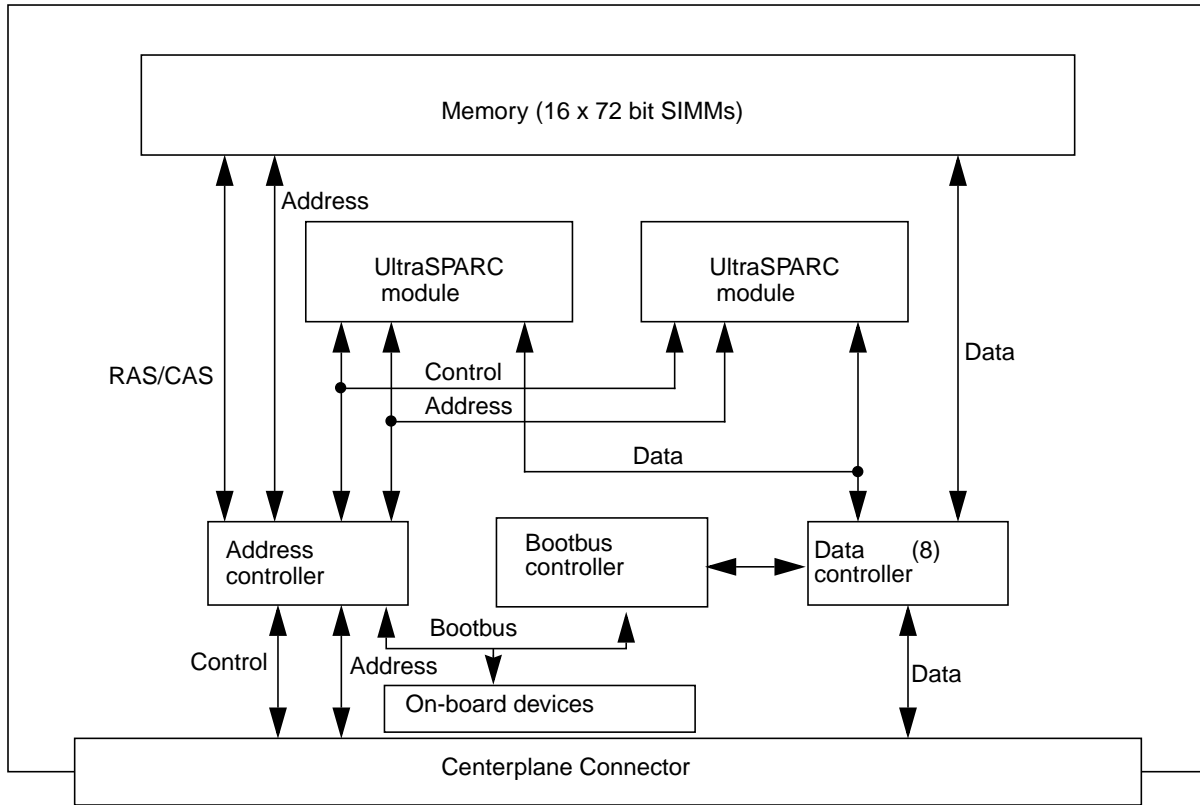


Figure 3-3 CPU/Memory Board Simplified Block Diagram

3.4.1 Removing a Board

3.4.1.1 Removing a Board from a Powered On System



Caution – Remove a board from a powered on system only after the ASR software has disabled the board. If a board has not been disabled by the ASR software, then the operating system should be halted and the system powered off prior to board removal. See Chapter 12, “Powering Off and On” and then see Section 3.4.1.2, “Removing a Board from a Nonpowered On System.”

1. Ensure that the board has been disabled by the ASR software. See Section 3.3, “Hot-Plug Feature.”

Once disabled by ASR, one of two results occurs:

- The three LEDs on the board are not lit (board has no power).
- The outer two green LEDs are not lit and the middle yellow LED is lit (board in low power mode).

Note – System software operates such that the LED pattern described is the same for a board that is component side down (installed in front of card cage) or component side up (installed in rear of card cage).

2. Use a Phillips #1 screwdriver to mechanically release the board from the system card cage.

Insert the screwdriver into each quarter-turn access slot (the slots are located on the left and right sides of the board front panel) and then turn a quarter turn so that the arrow points to the unlocked position. See Figure 3-4.

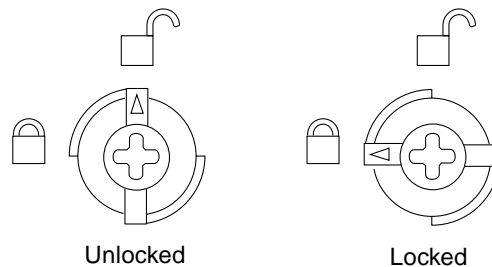


Figure 3-4 Unlocking and Locking Quarter-Turn Access Slots

3. Pull the ends of both extraction levers outward simultaneously to unseat the board centerplane connector from the centerplane receptacles. See Figure 3-5 for the positioning of the levers.

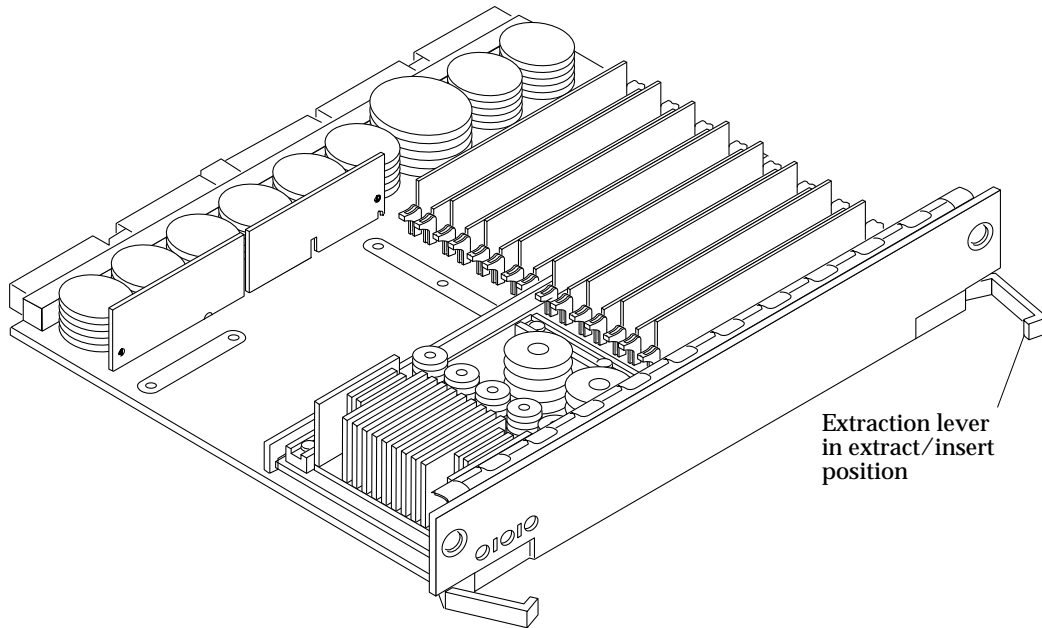


Figure 3-5 CPU/Memory Board

4. If a board is not immediately replaced, a load board (Enterprise 6000 systems only) or a filler panel (Enterprise 4000 and 5000 systems only) must be installed in its place. See Section 3.2, “Filler Panels and Load Boards.”

3.4.1.2 Removing a Board from a Nonpowered On System

1. Use a Phillips #1 screwdriver to mechanically release the board from the system card cage. Insert the screwdriver into each quarter-turn access slot (the slots are located on the left and right sides of the board front panel) and then turn a quarter turn so that the arrow points to the unlocked position. See Figure 3-4.

2. **Pull the ends of both extraction levers outward simultaneously to release the board from the centerplane receptacles.**
See Figure 3-5 for the positioning of the levers.
3. **If a board is not immediately replaced, a load board (Enterprise 6000 systems only) or a filler panel (Enterprise 4000 and 5000 systems only) must be installed in its place.**
See Section 3.2, “Filler Panels and Load Boards.”

3.4.2 *Installing a Board*

3.4.2.1 *Board Slot Selection*

Note – Logically there is no difference between the board slots in the front or rear of the card cage, and each slot can accept any board type. It is suggested that CPU/Memory boards be installed in the front slots, and I/O and disk boards be installed in the rear slots because of cabling. Should the need arise, however, any of these three board types can be placed in any of the numbered board slots, with the exception of slot 1. Slot 1 should be used by the first I/O board because it is the only slot connected to the onboard SCSI devices.

The first CPU/Memory board is placed in slot 0, followed sequentially by all remaining even numbered slots. If there are boards remaining, they can be installed sequentially in odd numbered slots, if available, in the system rear (with the exception of slot 1 as noted above). See Figure 3-6 and Figure 3-7 for board slot locations.

For CPU/Memory boards being placed in the rear of the system, ensure that the component side is up. If the boards are placed in the front of the system, ensure that the component side is down. See Figure 3-8.

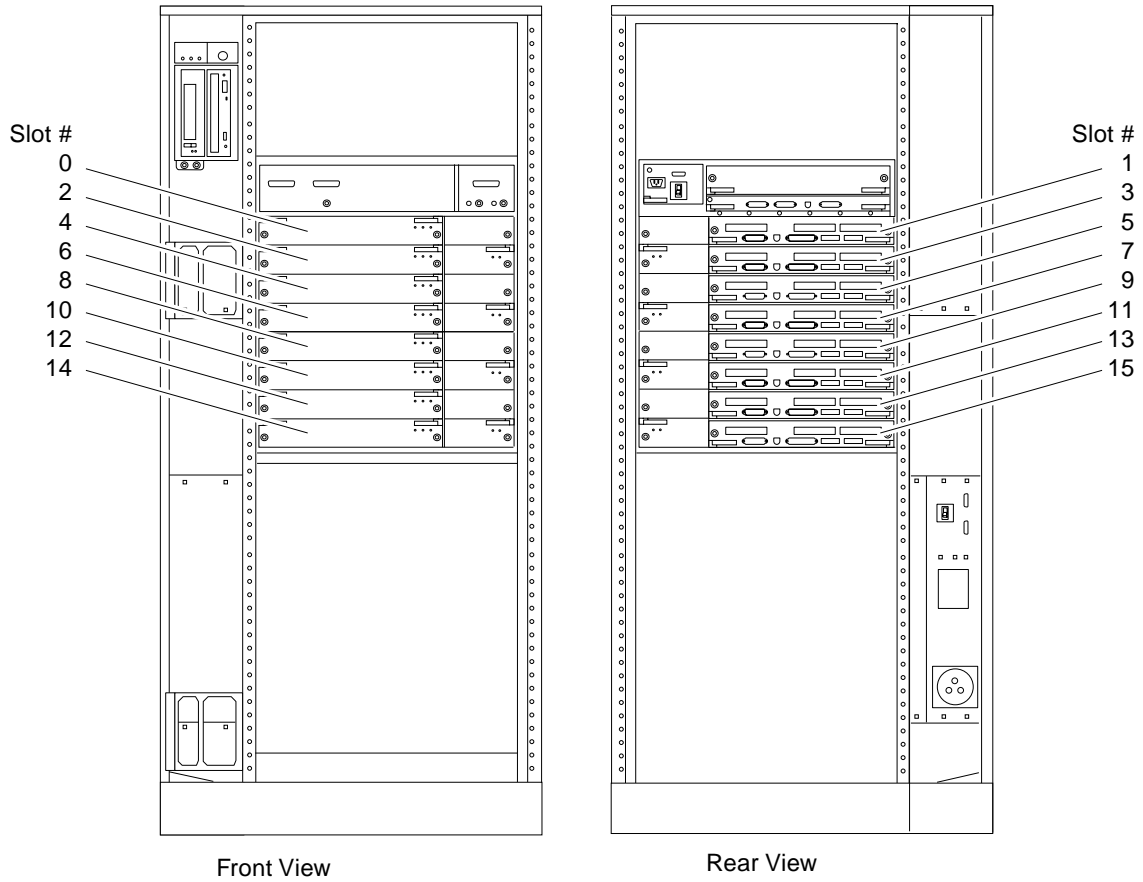


Figure 3-6 Enterprise 6000 Board Locations

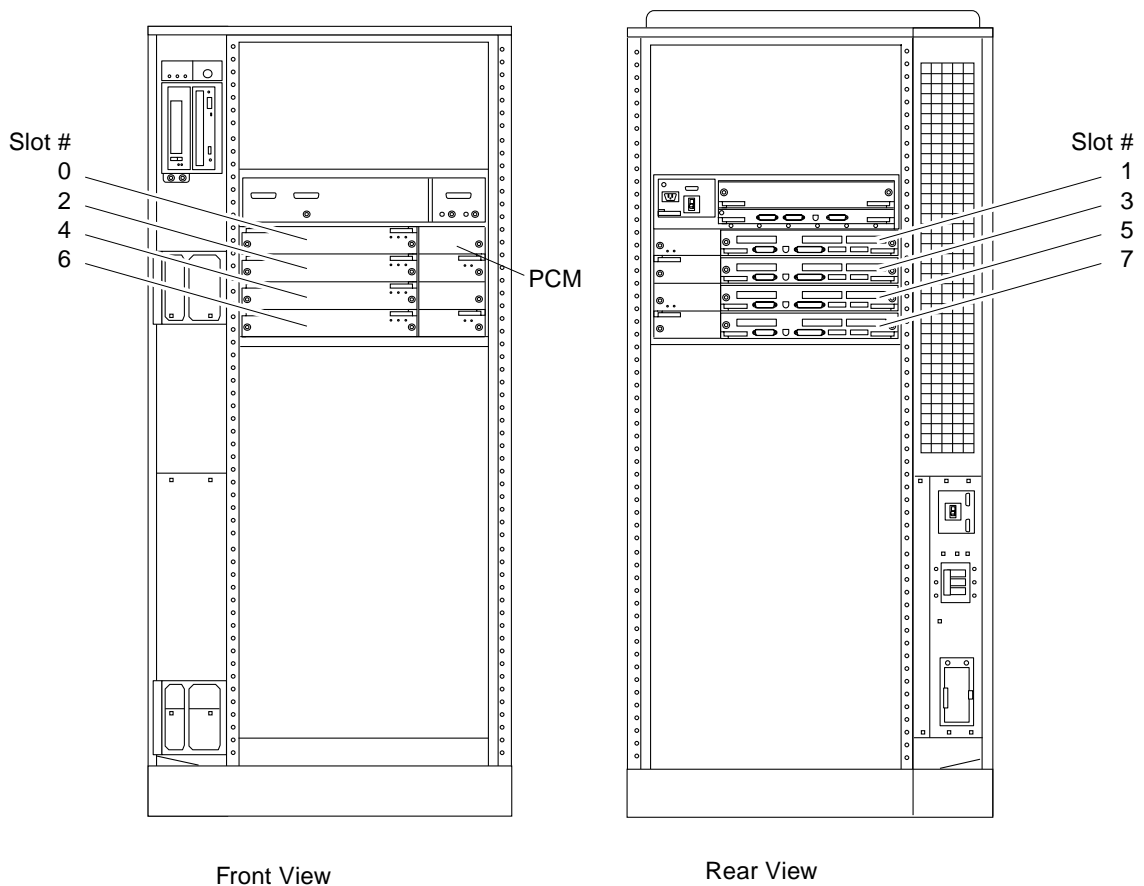


Figure 3-7 Enterprise 5000/4000 Board Locations

3.4.2.2 Cooling and Power Issues

There should be one power/cooling module (PCM) for every two boards to adhere to cooling and power requirements. The PCMs must be installed adjacent to populated board slots to ensure the fan in the PCM can cool the respective boards.

Note – All empty board slots in Enterprise 4000 or 5000 systems must have a filler panel installed to ensure proper cooling. All empty slots in Enterprise 6000 systems must have load boards installed.

3.4.2.3 Powered or NonPowered On System

1. Carefully insert the board (component side down if in front; component side up if in the rear) in the proper slot in the card cage, ensuring that the board does not slip out of the left and right card guides. See Figure 3-8.

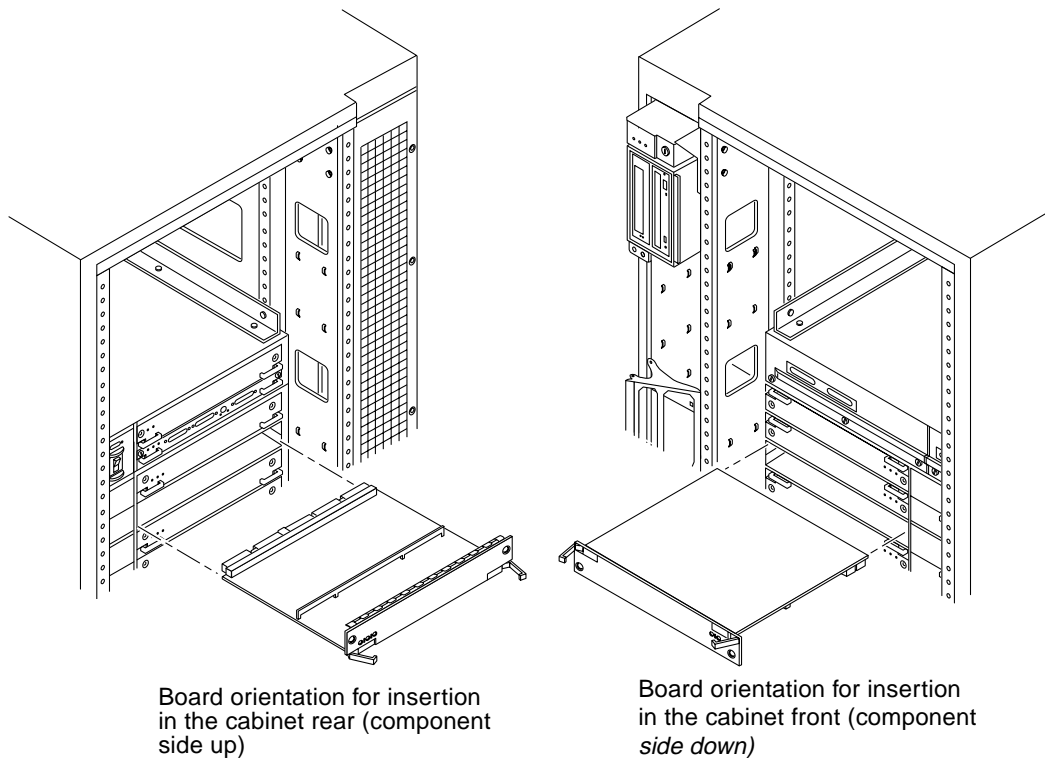


Figure 3-8 Board Replacement

2. **Ensure that both extraction levers are in the insert position (arrow pointing outward), and that the quarter-turn access slots are unlocked (arrow indicates unlocked position) as you slide the board toward the centerplane receptacles.**

See Figure 3-4 and Figure 3-5. The board will not seat fully unless the levers are in this starting position and both quarter-turn access slots are unlocked.



Caution – DO NOT FORCE any board into a slot; it can cause damage to the board and system. The board should insert and seat smoothly. If it binds, remove the board and inspect the card cage slot for any obvious obstructions. Also inspect both the board and the centerplane for bent pins or other damage.

3. **Push the board into the card cage, then simultaneously press both extraction levers to seat the board on the centerplane.**

Pushing both levers simultaneously avoids twisting the board and bending the connector pins, and mates the board centerplane connector to the matching receptacle on the centerplane. Do not press on board front panel to seat it—doing so will damage the connector pins.

4. **Mechanically lock the board to the system chassis by inserting a Phillips #1 screwdriver into each quarter-turn access slot and then turning to the locked position.**

See Figure 3-4.

5. **Once the board has been installed, a message similar to the following will be displayed on the monitor (if the system is powered on):**

Example depicts screen output when a new CPU/Memory board has been hot-plugged into slot 6 of an operating Enterprise system:

```
NOTICE: CPU Board Hotplugged into Slot 6
NOTICE: Board 6 is ready to remove
```

This screen output indicates that the board has been detected by the system and is in the low power mode. Additionally, any subsequent `prtdiag(1M)` output would include information for board slot 6. Again, note that the system will not use the new board until the system is rebooted.

6. **Reboot the system now or schedule a later time to reboot when system disruption will be minimized.**

3.4.3 UltraSPARC Modules

Each CPU/Memory board has four connectors for UltraSPARC modules (up to two modules per board, two connectors per module). For each module, there is a connector with 144 pins and a connector with 288 pins. See Figure 3-9.

3.4.4 Handling Precautions

The following precautions should be exercised when handling UltraSPARC modules:

- UltraSPARC modules are static-sensitive and a grounding wrist strap field kit must be used when handling the modules.
- Always handle the modules by the edges and not by the smaller black heat sinks that break easily if handled improperly.
- Do not handle the modules by touching the gold pins on the compression connectors. Natural oils on the hands cause these connectors to oxidize and corrode over a period of time, resulting in the need for module cleaning or replacement.

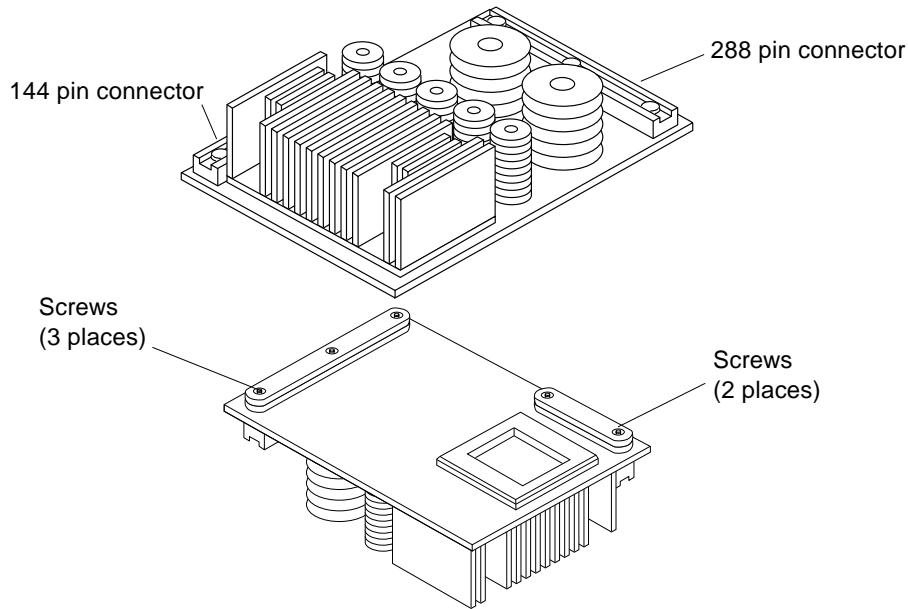


Figure 3-9 UltraSPARC Module Connector Detail

3.4.4.1 Removing a Module

Each module is locked to the main board with a single standoff and is connected to the main board by two connectors. The pins within the connectors are compressed to the corresponding board mating surfaces by a metal compression bar which, when secured with screws, compresses the module connector pins to the board mating surfaces. See Figure 3-10.

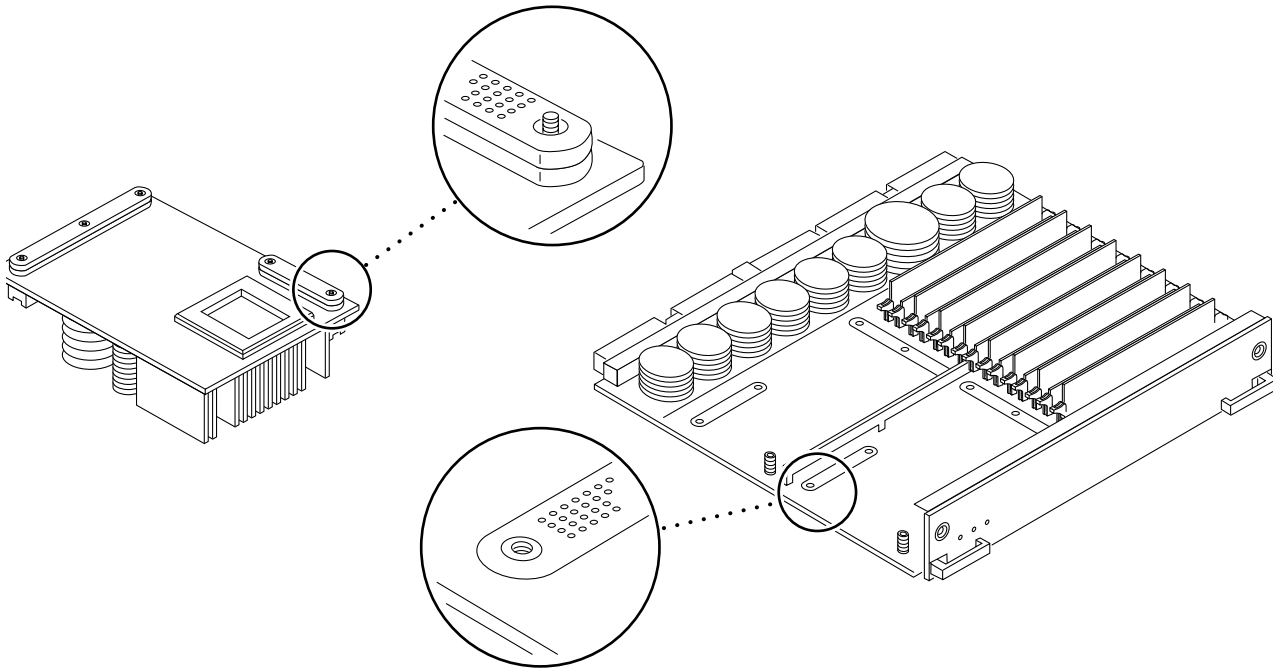


Figure 3-10 Ultra SPARC Module Connector Detail

1. Use the procedures in Section 3.4.1, “Removing a Board,” to remove the applicable CPU/Memory board.



Warning – The heatsinks on the UltraSPARC modules may be hot. Use caution when removing or installing UltraSPARC modules and avoid contact.

- 2. Use a 3/32 Hex driver to loosen all screws on each of the compression connectors on the module to be removed (three screws for the 288 pin connector, two screws for the 144 pin connector).
See Figure 3-9.**
- 3. Lift the module straight up, off the board mating surface and the single standoff that locks the module to the board.
Use pressure applied with fingers to assist in removing module from standoff. See Figure 3-11.**

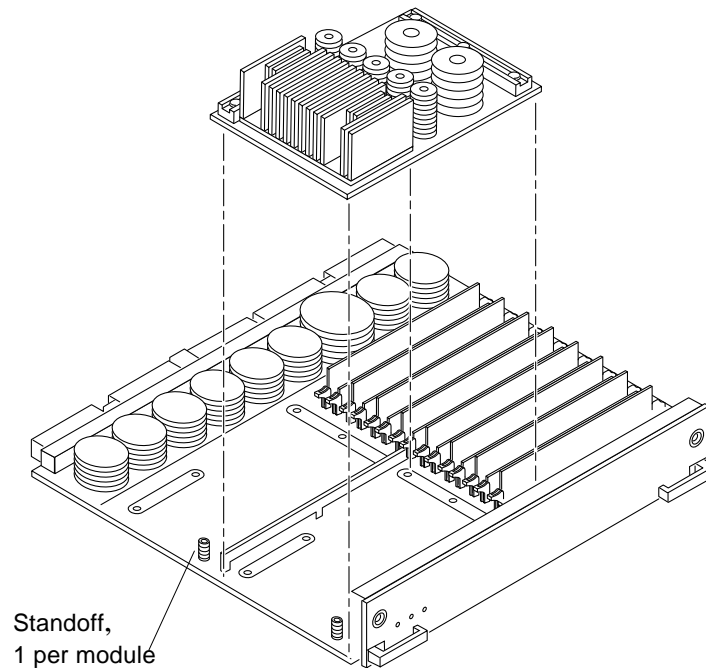


Figure 3-11 UltraSPARC Module Removal and Replacement

- 4. Place the module in an antistatic bag.**

3.4.4.2 *Installing a Module*

To maximize performance when installing UltraSPARC modules on a CPU/Memory board, use all CPU 0 connectors on the lowest numbered slot to the highest numbered slot. After this, if there are modules remaining, use the CPU 1 connectors in the same order.

1. Take the UltraSPARC module out of the protective packaging and inspect for dust on the connectors.

If necessary, clean the connectors with a dry, stiff toothbrush.

2. Remove the applicable CPU/Memory board as indicated in Section 3.4.1, “Removing a Board.”

3. Inspect the board module mating surface. If the surface requires cleaning, use a dry, stiff toothbrush to clean debris from the mating surfaces.

Note – There are miniature silver alignment pins on the compression connectors which, when the module is properly seated, align with related receptacles on the mating surfaces of the CPU/Memory board. In addition, there is a gold standoff mounted on the CPU/Memory board opposite the module’s smaller board connector. This acts as a standoff for the module as well as an alignment pin.

4. Align the module over the two board receptacles using the single standoff as well as the alignment pins located on the module compression connector as a guide.

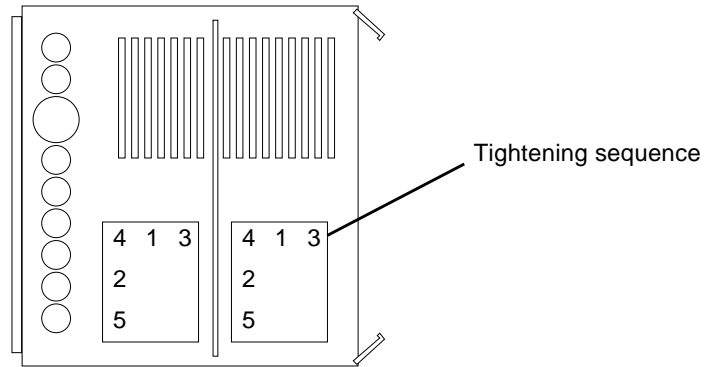
See Figure 3-10 and Figure 3-11.

5. Holding the module by the edges, rest it on the board standoff, aligning the compression connectors with the screws.

Firmly but gently press the module straight down until the standoff post snaps into place and the module connectors are fully seated.

6. Tighten the 3/32 hex screws of the module in two stages:

- a. **Tighten to 3 inch-pounds in the tightening sequence as follows:**



b. Tighten to 6 inch-pounds in the same tightening sequence.



Caution – Do not over-torque or under-torque the screws. Excessive force can warp the connector. Insufficient force can cause an incomplete electrical connection.

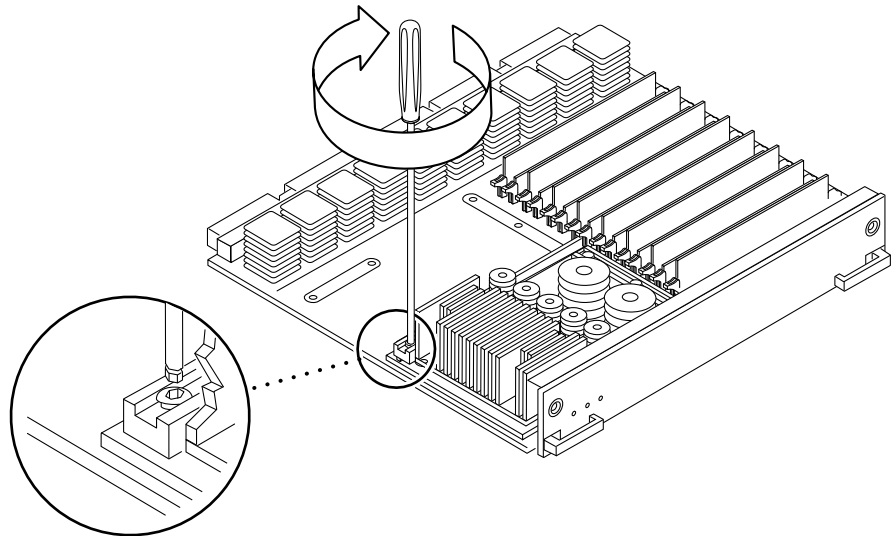


Figure 3-12 Tightening Compression Connector Screws

7. Use the procedures in Section 3.4.2, “Installing a Board,” to replace the applicable CPU/Memory board.

3.4.5 Memory Modules (SIMMs)

The CPU/Memory board has 16 SIMM sockets, which are divided into two banks of 8 SIMMs each, Bank 0 and Bank 1. Bank 0 and Bank 1 SIMMs occupy alternate slot locations; Bank 0 SIMMs are in the even numbered slots, and Bank 1 SIMMs are in odd numbered slots. See Figure 3-13.

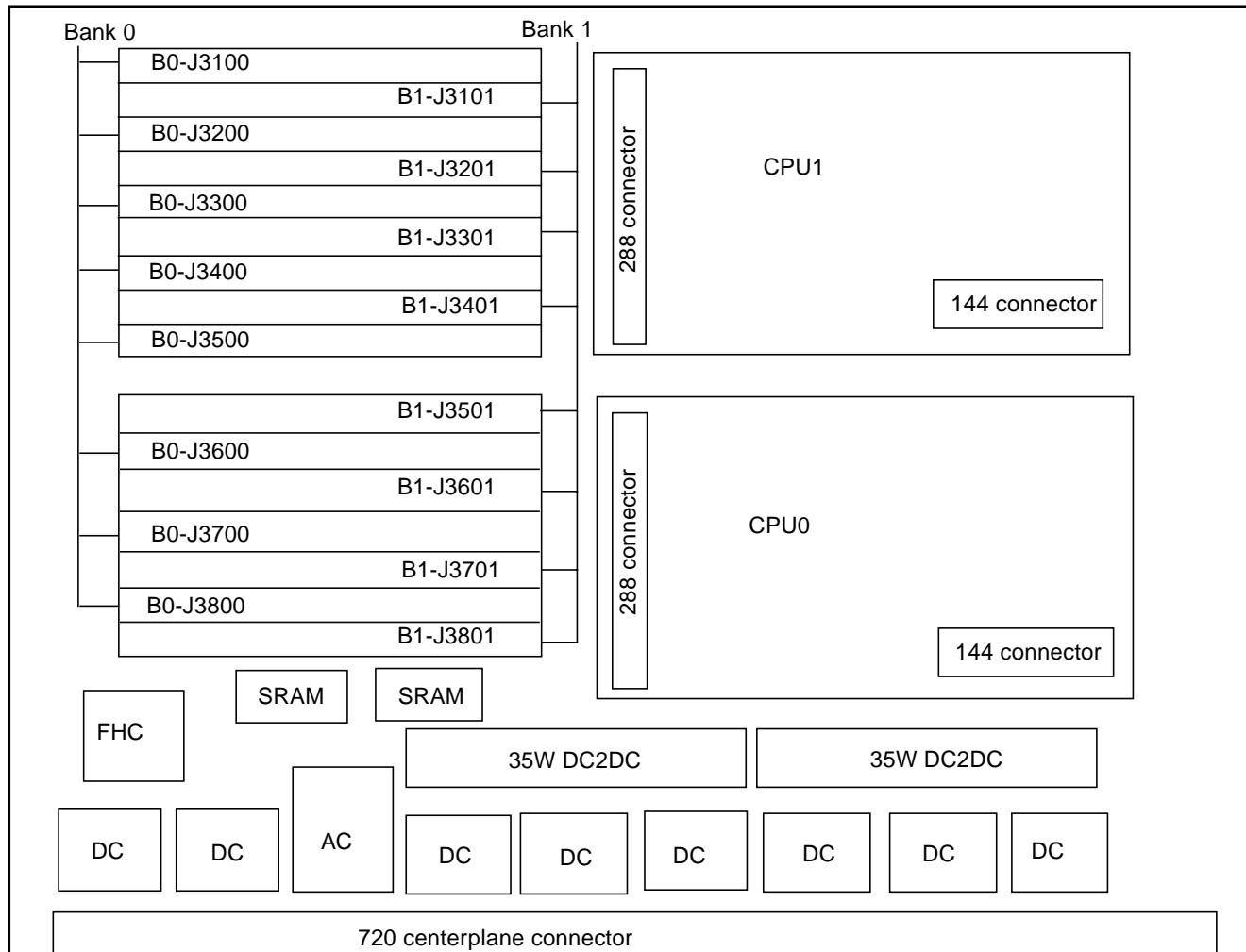


Figure 3-13 Layout of CPU/Memory Board

There are three types of SIMMs that can be used in both Bank 0 and Bank 1. Each type is listed together with the DRAMs used in Table 3-1.

Table 3-1 SIMM vs. DRAM

SIMM	DRAM
8 Mbyte	1 Mbyte x4
32 Mbyte	4 Mbyte x4
128 Mbyte	16 Mbyte x4

3.4.5.1 Removing a Memory Module

- 1. Remove the CPU/Memory board from which the SIMM is to be removed.**
See Section 3.4.1, “Removing a Board.”
- 2. Attach a wrist strap and place an antistatic surface next to the system.**
- 3. Locate the slot for the SIMM you need to replace.**
See Figure 3-13.

- Eject the faulty SIMM by pressing down on the ejection levers on both sides of the SIMM connector.**

See Figure 3-14.

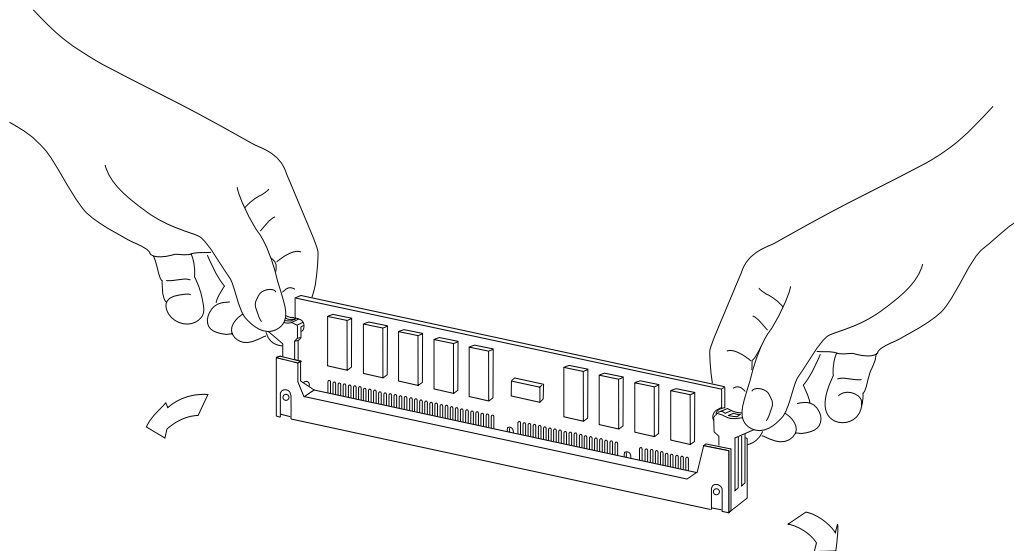


Figure 3-14 Ejecting a SIMM

- Holding the SIMM by its edges, remove it from the slot and place it on an antistatic surface.**

3.4.5.2 *Installing a Memory Module*

Requirements

All banks must have the same size SIMMs, however, SIMMs from different manufactures are interchangeable in a single bank if the SIMMs all have the same capacity and speed. Sort the SIMMs into banks of 8 using the same size SIMMs.

Maximizing Performance

The following guidelines will result in optimal memory interleaving across boards for performance. These guidelines are for optimal performance and are not requirements for a functional system. The guidelines apply to systems with no SIMMS installed and when adding SIMMs to a system; if you are adding SIMMs, you may need to move some SIMMs to meet the guidelines.

- 1. Install one bank on each board before installing the second bank on any board.**
It does not matter whether the first bank is bank 0 or bank 1.
- 2. Begin with the largest density banks first (128 Mbyte SIMMs), continue with medium sized banks (32 Mbyte SIMMs), and finish with the smallest banks (8 Mbyte SIMMs).**
- 3. If there is remaining memory, start filling the second banks on the boards in the same order as the first banks.**

Installation

- 1. Place the CPU/Memory board on which the SIMM is to be installed on an antistatic mat.**
- 2. Carefully remove the new SIMM from its protective packaging and place it on an antistatic surface.**
The bag that the SIMM is packed in makes a good antistatic surface.
- 3. Press down on the ejector levers at both ends of the SIMM connector slot that will receive the new SIMM.**
The connector slot will not accept the SIMM unless the levers are in the insert position. See Figure 3-15.
- 4. Align the SIMM with the slot.**
Hold the SIMM by its edges and orient it so that the two notches at the bottom of the SIMM line up with the two tabs in the SIMM connector. See Figure 3-15.
- 5. Place your thumbs on the top edge of the SIMM and push the SIMM firmly into its connector.**
See Figure 3-16.

6. **Lock the SIMM in place by pushing both ejector levers into the upright position.**
See Figure 3-16.
7. **Install the CPU/Memory board and detach the wrist strap.**
See Section 3.4.2, “Installing a Board.”
8. **As you reboot the system, watch for the system banner to verify that the new memory is recognized by the system.**

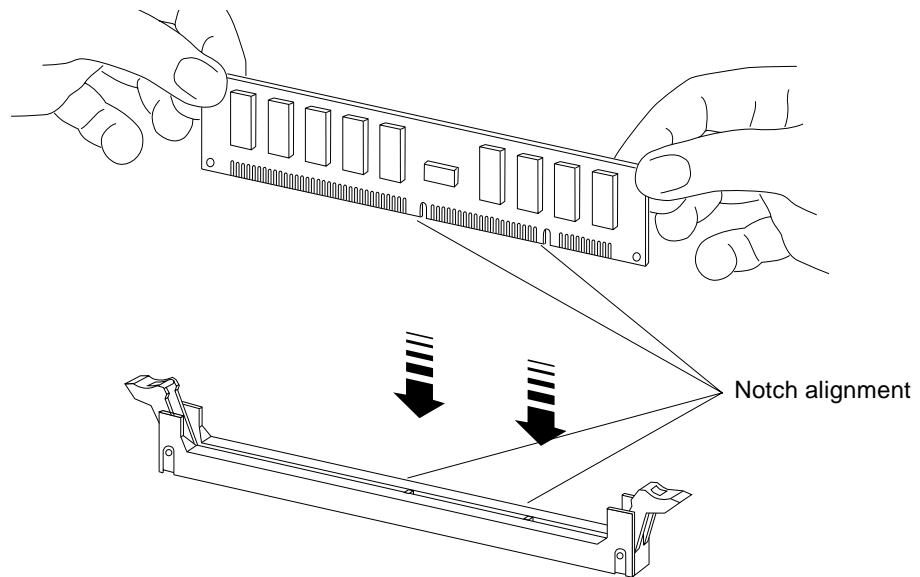


Figure 3-15 Orienting a SIMM

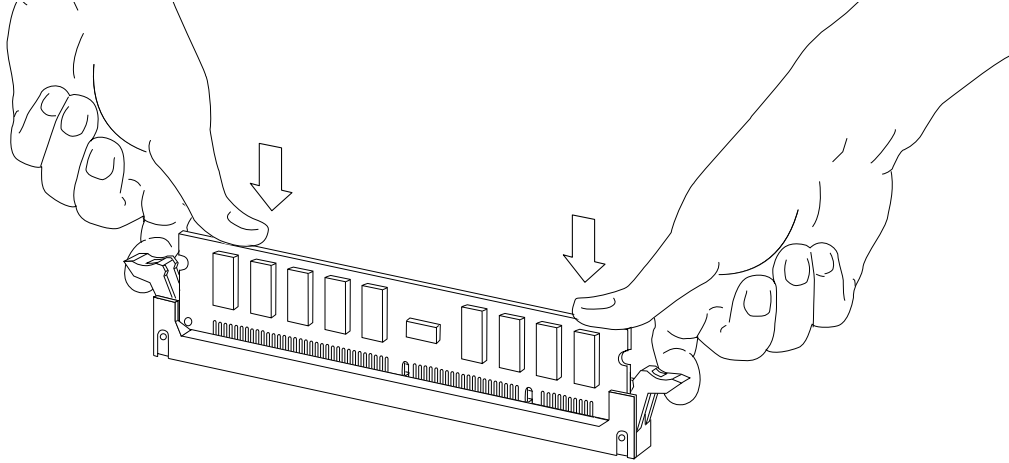


Figure 3-16 Installing a SIMM

I/O Boards and Components

To protect both yourself and the equipment, make sure you follow precautions in Chapter 2, “Safety Precautions and Tools Requirements.”

<i>Safety Precautions</i>	<i>page 2-1</i>
<i>Handling Boards and Assemblies</i>	<i>page 3-2</i>
<i>Filler Panels and Load Boards</i>	<i>page 3-3</i>
<i>SCSI Termination</i>	<i>page 3-4</i>
<i>Hot-Plug Feature</i>	<i>page 3-5</i>
<i>I/O Boards</i>	<i>page 3-5</i>
<i>SBus Cards</i>	<i>page 3-19</i>
<i>Graphics (UPA) Cards</i>	<i>page 3-27</i>
<i>Fibre Cards</i>	<i>page 3-31</i>
<i>Connectors</i>	<i>page G-5</i>

For your protection, also observe the following safety precautions when setting up your equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Never push objects of any kind through openings in the equipment as they may touch dangerous voltage points or short out components that could result in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

3.1 Handling Boards and Assemblies



Caution – The chassis AC power cord must remain connected to ensure a proper ground.



Caution – The I/O boards, their modules, and cards have surface-mount components that can be broken by flexing the boards.

To minimize the amount of board flexing, observe the following precautions:

- Hold the board only by the edges near the middle of the board, where the board stiffener is located. Do not hold the board *only* at the ends.
- When removing the board from an antistatic bag, keep the board vertical until you lay it on the Sun ESD mat.
- Do not place the board on a hard surface. Use a cushioned antistatic mat. The board connectors and components have very thin pins that bend easily.
- Do not use an oscilloscope probe on the components. The soldered pins are easily damaged or shorted by the probe point.
- Transport the board in an antistatic bag.
- Be careful of small parts located on the component side of the board.
- Be careful not to drag boards across surfaces as board components are easily damaged.



Caution – The heatsinks on the board can be damaged by incorrect handling. Do not touch the heatsinks while installing or removing the board. Hold the board only by the edges. If a heatsink is loose or broken, obtain a replacement board.



Caution – When inserting the board into slot 4 or slot 10 of a 16-slot card cage, lift the board slightly to avoid damage to the centerplane connectors.



Caution – The heatsinks on the board can be damaged by improper packaging. When storing or shipping the board, ensure that the heatsinks have sufficient protection.

3.2 Filler Panels and Load Boards

All empty board slots in Enterprise systems must have either a filler panel or a load board installed.

- Empty slots in Enterprise 5000 and 4000 systems must have a filler panel installed. See Figure 3-1.
- Empty slots in Enterprise 6000 systems must have a load board installed. See Figure 3-2.

Load boards and filler panels are inserted into a board slot with the springfingers facing down if inserted in the front of the system; the springfingers face up if inserted in the rear of the system.

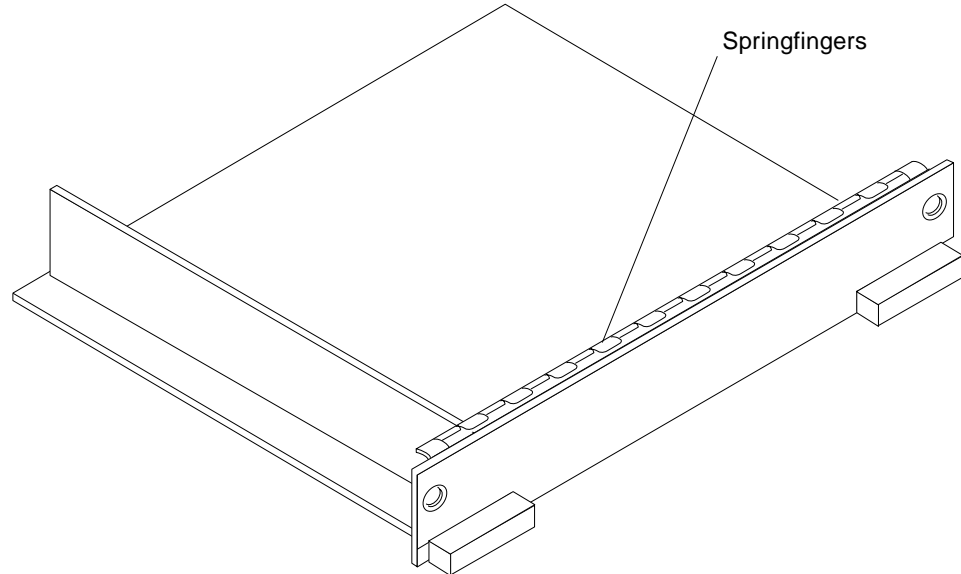


Figure 3-1 Filler Panel (Enterprise 5000/4000 Only)

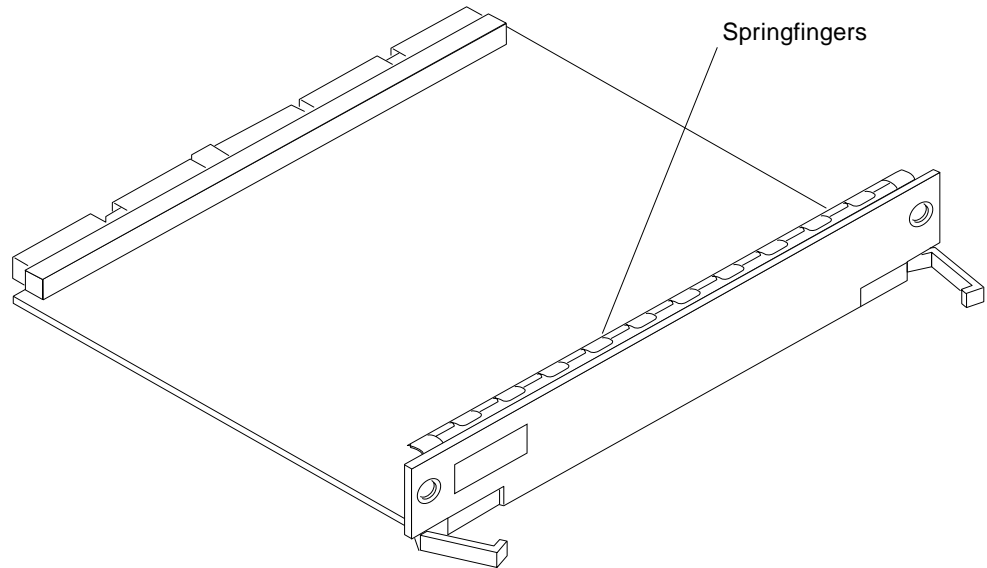


Figure 3-2 Load Board (Enterprise 6000 System Only)

3.3 SCSI Termination

The I/O board in slot 1 controls the internal SCSI tray devices. Therefore, the external SCSI connector on the I/O board in slot 1 of a system must be terminated with a SCSI terminator. See Figure 3-3.

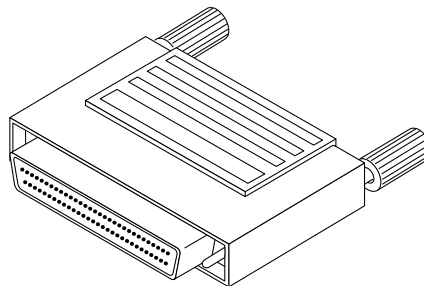


Figure 3-3 SCSI Terminator

3.4 Hot-Plug Feature

Enterprise systems have extensive error detection mechanisms, and an Automatic System Reconfiguration (ASR) feature that enables the system to be rebooted with failed components (such as CPUs, memory, or I/O) disabled. When an error is detected, the system can be reconfigured so that the board containing the failed components is placed in low power mode and is no longer accessible.



Caution – The peripheral power supply provides the precharge voltages required for hot-plug. Do not attempt hot-plug of a system component if the power supply is missing or inoperative. Use `prtdiag(1M)` to determine the status of the peripheral power supply.



Caution – If the message: NOTICE: Hot Plug not supported in this system is displayed during boot, do NOT attempt hot-plug in this system or damage to the hardware will occur.

The hot-plug feature enables you to insert a new board into a powered on system, despite the system being “live,” or being supplied with electrical power. When the hot-plug feature is used to add a board to a powered on system, the system will not use the new board until the system is rebooted.

3.5 I/O Boards

Enterprise systems support two types of I/O boards: SBus and Graphics. See Figure 3-4 through Figure 3-7.

The SBus I/O board includes two SYSIO ASICs that provide two SBuses:

- One for two plug-in SBus cards and two fiber interfaces
- One for one plug-in SBus card and the on-board devices (10/100Mbyte TPE and Single-ended Fast/Wide SCSI)

Note – SBus connector slots 1 and 2 on the SBus I/O board can accommodate a double-wide SBus card.

The Graphics I/O board includes one SYSIO ASIC that provides a single SBus for two plug-in SBus cards, two fiber interfaces, and the on-board devices (10/100Mbyte TPE and Single-ended Fast/Wide SCSI).

3.5.1 `tpe-link-test?` *Variable*

If the system cannot communicate with a network, the `tpe-link-test?` settings for the on-board Ethernet ports may be incompatible with the setting at the network hub. The `tpe-link-test?` variable is set separately for the on-board Ethernet port on each I/O board. The variable is also set for any SBus Ethernet cards in the system.

If you have problems verifying connection between Sun equipment and your hub, verify that your hub also has the link test function enabled.

See Section 8.5.3.2, “`printenv` Command,” for information about displaying configuration variables and Section 8.6.1, “Failure of Network Communications,” for additional `tpe-link-test?` information. Also, refer to the manual provided with your hub.

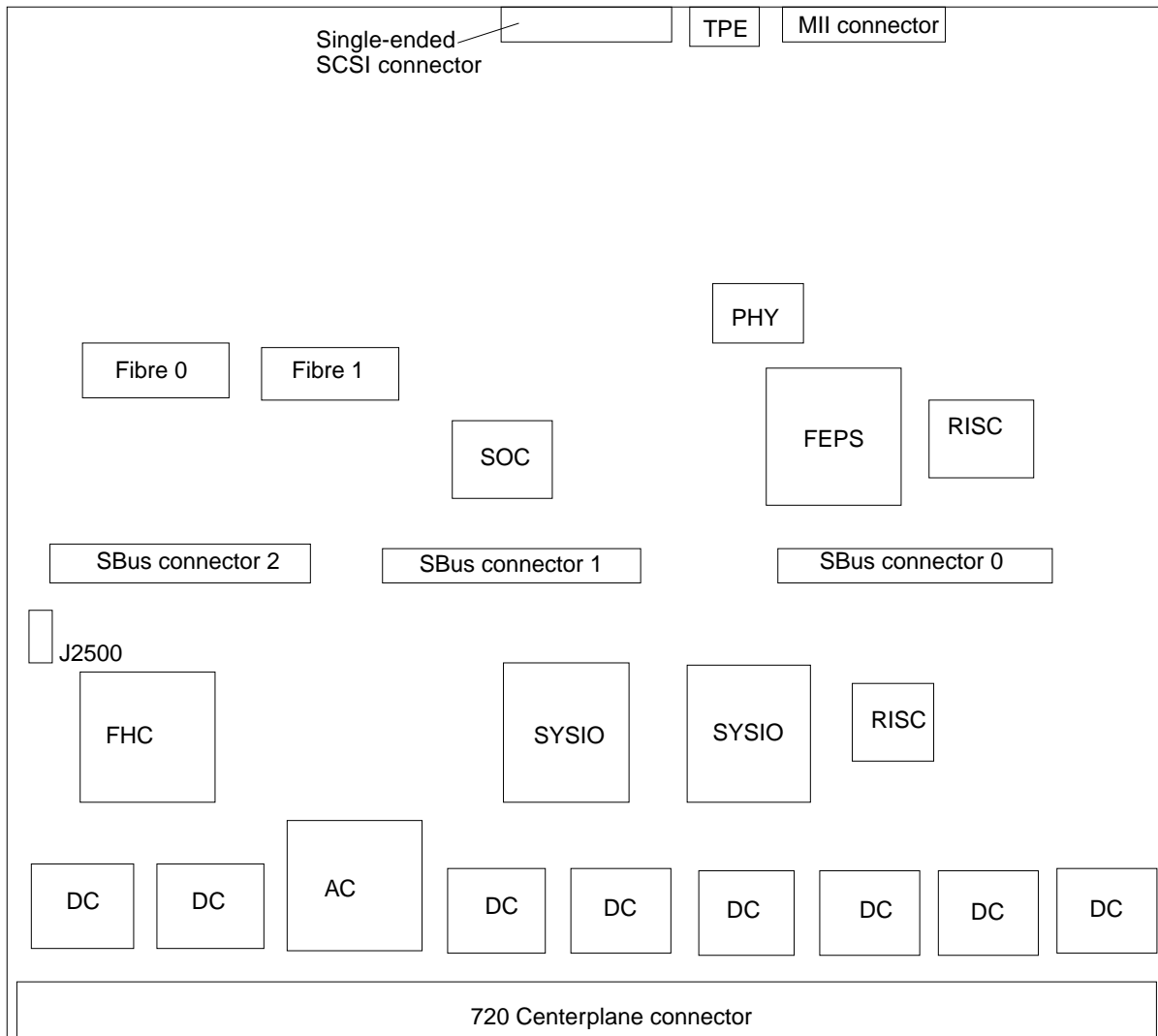


Figure 3-4 SBus I/O Board Components Locations

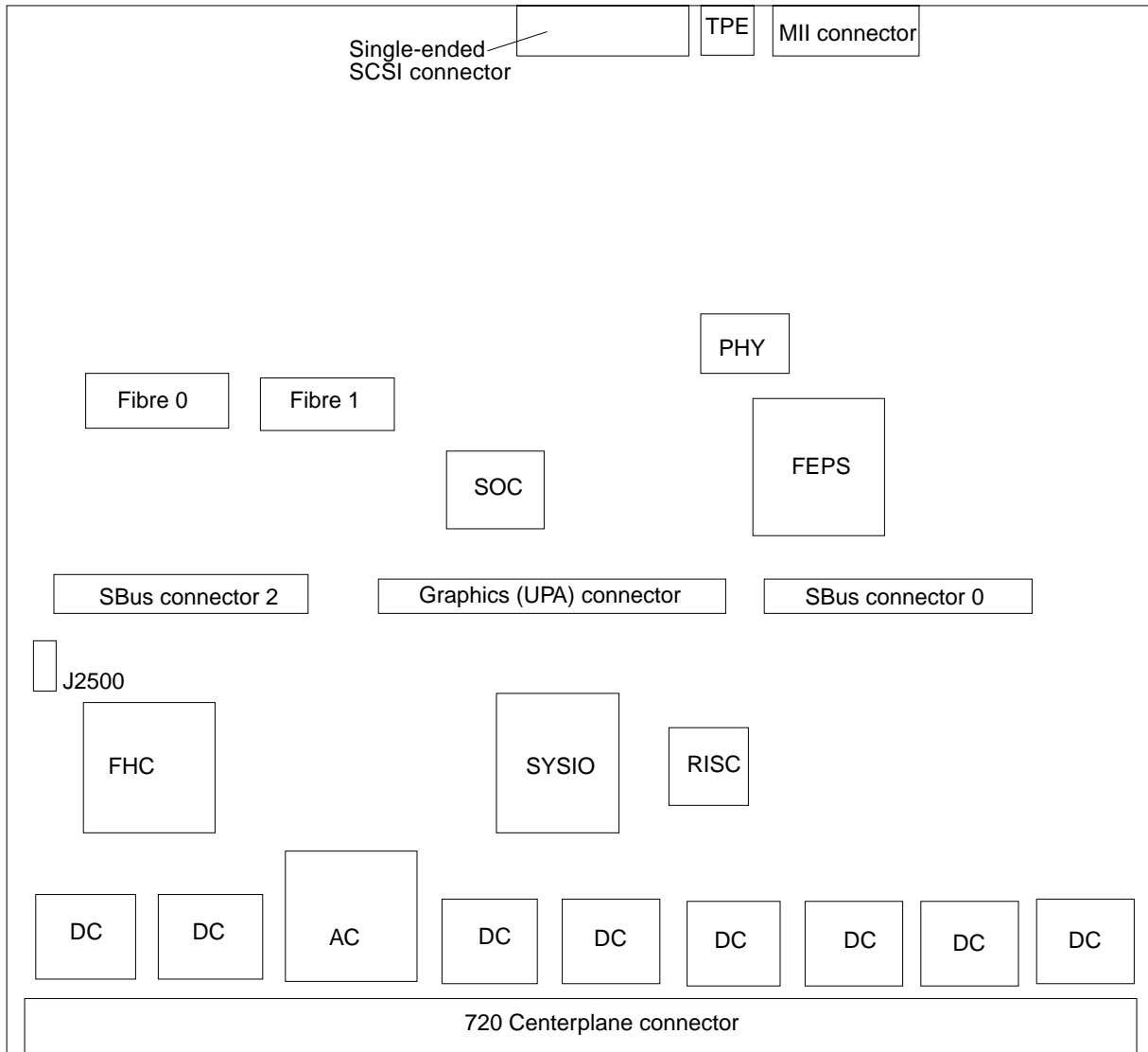


Figure 3-5 Graphics I/O Board Components Locations

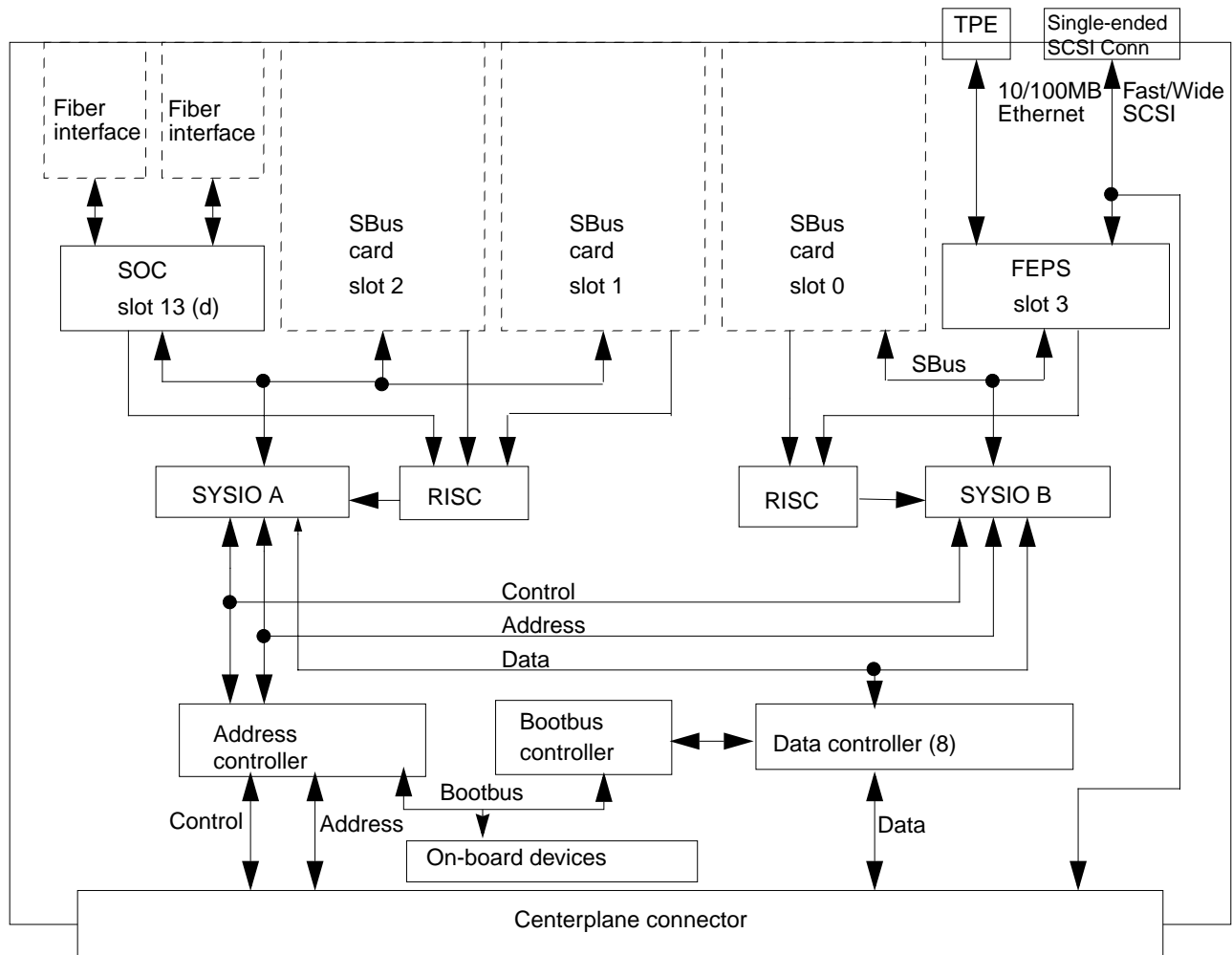


Figure 3-6 SBus I/O Board Simplified Block Diagram

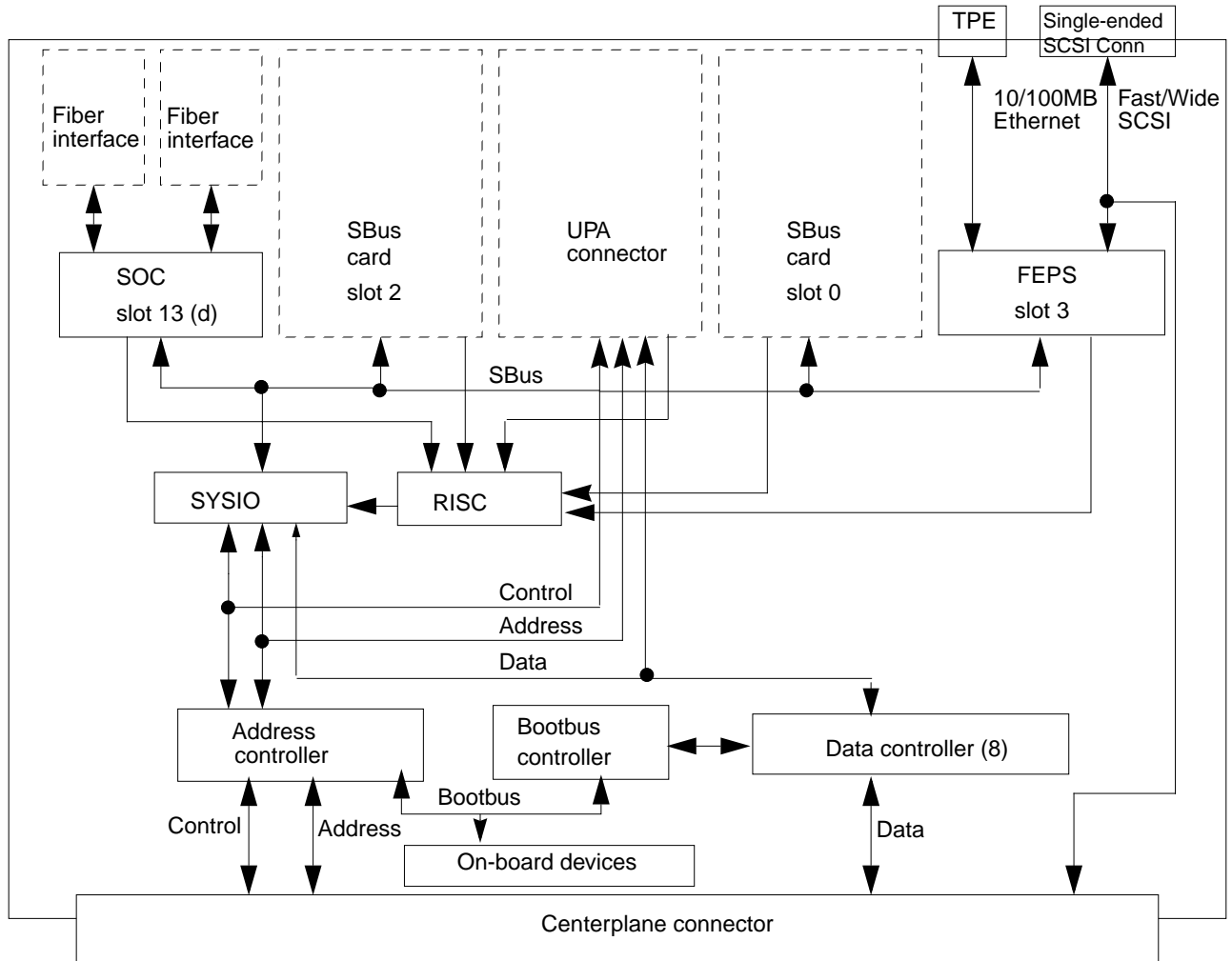


Figure 3-7 Graphics I/O Board Simplified Block Diagram

3.5.2 Removing a Board

3.5.2.1 Removing a Board from a Powered On System

Caution – Remove a board from a powered on system only after the ASR software has disabled the board. If a board has not been disabled by the ASR software, then the operating system should be halted and the system powered off prior to board removal. See Chapter 12, “Powering Off and On” and then Section 3.5.2.2, “Removing a Board from a Nonpowered On System.”

1. Ensure that the board has been disabled by the ASR software. See Section 3.4, “Hot-Plug Feature.”

Once disabled by ASR, one of two results occurs:

- The three LEDs on the board are not lit (board has no power).
- The outer two green LEDs are not lit and the middle yellow LED is lit (board in low power mode).

Note – System software operates such that the LED pattern described is the same for a board that is component side down (installed in front of card cage) or component side up (installed in rear of card cage).

2. Unfasten any cable connectors from the front panel and set them aside.

Label cables to identify them for reconnection later.

3. Use a Phillips #1 screwdriver to mechanically release the board from the system card cage.

Insert the screwdriver into each quarter-turn access slot (the slots are located on the left and right sides of the board’s front panel) and then turn a quarter turn so that the arrow points to the unlocked position. See Figure 3-8.

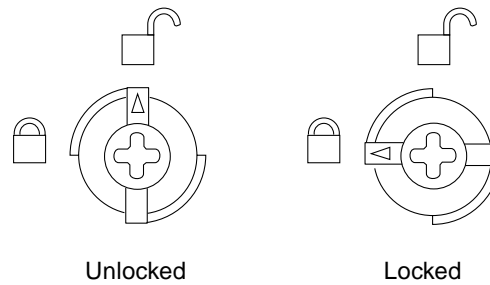
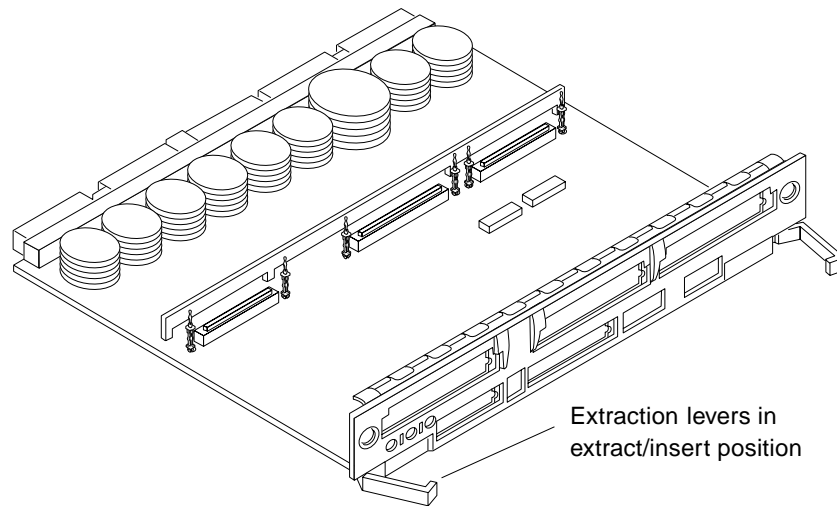
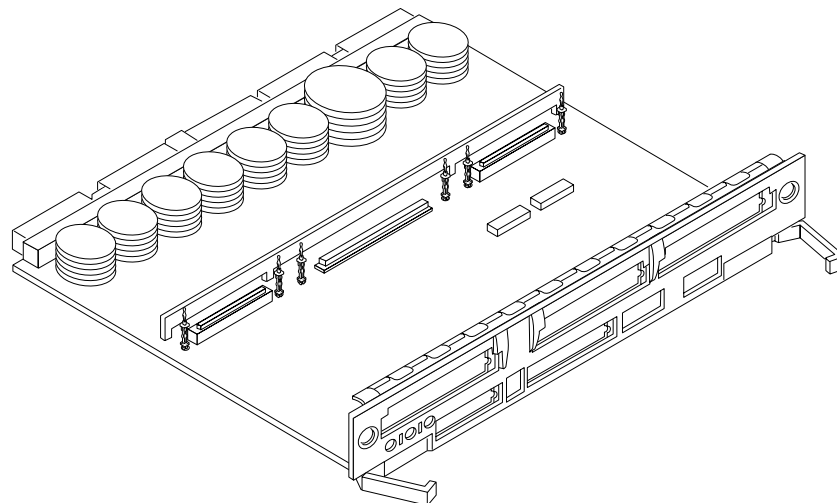


Figure 3-8 Unlocking and Locking Quarter-Turn Access Slots

- 4. Pull the ends of both extraction levers outward simultaneously to unseat the board centerplane connector from the centerplane receptacles.** See Figure 3-9 for positioning of extraction levers.



SBus I/O board



Graphics I/O board

Figure 3-9 I/O Boards

- 5. If a board is not immediately replaced, a load board (Enterprise 6000 systems only) or a filler panel (Enterprise 4000 and 5000 systems only) must be installed in its place.**

See Section 3.2, "Filler Panels and Load Boards."

3.5.2.2 Removing a Board from a Nonpowered On System

- 1. Use a Phillips #1 screwdriver to mechanically release the board from the system card cage.**

Insert the screwdriver into each quarter-turn access slot (the slots are located on the left and right sides of the board front panel) and then turn a quarter turn so that the arrow points to the unlocked position. See Figure 3-8.

- 2. Unfasten any cable connectors from the front panel and set them aside.**

Label cables to identify them for reconnection later.

- 3. Pull the ends of both extraction levers outward simultaneously to unseat the board from the centerplane receptacles.**

See Figure 3-9 for positioning of extraction levers.

3.5.3 Installing a Board

3.5.3.1 Board Slot Selection

Note – Logically there is no difference between the board slots in the front or rear of the card cage, and each slot can accept any board type. It is suggested that CPU/Memory boards be installed in the front slots, and I/O and disk boards be installed in the rear slots because of cabling. Should the need arise, however, any of these three board types can be placed in any of the numbered board slots, with the exception of slot 1. Slot 1 should be used by the first I/O board because it is the only slot connected to the onboard SCSI devices.

The first CPU/Memory board is placed in slot 0, followed sequentially by all remaining even numbered slots. If there are boards remaining, they can be installed sequentially in odd numbered slots, if available, in the system rear (with the exception of slot 1 as noted above). See Figure 3-10 and Figure 3-11.

For I/O boards being placed in the rear of the system, ensure that the component side is up. If the boards are placed in the front of the system, ensure that the component side is down. See Figure 3-12.

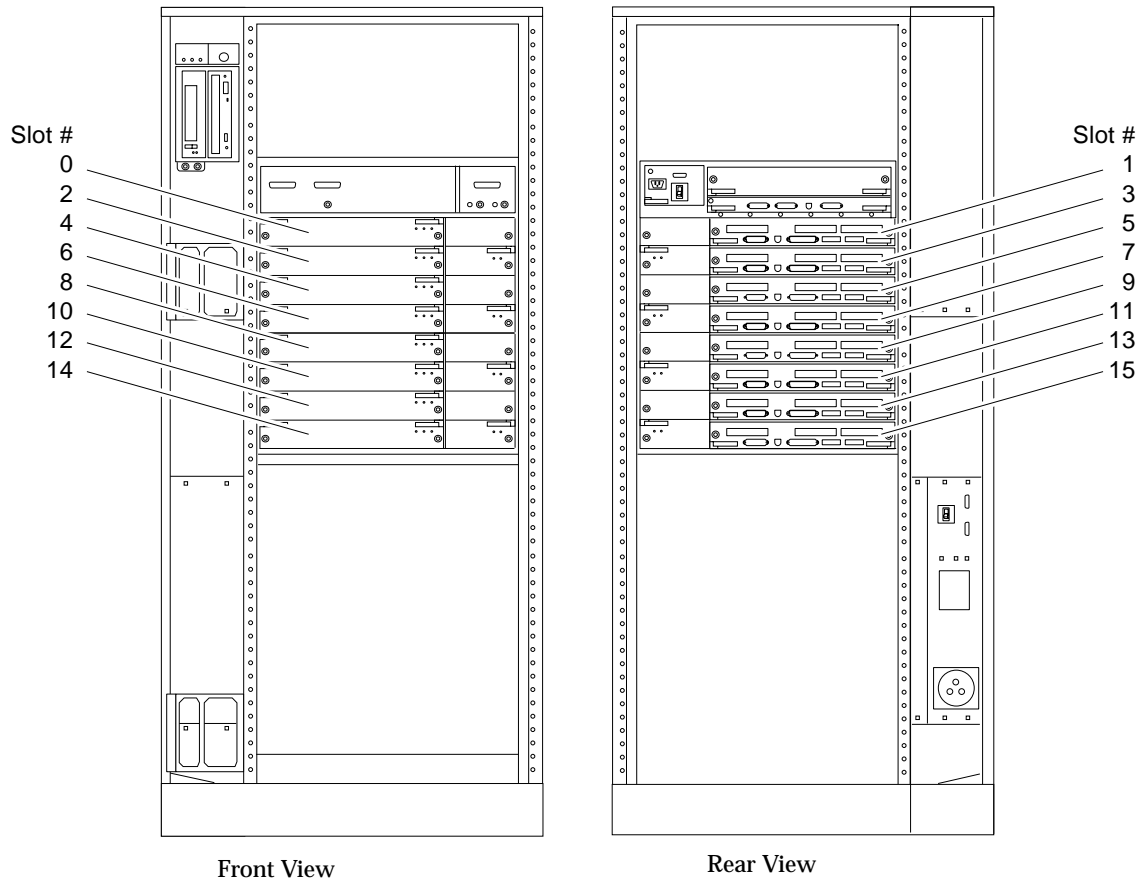


Figure 3-10 Enterprise 6000 Board Locations

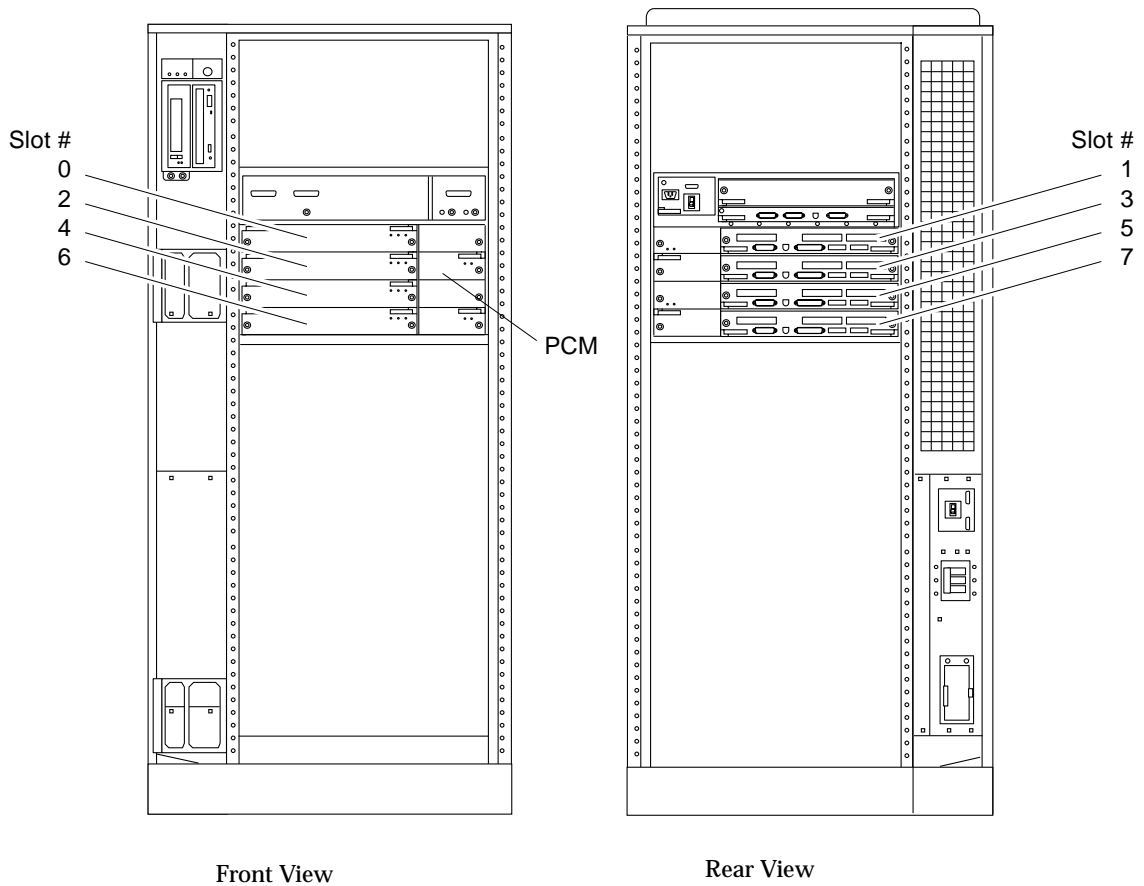


Figure 3-11 Enterprise 5000/4000 Board Locations

3.5.3.2 Cooling and Power Issues

There should be one power/cooling module (PCM) for every two boards to adhere to cooling and power requirements. The PCMs must be installed adjacent to populated board slots to ensure the fan in the PCM can cool the respective boards.

Note – All empty board slots in Enterprise 4000 or 5000 systems must have a filler panel installed to ensure proper cooling. All empty slots in Enterprise 6000 systems must have load boards installed.

3.5.3.3 Powered or Nonpowered On System

1. Carefully insert the board (component side down if in front; component side up if in the rear) in the proper slot in the card cage, ensuring that the board does not slip out of the left and right card guides.

See Figure 3-12

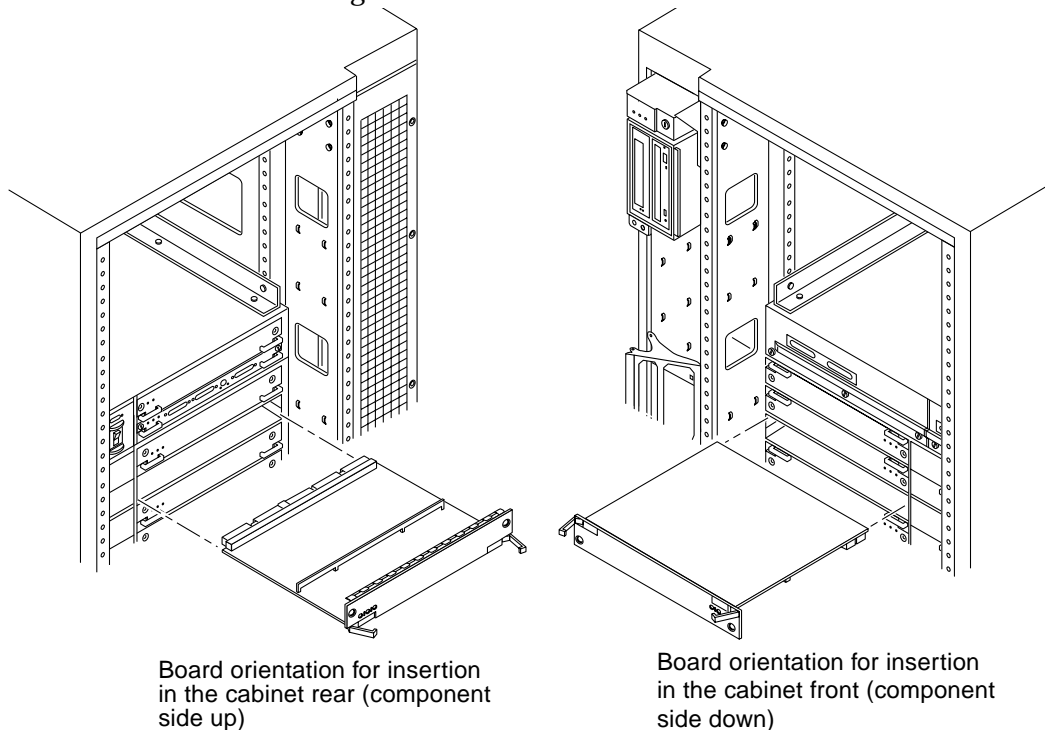


Figure 3-12 Board Replacement

- 2. Ensure that both extraction levers are in the insert position (arrow pointing outward), and that the quarter-turn access slots are unlocked (arrow indicates unlocked position) as you slide the board toward the centerplane receptacles.**

See Figure 3-8 and Figure 3-9. The board will not seat fully unless the levers are in this starting position and the access slots are unlocked.



Caution – DO NOT FORCE any board into a slot; this can cause damage to the board and system. The board should insert and seat smoothly. If it binds, remove the board and inspect the card cage slot for any obvious obstructions. Also inspect both the board and the centerplane for bent pins or other damage.

- 3. Push the board into the card cage, then simultaneously press both extraction levers to seat the board on the centerplane.**

Pushing both levers simultaneously avoids twisting the board and bending the connector pins, and mates the board centerplane connector to the matching receptacle on the centerplane. Do not press on board front panel to seat it—doing so will damage the connector pins.

- 4. Mechanically lock the board to the system chassis by inserting a Phillips #1 screwdriver into each quarter-turn access slot and then turning to the locked position.**

See Figure 3-8.

- 5. Replace or connect all necessary cables to the front of the board.**

Note – The I/O board in slot 1 controls the internal SCSI tray devices. Therefore, the external SCSI connector on the I/O board in slot 1 of a system must be terminated with a SCSI terminator. See Figure 3-3.

- 6. Terminate the board SCSI connector if required, see above note.**

- 7. Once the board has been installed, a message similar to the following will be displayed on the monitor (if the system is powered on):**

Example depicts screen output when a new I/O board has been hot-plugged into slot 6 of an operating Enterprise system:

```
NOTICE: I/O Board Hotplugged into Slot 6
NOTICE: Board 6 is ready to remove
```

This screen output indicates that the board has been detected by the system and is in the low power mode. Additionally, any subsequent `prtdiag(1M)` output would include information for board slot 6. Again, note that the system will not use the new board until the system is rebooted.

- 8. Reboot the system now or schedule a later time to reboot when system disruption will be minimized.**

3.5.4 SBus Cards

There are three SBus card locations on the SBus I/O board; the Graphics I/O board has two. Figure 3-13 shows the SBus card locations for both types of boards.

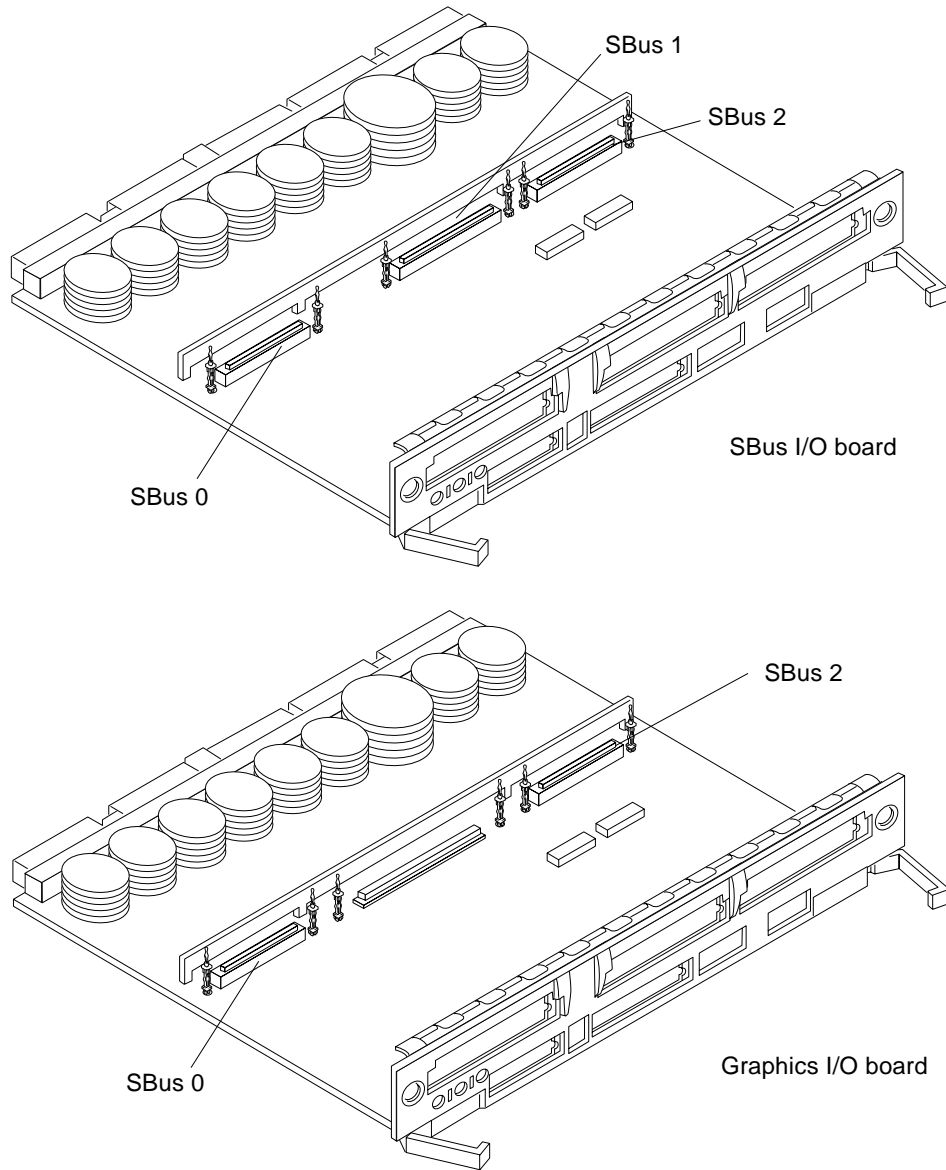


Figure 3-13 I/O Board SBus Card Locations

3.5.4.1 Plastic Standoffs

Plastic standoffs lock the SBus and graphics (UPA) cards to the I/O boards. See Figure 3-14.

- To unlock a standoff, pull up the tip insert.
- To lock a standoff, first ensure that the module or card rests on the standoff flange, then press down the tip insert.

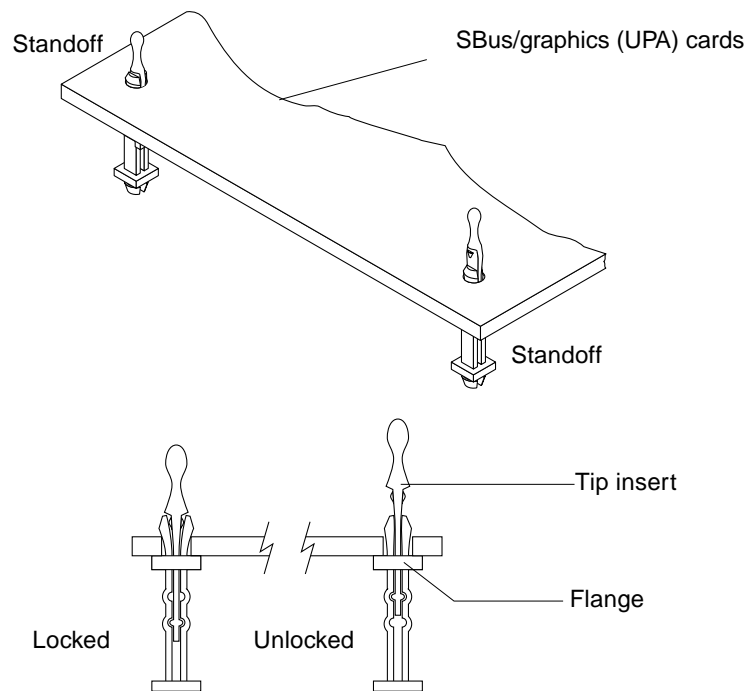


Figure 3-14 Locking and Unlocking Standoffs

3.5.4.2 Removing an SBus Card

1. Use the procedures in Section 3.5.2, “Removing a Board,” to remove the applicable I/O board.
2. Use Figure 3-13 to locate the card to be removed.

3. **Remove the two screws that secure the SBus card to the back panel.**
Save the screws for installation of a replacement SBus card or a filler panel.
4. **Unlock the SBus card by pulling up the tips of the two standoffs.**
See Figure 3-14.
5. **Hold the card by the edges near the connector and gently rock the card back and forth to loosen it from the socket.**
You may have to remove the SBus cards or the FFB card next to this card in order to have enough room to hold onto the SBus card being removed.



Caution – The connector housing may break if the SBus card is tilted too far.

6. **Lift the SBus card from the socket at an angle while guiding the face plate out from the back panel opening.**
See Figure 3-15.

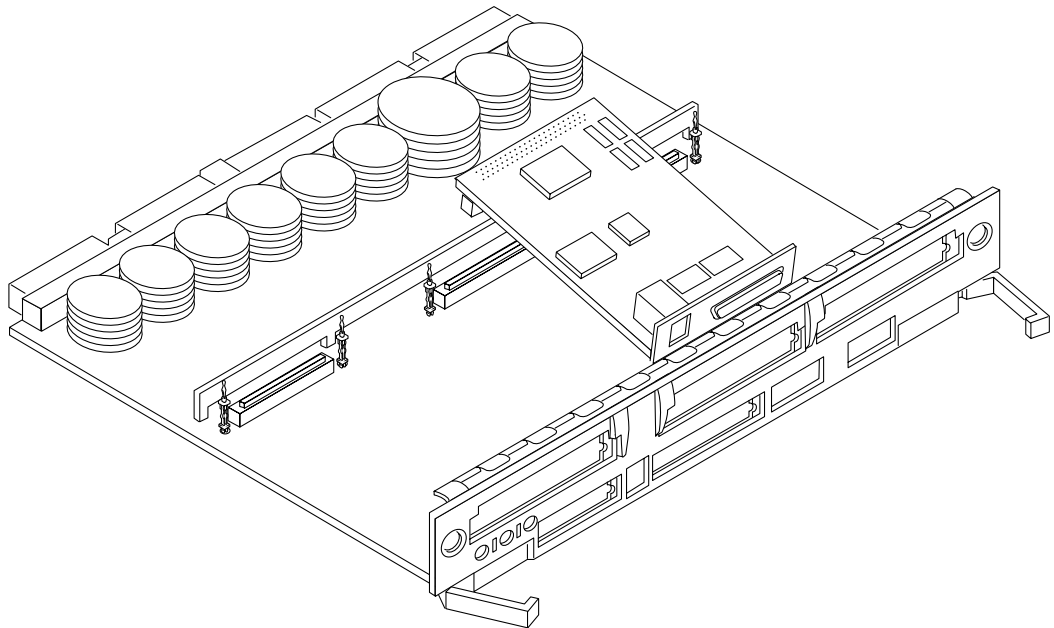


Figure 3-15 Removing or Installing an SBus Card

7. Place the SBus card in an antistatic bag.
8. If the SBus card is not immediately replaced, install a filler panel (part number 340-2305) on the I/O board back panel opening. To secure the filler panel, use the screws that were removed in Step 3.



Caution – Be sure to install the filler panel right-side up. Installing it upside down creates a gap at the top edge of the SBus slot opening that can impair system cooling and FCC regulatory compliance.

9. Replace the I/O board. Use the procedures in Section 3.5.3, “Installing a Board.”

3.5.4.3 Preparing to Install an SBus Card

Note – If the new SBus card does not have an adapter plate or the Link Integrity Test feature, proceed to “Installing an SBus Card” on page 3-26.

1. Attach a wrist strap and take the SBus card out of the protective packaging and place the SBus card on an antistatic mat.
2. Remove the adapter bracket from the SBus card rear panel.
See Figure 3-16. Remove the two screws securing the adapter to the card rear panel (the adapter bracket and the screws are not needed for this installation).

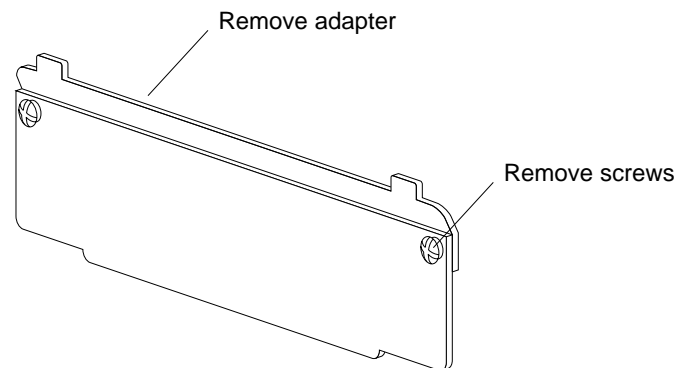


Figure 3-16 SBus Card Rear Panel with Adapter

3. Remove the black plastic card retainer shipped with the card.

See Figure 3-17. Spread the ends of the retainer apart to remove it from the card (the retainer is not needed for this installation).

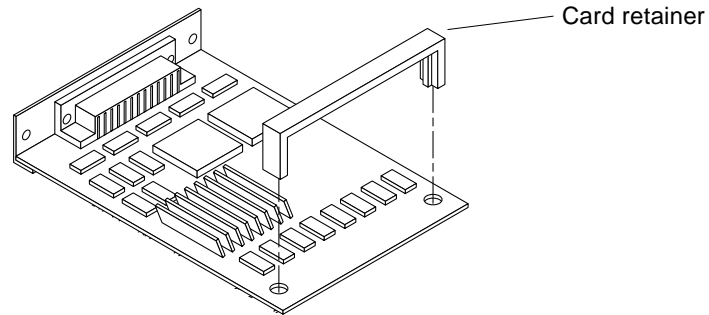


Figure 3-17 Card Retainer

Link Integrity Test

1. Ensure that the SBus card is on an antistatic mat.
2. For DSBE/S and FSBE/S cards: remove the two outer retaining screws (see Figure 3-18), but do NOT remove the middle screw or the springfinger. Use a #0 Phillips screwdriver and a 3/16 nut driver or socket wrench.
3. For DSBE/S and FSBE/S cards, configure jumper J0302 for Link Integrity Test functionality. See Figure 3-18 (DSBE/S) or Figure 3-19 (FSBE/S).
 - a. Put the shunt over both pins to *disable* the Link Integrity Test. See Figure 3-20 “Disabled.”
 - b. Put the shunt in one pin to *enable* the Link Integrity Test. See Figure 3-20 “Enabled.”



Caution – If you choose to disable the test, it must be disabled both at the hub and at the SBus card. In the event of “loss of carrier” or “not responding” problems, check the status of the link enable on both the SBus card and the hub.

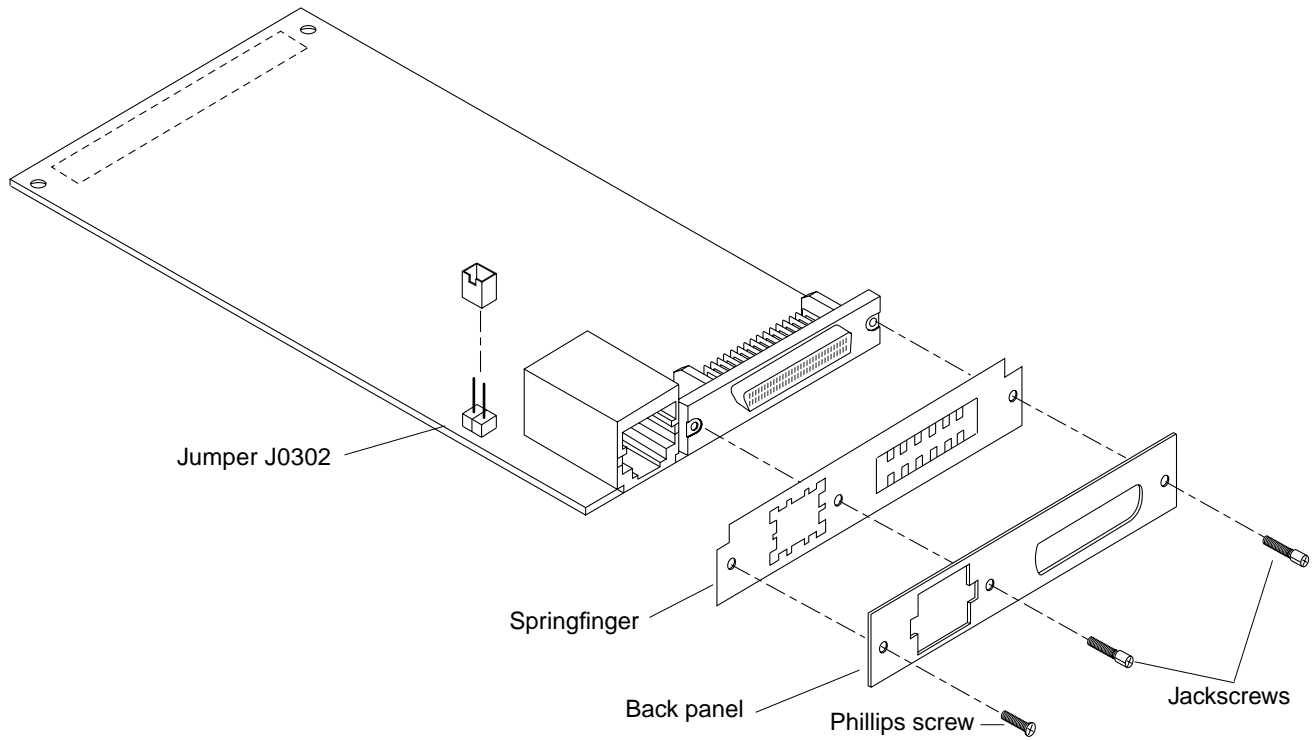


Figure 3-18 DSBE/S SBus Card

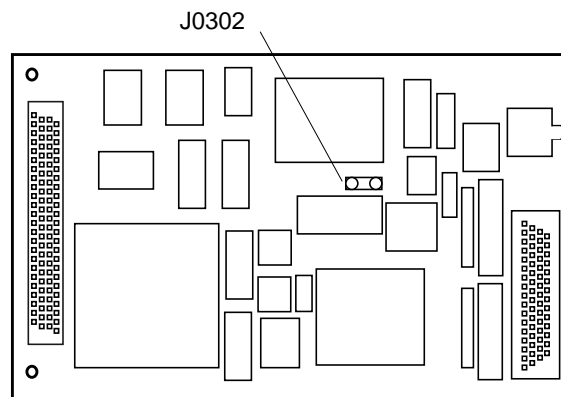


Figure 3-19 FSBE/S SBus Card



Figure 3-20 Disabling and Enabling the Link Integrity Test

3.5.4.4 Installing an SBus Card

1. Use the procedures in Section 3.5.2, “Removing a Board,” to remove the applicable I/O board.
2. Use Figure 3-13 to locate the SBus connector for the card that is to be installed.
3. If a filler panel covers the back panel SBus slot, remove the two screws and detach the filler panel.
Retain the screws to attach the SBus card to the back panel, unless the card has a wide connector, or set of connectors.
4. Unlock the tip insert of the two standoffs for the SBus slot.
See Figure 3-14.
5. Attach a wrist strap and take the SBus card out of the protective packaging. Inspect the pins in the connector to make sure they are not bent.
6. Hold the SBus card at an angle and guide the SBus card face plate under the springfingers and against the rear face of the I/O board front panel.
See Figure 3-15 on page 3-22. The I/O connectors of the SBus card should be visible through the opening in the back panel.
7. Hold the card by the edges nearest the SBus connector and place the card over the two standoffs.
8. Hold the SBus card by the edges near the connector and firmly but gently press the card down until the connector is fully seated.
To align the connector and socket, push the card toward the I/O board back panel.



Caution – Do not rock the card onto the socket; the plastic connector housing may break.

9. Press each corner of the SBus card to ensure that it rests on the collar of the standoff.
10. Press down on the tip insert of each standoff to lock the card in place.
11. Replace and tighten the back panel screws to secure the SBus card to the I/O board back panel.
12. Replace the I/O board using the procedures described in Section 3.5.3, “Installing a Board.”

3.5.5 Graphics (UPA) Cards

The Graphics I/O board contains a single connector that accommodates graphics (UPA) cards. See Figure 3-21.

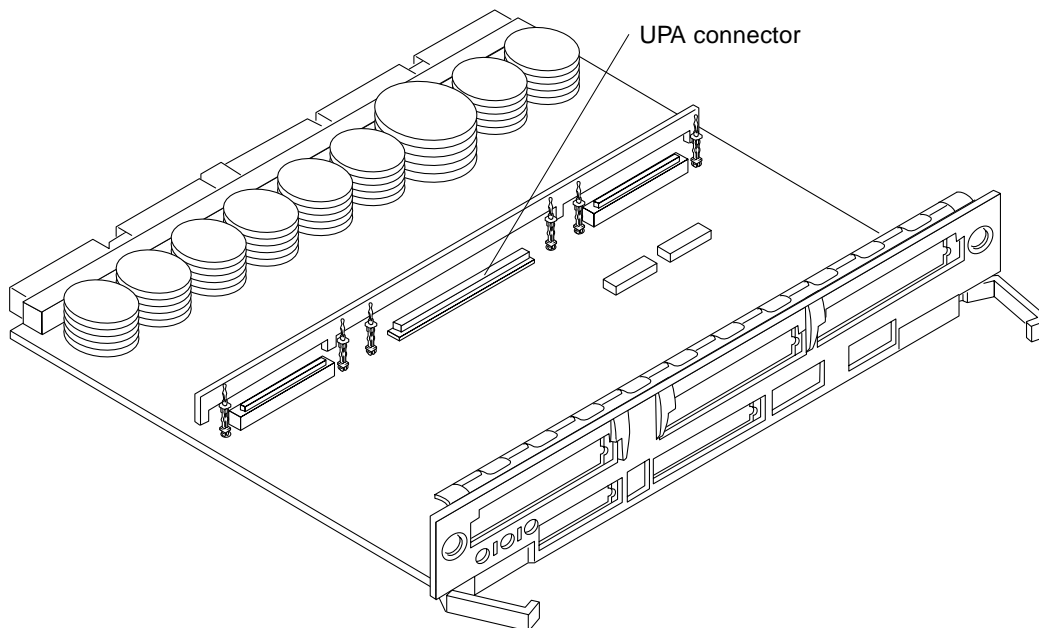


Figure 3-21 Graphics (UPA) Card Connector Location

3.5.5.1 *Removing a Graphics (UPA) Card*

1. **Use the procedures in Section 3.5.2, “Removing a Board,” to remove the applicable Graphics I/O board.**
2. **Locate the card. See Figure 3-22.**
3. **Remove the two screws that secure the card to the Graphics I/O board front panel.**
Save the screws for installation of a replacement card or a filler panel.
4. **Unlock the card by pulling up the tips of the two standoffs.**
See Figure 3-14.
5. **Hold the card by the edges near the connector and gently rock the card back and forth to loosen it from the socket.**
You may have to remove the SBus cards next to this card in order to have enough room to hold onto the graphics (UPA) card being removed.



Caution – The connector housing may break if the card is tilted too far.

6. **Lift the card from the socket at an angle while guiding the face plate out from the back panel opening.**
See Figure 3-22.

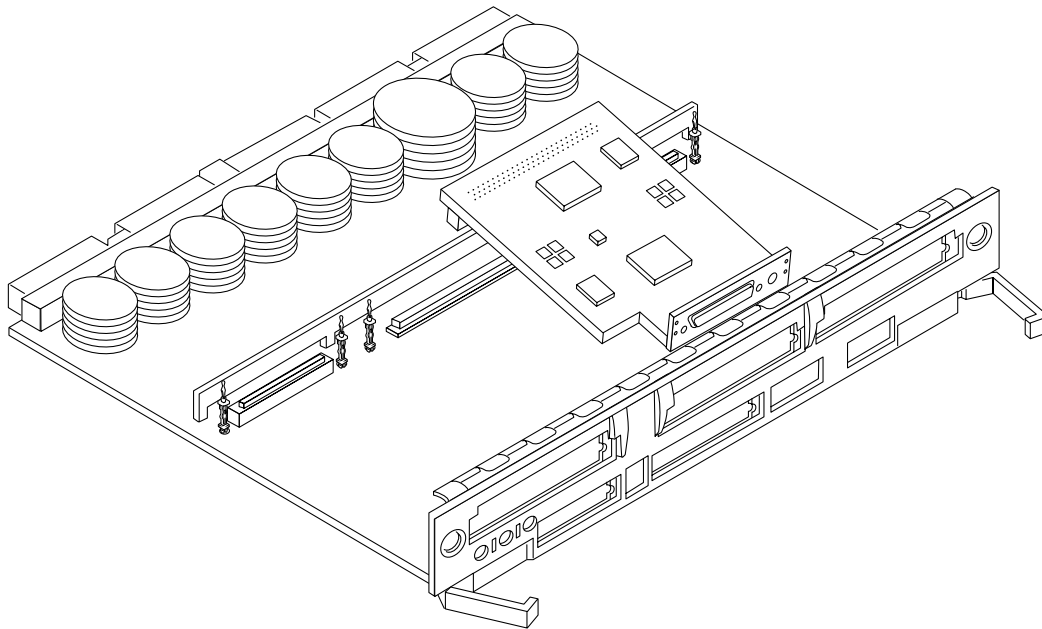


Figure 3-22 Removing or Installing a Graphics (UPA) Card

7. Place the card in an antistatic bag.
8. If the graphics (UPA) card is not immediately replaced, install a filler panel (part number 340-2305) on the Graphics I/O board back panel opening. To secure the filler panel, use the screws that were removed in Step 3.



Caution – Be sure to install the filler panel right-side up. Installing it upside down creates a gap at the top edge of the card slot opening that can impair system cooling and regulatory compliance.

9. Use the procedures in Section 3.5.3, “Installing a Board,” to replace the Graphics I/O board.

3.5.5.2 *Installing a Graphics (UPA) Card*

1. **Use the procedures described in Section 3.5.2, “Removing a Board,” to remove the applicable Graphics I/O board.**

Note – The connector pins on graphics (UPA) cards are extremely delicate, use care when handling.

2. **Attach a wrist strap and take the graphics (UPA) card out of the protective packaging and place the card on an antistatic mat.**
Inspect the pins in the connector to make sure they are not bent.
3. **Remove the adapter bracket from the rear panel of the card.**
See Figure 3-16. Remove the two screws securing the adapter to the card rear panel (the adapter bracket and the screws are not needed for this installation).
4. **Locate the UPA connector for the card. See Figure 3-21.**
5. **If a filler panel covers the back panel slot for the graphics (UPA) card, remove the two screws and detach the filler panel.**
Retain the screws to attach the graphics (UPA) card to the back panel, unless the card has a wide connector, or set of connectors.
6. **Unlock the two standoffs for the UPA connector slot.**
See Figure 3-14.
7. **Hold the card at an angle and guide the card face plate under the springfingers and against the rear face of the Graphics I/O board front panel.**
The I/O connectors of the card should be visible through the opening in the I/O board front panel.
8. **Hold the card by the edges nearest the UPA connector and position the card over the two standoffs.**
9. **Hold the card by the edges near the connector and firmly but gently press the card down until the connector is fully seated.**
To align the connector and socket, push the card toward the Graphics I/O board front panel.



Caution – Graphics (UPA) cards have very fragile connectors. Press gently to ensure pins do not break or bend.



Caution – Do not rock the card onto the socket; the plastic connector housing may break.

10. Press each corner of the card to ensure that it rests on the collar of the standoff.
11. Press down on the tip insert of each standoff to lock the card in place.
12. Replace and tighten the back panel screws to secure the card to the Graphics I/O board front panel.
See Figure 3-15
13. Use the procedures in Section 3.5.3, “Installing a Board,” to replace the Graphics I/O board.

3.5.6 Fibre Cards

3.5.6.1 Removing a Fibre Card

1. Use the procedures in Section 3.5.2, “Removing a Board,” to remove the applicable I/O board.
2. Locate the card to be removed. See Figure 3-23.
You may have to remove the SBus cards over (or next to) this card in order to have enough room to hold onto the fibre card being removed. See Figure 3-24.

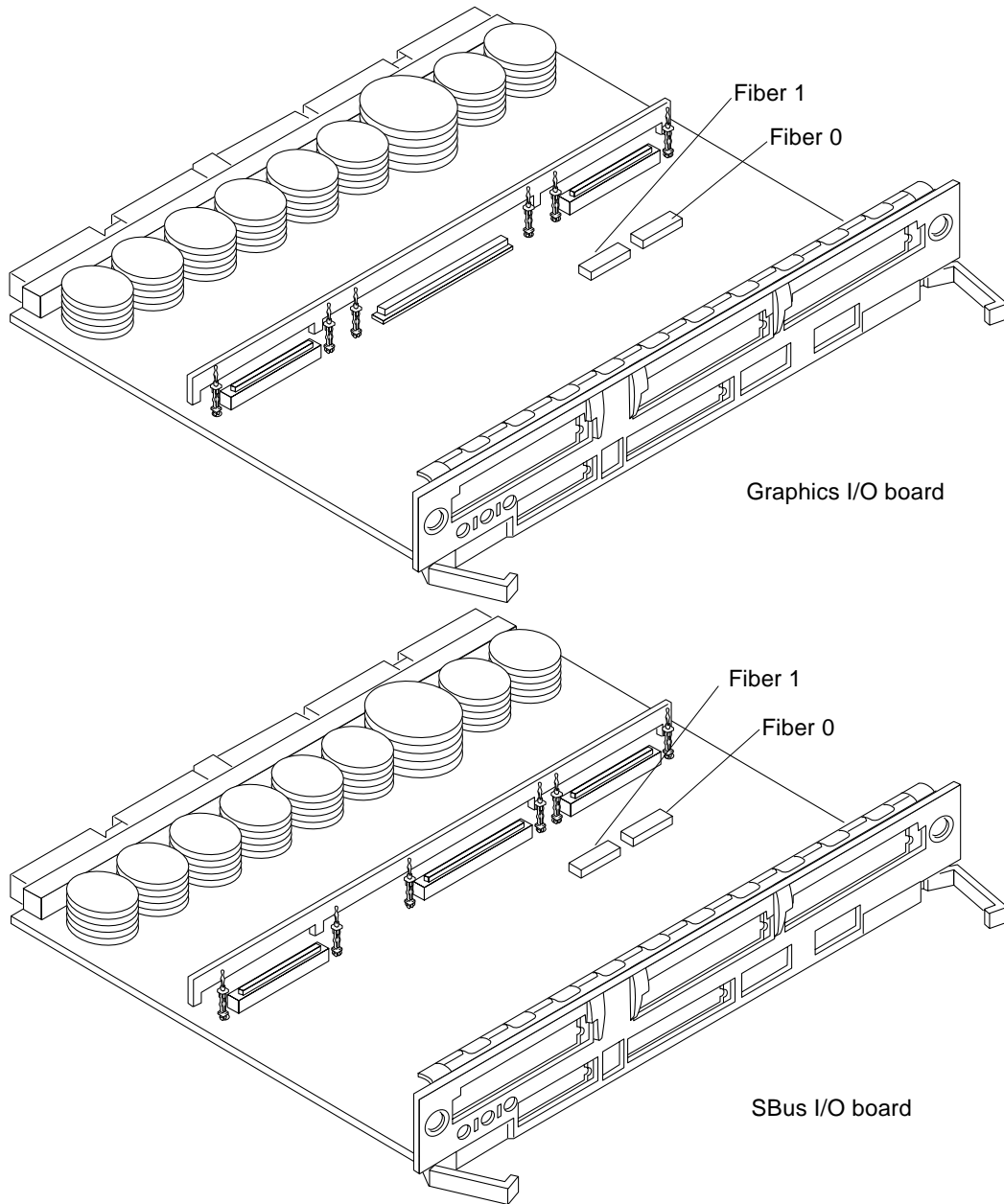


Figure 3-23 I/O Board Fibre Card Connector Locations

Note – There are four plastic standoffs located on the bottom of each card, two on each end. These secure the card once they are inserted into corresponding openings on the I/O board. See detail in Figure 3-24.

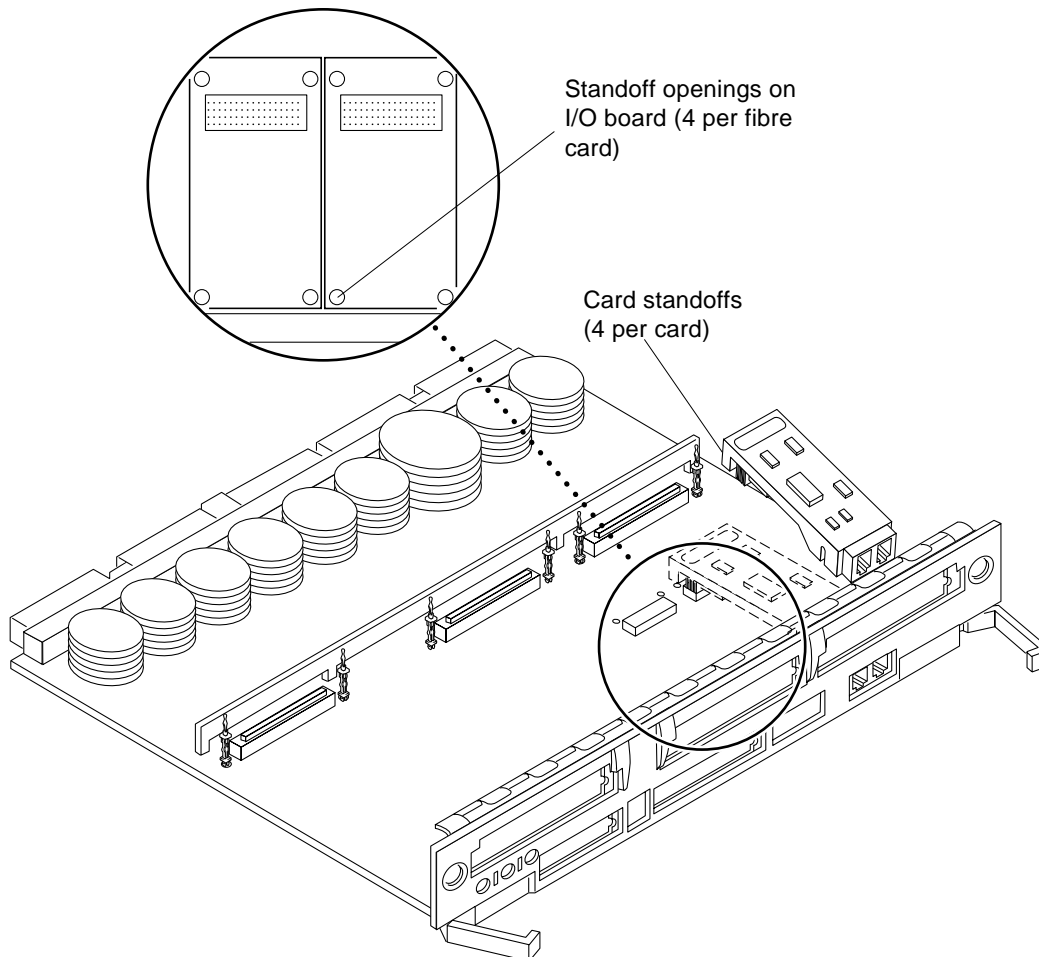


Figure 3-24 Removing or Installing a Fibre Card

3. **Unseat the card from the I/O board:**
 - a. **Grasp the card underneath each corner on the end of the card that connects to the I/O board receptacle (opposite the I/O board front panel end), then firmly unseat the two standoffs and the card connector.**
 - b. **Grasp the card underneath each corner near the I/O board front panel, and then firmly unseat the remaining two standoffs from the I/O board.**
4. **Once the card standoffs and connector are unseated, hold the card at a slight angle as shown in Figure 3-24 on page 3-33. Guide the card fiber connector end from the front panel opening on the I/O board.**
5. **If the fibre card is not immediately replaced, install an OLC plug on the I/O board front panel opening.**
6. **Use the procedures in Section 3.5.3, “Installing a Board,” to replace the I/O board.**

3.5.6.2 Installing a Fibre Card

1. **Use the procedures in Section 3.5.2, “Removing a Board,” to remove the applicable I/O board.**

Note – If required, remove the OLC plug that protects the fiber optic connector opening on the front panel of the I/O board. These OLC plugs are installed in factory shipped systems without fibre cards installed.

2. **Locate the card slot for installation.**

See Figure 3-23 on page 3-32. You may need to remove the SBus cards over (or next to) this card to have enough room to hold onto the fibre card being installed.

Note – There are four plastic inserts located on the bottom of each card, two on each end of the card. These secure the card once they are inserted into corresponding openings on the I/O board. See detail in Figure 3-24 on page 3-33.

- 3. Hold the card at a slight angle and position it so the fiber connector end is loosely inserted into the I/O board front panel opening.**
- 4. Align the card over the I/O board fiber connector receptacle and over the four standoff holes on the I/O board.**
See Figure 3-24 on page 3-33.
- 5. Seat the card:**
 - a. Grasp the card underneath each corner near where the card connects to the I/O board fiber connector receptacle. Firmly seat the card on the connector and on the two adjacent standoffs.**
 - b. On the end of the card near the I/O board front panel, grasp the card underneath each side and firmly seat the remaining two standoffs.**
- 6. Use the procedures in Section 3.5.3, “Installing a Board,” to replace the I/O board.**

Disk Boards and Components



To protect both yourself and the equipment, make sure you follow precautions in Chapter 2, “Safety Precautions and Tools Requirements.”

<i>Safety Precautions</i>	<i>page 2-1</i>
<i>Handling Boards and Assemblies</i>	<i>page 5-2</i>
<i>Filler Panels and Load Boards</i>	<i>page 5-2</i>
<i>SCSI Termination</i>	<i>page 5-4</i>
<i>Hot-Plug Feature</i>	<i>page 5-5</i>
<i>Disk Boards</i>	<i>page 5-5</i>
<i>Disk Drives</i>	<i>page 5-13</i>
<i>Connectors</i>	<i>page G-11</i>

For your protection, also observe the following safety precautions when setting up your equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Never push objects of any kind through openings in the equipment as they may touch dangerous voltage points or short out components that could result in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

5.1 Handling Boards and Assemblies



Caution – The chassis AC power cord must remain connected to ensure a proper ground.



Caution – The Disk boards, their modules, and cards have surface-mount components that can be broken by flexing the boards.

To minimize the amount of board flexing, observe the following precautions:

- Hold the board only by the edges near the middle of the board, where the board stiffener is located. Do not hold the board *only* at the ends.
- When removing the board from an antistatic bag, keep the board vertical until you lay it on the Sun ESD mat.
- Do not place the board on a hard surface. Use a cushioned antistatic mat. The board connectors and components have very thin pins that bend easily.
- Do not use an oscilloscope probe on the components. The soldered pins are easily damaged or shorted by the probe point.
- Transport the board in an antistatic bag.
- Be careful of small parts located on the component side of the board.
- Be careful not to drag boards across surfaces as board components are easily damaged.



Caution – The heatsinks on the board can be damaged by incorrect handling. Do not touch the heatsinks while installing or removing the board. Hold the board only by the edges. If a heatsink is loose or broken, obtain a replacement board.



Caution – The heatsinks on the board can be damaged by improper packaging. When storing or shipping the board, ensure that the heatsinks have sufficient protection.

5.2 Filler Panels and Load Boards

All empty board slots in Enterprise systems must have either a filler panel or a load board installed.

- Empty slots in Enterprise 5000 and 4000 systems must have a filler panel installed. See Figure 5-1.
- Empty slots in Enterprise 6000 systems must have a load board installed. See Figure 5-2.

Load boards and filler panels are inserted into a board slot with the springfingers facing down if inserted in the front of the system; the springfingers face up if inserted in the rear of the system.

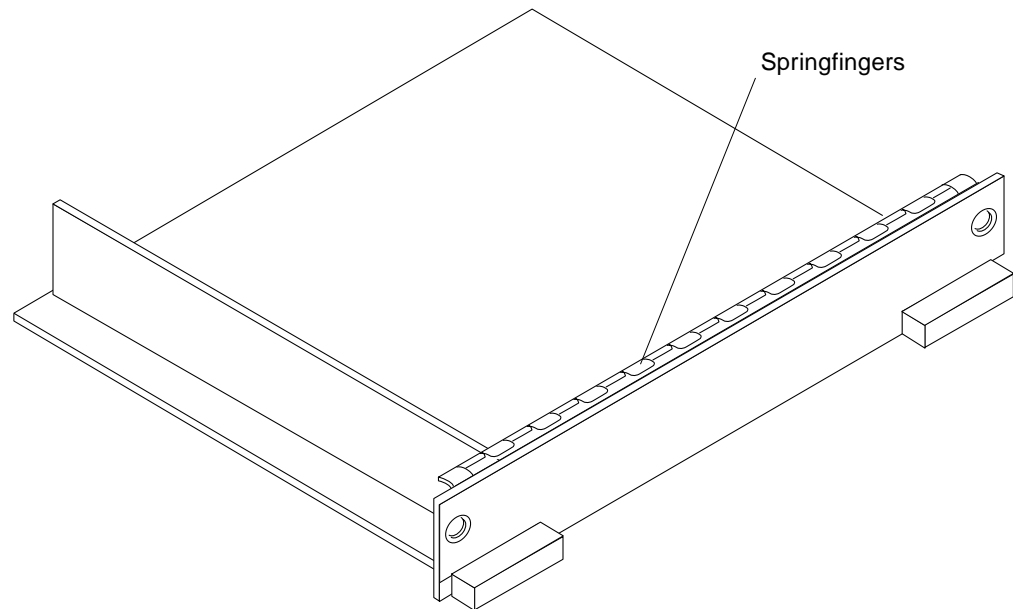


Figure 5-1 Filler Panel (Enterprise 5000/4000 Only)

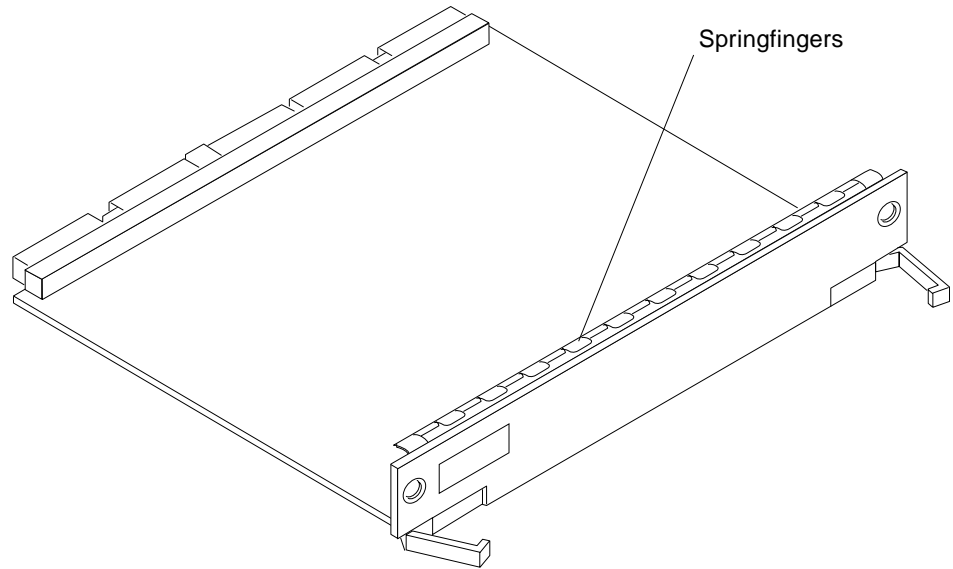


Figure 5-2 Load Board (Enterprise 6000 Systems Only)

5.3 SCSI Termination

The last or only Disk board in a system must have the SCSI out connector terminated with a SCSI terminator. See Figure 5-3.

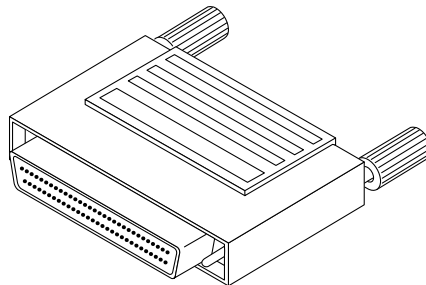


Figure 5-3 SCSI Terminator

5.4 Hot-Plug Feature

Enterprise systems have extensive error detection mechanisms, and an Automatic System Reconfiguration (ASR) feature that enables the system to be rebooted with failed components (such as CPUs, memory, or I/O) disabled. When an error is detected, the system can be reconfigured so that the board containing the failed components is placed in low power mode and is no longer accessible.



Caution – The peripheral power supply provides the precharge voltages required for hot-plug. Do not attempt hot-plug of a system component if the peripheral power supply is missing or inoperative. Use `prtdiag(1M)` to determine the status of the peripheral power supply.



Caution – If the message: NOTICE: Hot Plug not supported in this system is displayed during boot, do NOT attempt hot-plug in this system or damage to the hardware will occur.

The hot-plug feature enables you to insert a new board into a powered on system, despite the system being “live,” or being supplied with electrical power. When the hot-plug feature is used to add a board to a powered on system, the system will not use the new board until the system is rebooted.

5.5 Disk Boards

A maximum of two Disk boards can be installed in Enterprise 6000 systems; four Disk boards can be installed in Enterprise 5000/4000 systems.

Note – Disk boards can be installed only in slots 14 and 15 in Enterprise 6000 systems, and *slot 15 must be used* when installing only one Disk board.

Each Disk board contains a fast and wide single-ended SCSI chain with sockets for two disks. There are three status and two activity LEDs; each activity LED is driven directly by a disk drive.

5.5.1 Removing a Board

5.5.1.1 Removing a Board from a Powered On System



Caution – Remove a board from a powered on system only after the ASR software has disabled the board. If a board has not been disabled by the ASR software, then the operating system should be halted and the system powered off prior to board removal. See Chapter 12, “Powering Off and On” and then Section 5.5.1.2, “Removing a Board from a Nonpowered On System.”

1. Ensure that the board has been disabled by the ASR software. See Section 5.4, “Hot-Plug Feature.”

Once disabled by ASR, one of two results occurs:

- The three LEDs on the board are not lit (board has no power)
- The outer two green LEDs are not lit and the middle yellow LED is lit (board in low power mode).

Note – System software operates such that the LED pattern described is the same for a board that is component side down (installed in front of card cage) or component side up (installed in rear of card cage).

2. Unfasten any cable connectors from the front panel and set them aside.

Label cables to identify them for reconnection later.

3. Use a Phillips #1 screwdriver to mechanically release the board from the system card cage.

Insert the screwdriver into each quarter-turn access slot (the slots are located on the left and right sides of the board’s front panel) and then turn a quarter turn so that the arrow points to the unlocked position. See Figure 5-4.

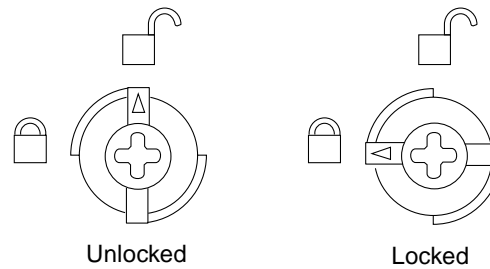


Figure 5-4 Unlocking and Locking Quarter-Turn Access Slots

- 4. Pull the ends of both extraction levers outward simultaneously to unseat the board centerplane connector from the centerplane receptacles. See Figure 5-5 for positioning of extraction levers.**

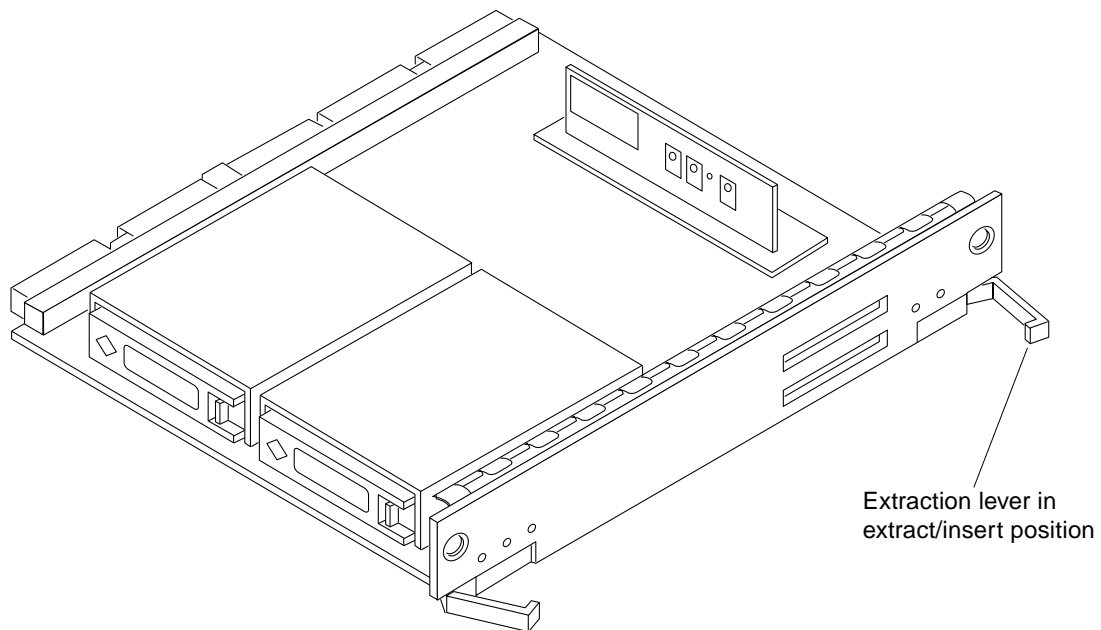


Figure 5-5 Disk Board

- 5. If a board is not immediately replaced, a filler panel or a load board (for Enterprise 6000 systems only) must be installed in its place.**
See Section 5.2, "Filler Panels and Load Boards."

5.5.1.2 Removing a Board from a Nonpowered On System

- 1. Use a Phillips #1 screwdriver to mechanically release the board from the system card cage.**
Insert the screwdriver into each quarter-turn access slot (the slots are located on the left and right sides of the board's front panel) and then turn a quarter turn so that the arrow points to the unlocked position. See Figure 5-4 on page 5-7.
- 2. Unfasten any cable connectors from the front panel and set them aside.**
Label cables to identify them for reconnection later.
- 3. Pull the ends of both extraction levers outward simultaneously to unseat the board from the centerplane receptacles.**
See Figure 5-5 on page 5-7.

5.5.2 Installing a Board

5.5.2.1 Board Slot Selection

Note – Logically there is no difference between the board slots in the front or rear of the card cage, and each slot can accept any board type. It is suggested that CPU/Memory boards be installed in the front slots, and I/O and Disk boards be installed in the rear slots because of cabling. Should the need arise, however, any of these three board types can be placed in any of the numbered board slots, with these exceptions:

Slot 1: Slot 1 should be used by the first I/O board because it is the only slot connected to the onboard SCSI devices.

Slots 14 and 15: In Enterprise 6000 systems, Disk boards are supported only in these two slots.

The first CPU/Memory board is placed in slot 0, followed sequentially by all remaining even numbered slots. If there are boards remaining, they can be installed sequentially in odd numbered slots, if available, in the system rear (with the exception of slot 1 as noted above). See Figure 5-6.

Other than the slot 1 exception, a Disk board can be placed in any of the numbered board slots in Enterprise 5000/4000 systems. Use only slot 14 and slot 15 in Enterprise 6000 systems, and *you must use slot 15 if only one* Disk board is installed.

For boards being placed in the rear of the system, ensure that the component side is up. If the boards are placed in the front of the system, ensure that the component side is down. See Figure 5-7.

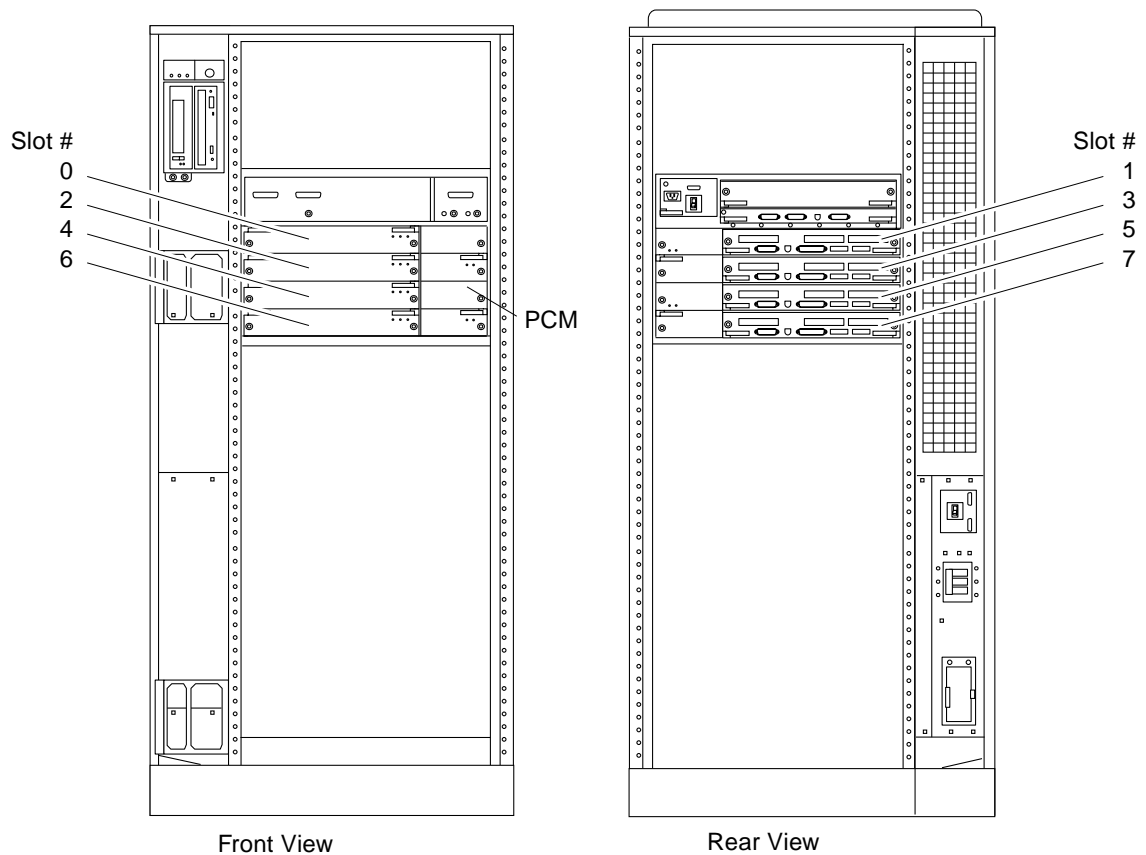


Figure 5-6 Enterprise 5000/4000 Board Locations

5.5.2.2 *Cooling and Power Issues*

There should be one power/cooling module (PCM) for every two boards to adhere to cooling and power requirements. The PCMs must be installed adjacent to populated board slots to ensure the fan in the PCM can cool the respective boards.

Note – All empty board slots in Enterprise 4000 or 5000 systems must have a filler panel installed to ensure proper cooling. All empty slots in Enterprise 6000 systems must have load boards installed.

5.5.2.3 *Powered or Nonpowered On System*

- 1. Carefully insert the board (component side down if in front; component side up if in the rear) in the proper slot in the card cage, ensuring that the board does not slip out of the left and right card guides.**

See Figure 5-7.

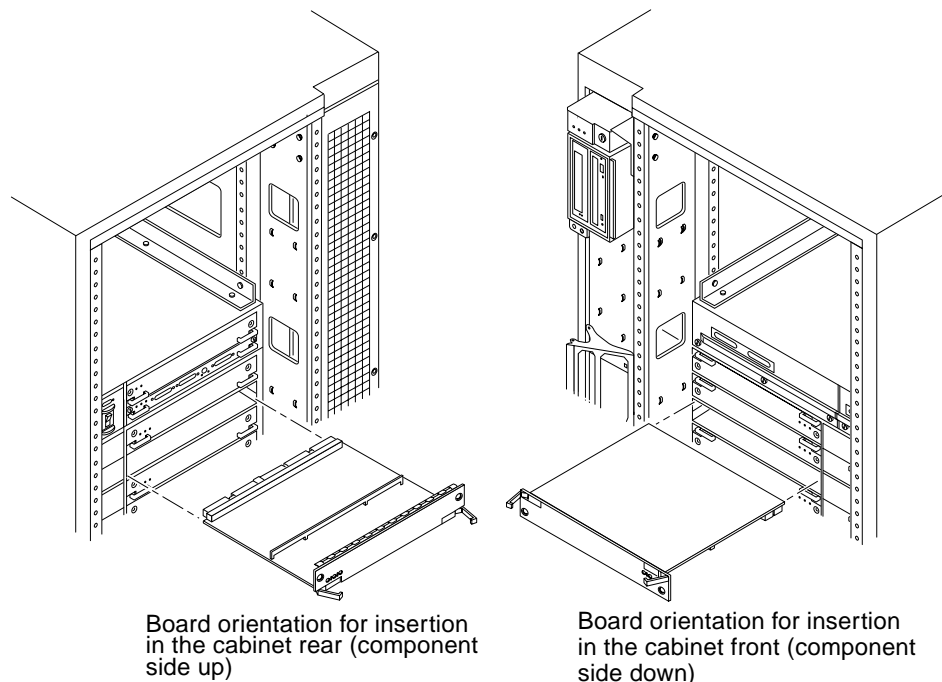


Figure 5-7 Board Replacement

2. Ensure that both extraction levers are in the insert position (arrow pointing outward) and that the quarter-turn access slots are unlocked (arrow indicates unlocked position) as you slide the board toward the centerplane receptacles.

See Figure 5-4 on page 5-7 and Figure 5-5 on page 5-7. The board will not seat fully unless the levers are in this starting position and both quarter-turn access slots are unlocked.



Caution – DO NOT FORCE any board into a slot; this can cause damage to the board and system. The board should insert and seat smoothly. If it binds, remove the board and inspect the card cage slot for any obvious obstructions. Also inspect both the board and the centerplane for bent pins or other damage.

3. Push the board into the card cage, then simultaneously press both extraction levers to seat the board on the centerplane.

Pushing both levers simultaneously avoids twisting the board and bending the connector pins, and mates the board centerplane connector to the matching receptacle on the centerplane. Do not press on board front panel to seat it—doing so will damage the connector pins.

4. Mechanically lock the board to the system chassis by inserting a Phillips #1 screwdriver into each quarter-turn access slot and then turning to the locked position.

See Figure 5-4 on page 5-7.

5. Replace or connect all necessary cables to the front of the board.

6. Terminate the SCSI out connector if necessary.

The SCSI out connector on Disk boards in a system, which are not daisy chained to an additional device, must be terminated with a SCSI terminator. See Figure 5-3 on page 5-4.

Note – The last or only Disk board in a system must have the SCSI out connector terminated with a fast-wide SCSI terminator, part number 150-2267.

7. Once the board has been installed, a message similar to the following will be displayed on the monitor (if the system is powered on):

Example depicts screen output when a new Disk board has been hot-plugged into slot 6 of an operating Enterprise system:

```
NOTICE: Disk Board Hotplugged into Slot 6
NOTICE: Board 6 is ready to remove
```

This screen output indicates that the board has been detected by the system and is in the low power mode. Additionally, any subsequent `prtdiag(1M)` output would include information for board slot 6. Again, note that the system will not use the new board until the system is rebooted.

8. Reboot the system now or schedule a later time to reboot when system disruption will be minimized.

5.5.2.4 *Cabling Issues for Enterprise 6000 Systems*

Slot 15 installation:

- Use an 80-cm SCSI cable to connect the Disk board to the SCSI Host Adapter (on-board or SBus card).

Slot 14 installation:

- If an I/O board is installed in the front, use an 80-cm SCSI cable to connect the Disk board to the SCSI Host Adapter.
- If all I/O Boards are installed in the rear, use a 2-meter SCSI cable (sold separately) to connect the Disk board to the SCSI Host Adapter. Route the cable down the side of the card cage, through the cable pass in the cabinet.

5.5.3 *Disk Drives*

5.5.3.1 *Removing a Disk Drive*

- 1. Use the procedures described in, Section 5.5.1, “Removing a Board,” To remove the applicable Disk board.**
- 2. Unlatch and open the ejector drive retainer on the drive to be replaced.** See Figure 5-8. Using the extended drive retainer as a handle pull the drive straight out to disengage it from the board mating receptacle and the drive mounting bracket.

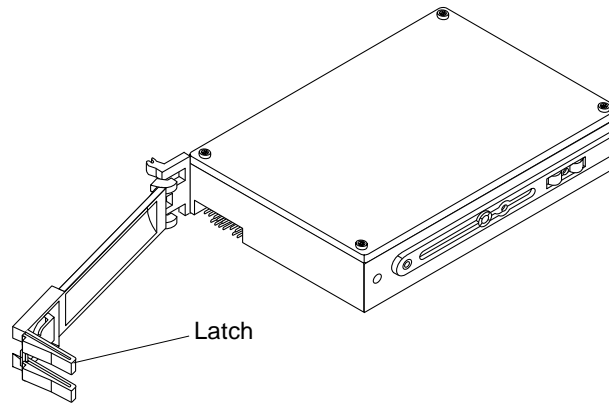


Figure 5-8 Disk Drive with Ejector Drive Retainer Open

3. **If a new drive is to be installed, proceed to the next section.**
If the drive is not to be replaced, replace the Disk board as described in Section 5.5.2, "Installing a Board".

5.5.3.2 *Installing a Disk Drive*

1. **Inspect the shipping container upon receipt of your drive, and look for evidence of damage.**
If the carrier's agent is not present when the container is opened, and the contents are damaged, keep all contents and packing materials for the agent's inspection.
2. **If there is no evidence of damage, carefully remove the drive from the shipping container.**
Save the carton and the packing material for possible later use.
3. **Place the antistatic mat on a table or work surface.**
4. **Attach a grounding wrist strap.**
Refer to the documentation that came with your ESD kit.
5. **Remove the disk drive from its protective packaging.**
Hold the disk drive by the edges, near the middle of the drive. Keep the drive vertical until you lay it on the ESD mat.

- 6. Place it on the antistatic mat with the component side of the disk drive controller cards facing up.**
- 7. Unlatch and then open the ejector drive retainer for the drive being replaced or installed.**
See Figure 5-8.
- 8. Using the drive retainer as a handle, slide the drive in and then seat it to the board connector receptacle.**
Close and latch the ejector drive retainer.
- 9. SCSI IDs for disk drives on Disk boards are selected on the Disk board.**
See Appendix C, “SCSI Devices” to select the SCSI ID for the disk drive.
- 10. Check that the ejector drive retainers on both disk drives are closed, latched in place, and do not extend past the edge of the board.**
If an ejector drive retainer extends past the edge of the Disk board or is not fully closed, the disk drive connector is not joined with the Disk board connector. Do the following:
 - a. Use the unlatched drive retainer to unseat the drive from the board connector receptacle and slide it out an inch or two.**
 - b. Check that the connectors are not broken and that nothing blocks the joining of these two connectors.**
If there is a problem, put the disk drive back into its protective packaging, and contact your service representative.

Note – Save the antistatic shipping bag and other original packing. You will need these materials when transporting the disk drive.

- 11. Terminate the SCSI out connector, if necessary.**
The SCSI out connector on Disk boards that are not daisy chained to an additional device must be terminated with a SCSI terminator. See Figure 5-3 on page 5-4.

Note – The last or only disk board in a system must have the SCSI out connector terminated with a fast-wide SCSI terminator, part number 150-2267.

- 12. Replace the Disk board as described in Section 5.5.2, “Installing a Board.”**

Clock Board



To protect both yourself and the equipment, make sure you follow precautions in Chapter 2, “Safety Precautions and Tools Requirements.”

<i>Safety Precautions</i>	<i>page 2-1</i>
<i>Handling Boards and Assemblies</i>	<i>page 6-2</i>
<i>Clock Board</i>	<i>page 6-2</i>
<i>Connectors</i>	<i>page G-13</i>

For your protection, also observe the following safety precautions when setting up your equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Never push objects of any kind through openings in the equipment as they may touch dangerous voltage points or short out components that could result in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

6.1 Handling Boards and Assemblies



Caution – The chassis AC power cord must remain connected to ensure a proper ground.



Caution – The clock board and its modules have surface-mount components that can be broken by flexing the board.

To minimize the amount of board flexing, observe the following precautions:

- Hold the board only by the edges near the middle of the board, where the board stiffener is located. Do not hold the board *only* at the ends.
- When removing the board from an antistatic bag, keep the board vertical until you lay it on the Sun ESD mat.
- Do not place the board on a hard surface. Use a cushioned antistatic mat. The board connectors and components have very thin pins that bend easily.
- Do not use an oscilloscope probe on the components. The soldered pins are easily damaged or shorted by the probe point.
- Transport the board in an antistatic bag.
- Be careful not to drag boards across surfaces as board components are easily damaged.

6.2 Clock Board

There is one clock board to a system. The clock board provides:

- Programmable system and processor clock
- Serial, keyboard, and mouse ports for the console
- Centralized Time-of-day (TOD) chip that includes NVRAM
- Centralized reset logic
- Status and control of power supplies

The clock board consists of the following subsystems:

- Console Bus
- Clocks
- Reset logic
- JTAG
- Centerplane connector signals

Figure 6-1 depicts a block diagram of the subsystems and centerplane connector.

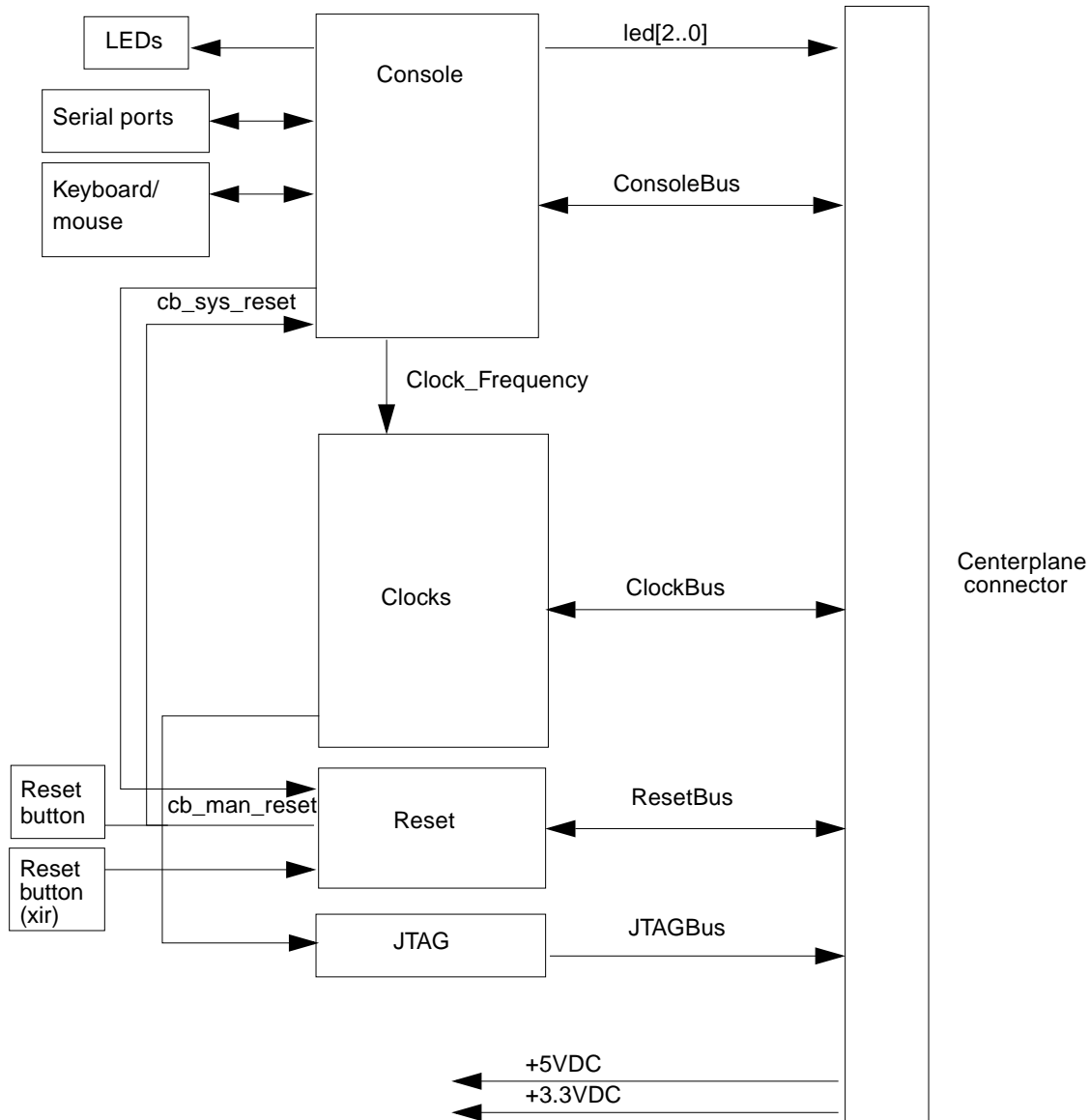


Figure 6-1 Clock Board Simplified Block Diagram

6.2.1 ConsoleBus

The ConsoleBus provides system boards access to global system control and status as well as to the keyboard, mouse, and serial ports. In addition, there is a NVRAM/TOD chip that maintains the date and time and 8 Kbytes worth of data when the power to the system is shut off.

The state of physical hardware conditions is maintained in registers on the clock board. Each of these registers has inputs generated from other subsystems on the clock board, from other boards, or from the power supplies in the system. Some clock board registers are reserved for controlling various states of the machine.

The ConsoleBus also provides a serial port interface and a keyboard/mouse interface. The primary purpose of the serial port interface is to provide POST messages during power-on. The serial port can be used as a console for systems without a keyboard and display, and for standard serial peripheral hook-ups such as modems and printers.

6.2.2 Clocks

The clock subsystem generates the clocks for the entire system. The base clock is synthesized and then divided into various frequencies. The base clocks are then “fanned-out” and driven to the centerplane by an array of driver chips. Two processor clocks and one system clock go to each of the board slots on the centerplane.

6.2.3 Reset logic

The reset logic consists of four subcircuits for controlling the system reset and error state:

- Manual reset
- System reset
- XIR
- System error

6.2.4 Removing a Clock Board



Caution – The clock board is not hot-pluggable. Do not remove the clock board until the system has been halted and powered-off.



Caution – To avoid damaging internal circuits, do not disconnect or connect any cable while power is applied to the system.

Note – If you are replacing the clock board, then the TOD NVRAM from the old board must be removed and placed on the new board. This is necessary to match the host ID with the Ethernet ID. Note also that if a system is replaced, then the TOD NVRAM on the clock board must also be changed.

- 1. You must halt the operating system before turning off the system power. See Chapter 12, “Powering Off and On,” for this procedure.**
- 2. Unfasten cable connectors from the board front panel and set them aside.** Label cables to identify them for reconnection later.
- 3. Loosen the two captive screws securing the board to the system chassis.**
- 4. Pull the ends of both extraction levers outward simultaneously to release the board from the centerplane receptacles.**
See Figure 6-2.

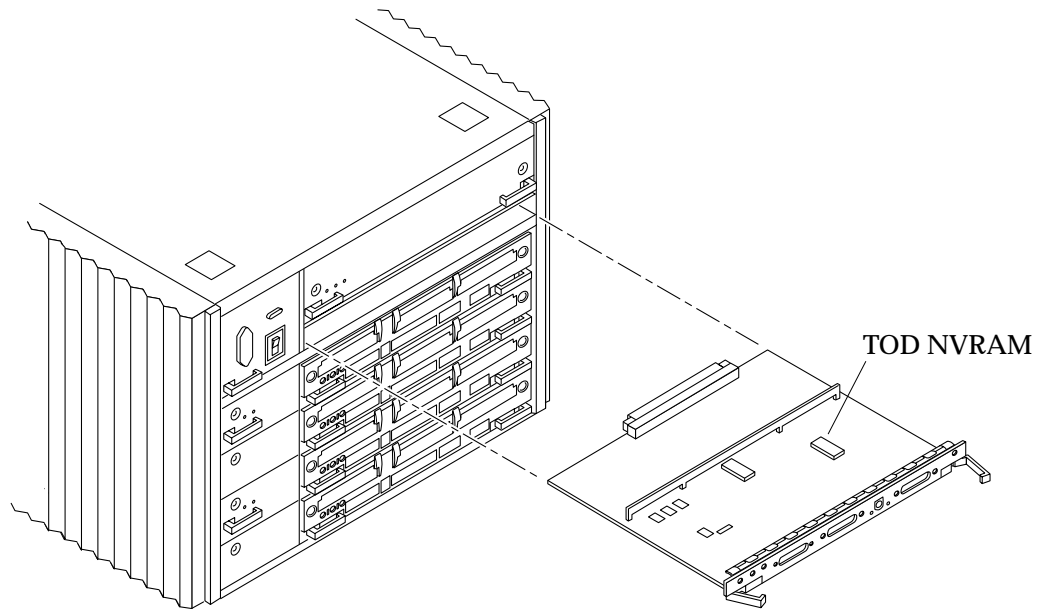


Figure 6-2 Standalone Clock Board

6.2.5 Installing a Clock Board

The clock board slot is located at the top of the system, immediately below the peripheral power supply. See Figure 6-3.

Note – If you are replacing the clock board, then the TOD NVRAM from the old board must be removed and placed on the new board. Note also that if a system is replaced, then the TOD NVRAM on the clock board must also be changed.

1. Carefully insert the board in the proper slot in the card cage, ensuring that the board does not slip out of the left and right card guides. The component side of the board must face up.

- 2. Ensure that both extraction levers are in the outward position as you slide the board toward the backplane connectors.**

See Figure 6-2. The board will not seat fully unless the levers are in this starting position.



Caution – DO NOT FORCE any board into a slot; this can cause damage to the board and system. The board should insert and seat smoothly. If it binds, remove the board and inspect the card cage slot for any obvious obstructions. Also inspect both the board and the backplane for bent pins or other damage.

- 3. Use the extraction levers to seat the board.**

Simultaneously swing both levers into the locked position. Do not press on board front panel to seat it—doing so will damage the connector pins.

- 4. Secure the board to the chassis using the two captive screws, one on each side.**
- 5. Connect any applicable interface cables to the front panel of the board.**
- 6. Turn on system power. See Chapter 12, “Powering Off and On,” for this procedure.**
- 7. Boot the system.**

	Peripheral PS	
	Clock board	
PS 1		Slot # 1
		3
PS 3		5
		7
PS 5		9
		11
PS 7		13
		15

Enterprise 6000 System

	Peripheral PS	
	Clock board	
PS 1		Slot # 1
		3
PS 3		5
		7

Enterprise 5000/4000 System

Figure 6-3 Clock Board Slot Location (System Rear View)

Power Supplies

<i>Safety Precautions</i>	<i>page 6-2</i>
<i>Distribution</i>	<i>page 6-3</i>
<i>Peripheral Power Supply</i>	<i>page 6-3</i>
<i>Troubleshooting a Peripheral Power Supply</i>	<i>page 6-4</i>
<i>Replacing a Peripheral Power Supply</i>	<i>page 6-4</i>
<i>Power/Cooling Module (PCM)</i>	<i>page 6-8</i>
<i>Troubleshooting a PCM</i>	<i>page 6-11</i>
<i>Replacing a PCM</i>	<i>page 6-11</i>

This chapter describes the power supplies and environmental sensing and reporting in Ultra Enterprise systems. There are differences in the power distribution depending on the enclosure (16-slot or 8-slot).

There are two types of power supplies: a power/cooling module (PCM) and a peripheral power supply (PPS).

Both types of power supplies are hot-pluggable. This feature allows you to physically remove the failed component, despite its being “live,” or being supplied with electrical power. In addition, a new component may be inserted into a running system.

Note – A functioning peripheral power supply provides electrical precharge that is required for the hot-plug feature. Use the `prtdiag (1M)` command to determine if electrical precharge is available.

Table 6-1 lists the power supply voltages, their uses, and the power supplies that generate them.

Table 6-1 Power Supply Summary

Voltage	Supply	Use
2.0V	PCM	GTL centerplane termination
3.3V	PCM	CPU/Memory Board (AC, DCs, FHC, SIMMs) UltraSPARC Module (SRAMs, SDBs, CPU I/O)
5V	PCM, PPS	SBus, Clock Board UltraSPARC Module power (via DC/DC converter)
12V	PPS	Peripherals (CD drive, tape drive)

6.1 Safety Precautions

To protect both yourself and the equipment, any servicing of equipment should be performed by qualified personnel. Observe the precautions in Table 6-2.

Table 6-2 Safety Precautions

Item	Problem	Precaution
Wrist or foot strap	ESD	Wear a conductive wrist strap or foot strap when handling power supplies.
ESD mat	ESD	An approved ESD mat provides protection from static damage when used with a wrist strap or foot strap.
Cover panels	System damage and overheating	Re-install all cabinet cover panels after performing any service work on the system.
SBus slot covers	System damage and overheating	Install SBus slot covers in all unused SBus slots.

6.2 Distribution

In the 16-slot and 8-slot systems there is a single peripheral power supply and a slot for a PCM for each pair of board slots. There is a single alternating current (AC) power cord for the whole system. AC is then distributed to each of the PCMs within the chassis. The software monitors the status of the AC power source. Current-sharing between power supplies provides redundant power.

6.3 Peripheral Power Supply

The peripheral power supply in Figure 6-1 provides power to the peripheral subsystems, the drives, the fans in the AC box, and the fan in the keyswitch box. The PPS provides auxiliary 5V output to power the remote console. This power supply incorporates current sharing to operate in redundant and parallel operations. The peripheral power supply provides three precharge outputs (3.3V, 5V, and 12V) to enable hot plug-in of system boards, PCMs, or drives into an active centerplane.

In addition, the peripheral power supply incorporates current sharing on the 5V output for parallel operation with PCMs. Consequently, if a PCM fails, the PPS provides redundant 5V output through the centerplane to the system boards.

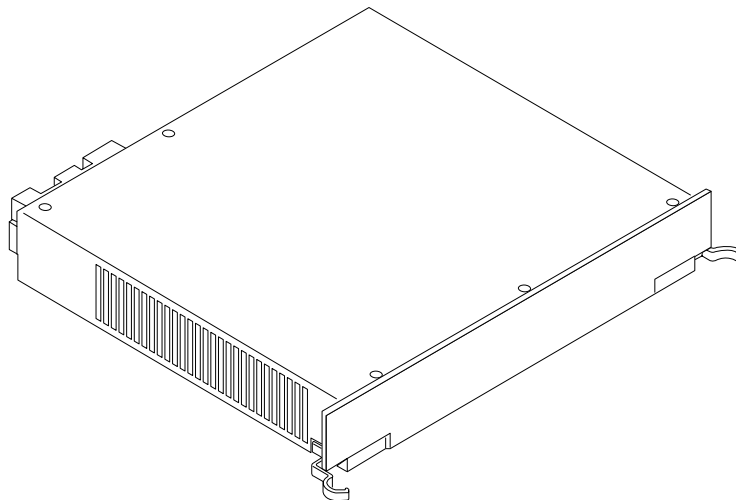


Figure 6-1 Peripheral Power Supply

6.3.1 Troubleshooting a Peripheral Power Supply

A green LED is lit on the power supply when it is operational. When a peripheral power supply fails, a yellow LED is lit on the power supply.

See Chapter 10, “Flow Diagrams for Troubleshooting,” for more information.

6.3.2 Replacing a Peripheral Power Supply



Caution – Remove and replace the peripheral power supply in a running system (and not in the low power mode). In the low power mode, the front panel and board LEDs are all off while the yellow LEDs are lit on the power supplies.

Replacing the PPS during low power mode will cause the system to power up.



Caution – Be sure that onboard peripheral devices are not in use.

Note – While the peripheral power supply is removed:

- There is the loss of peripheral power.
- There is the loss of precharge (no hot-pluggable replacements are possible except for the PPS).
- Onboard peripheral devices are not operational.

1. **Mechanically release the power supply from the system chassis by inserting a Phillips #1 screwdriver into each quarter-turn access slot and then turning to the unlocked position.**

See Figure 6-2.

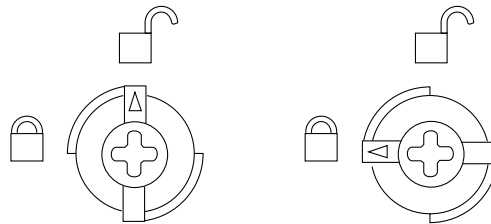


Figure 6-2 Quarter-Turn Access Slot

2. Pull the ends of the extraction levers outward to release the power supply from the centerplane.

See Figure 6-3 and Figure 6-4.

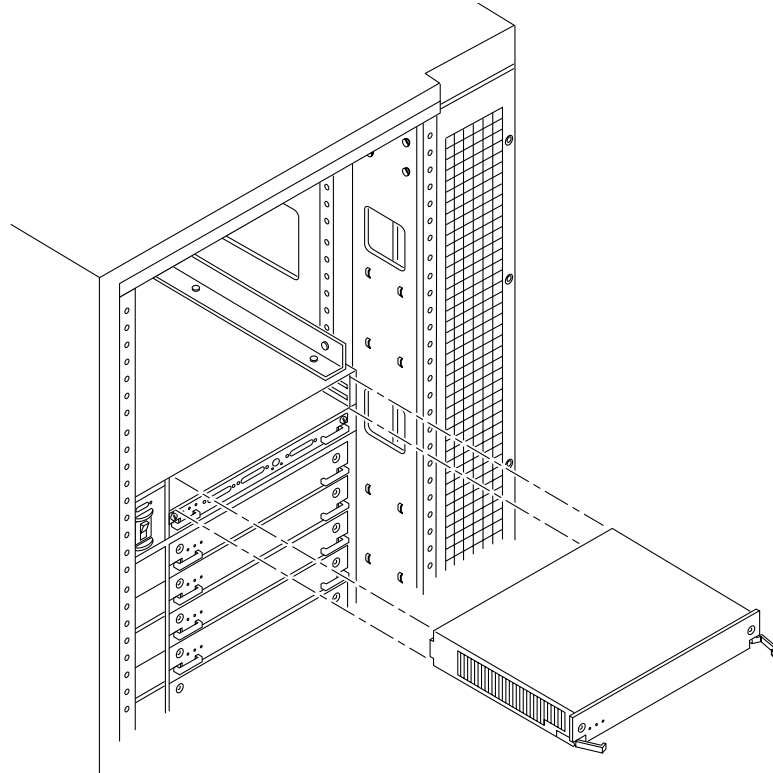


Figure 6-3 Replacing the Peripheral Power Supply in the Enterprise 6000/5000 Systems

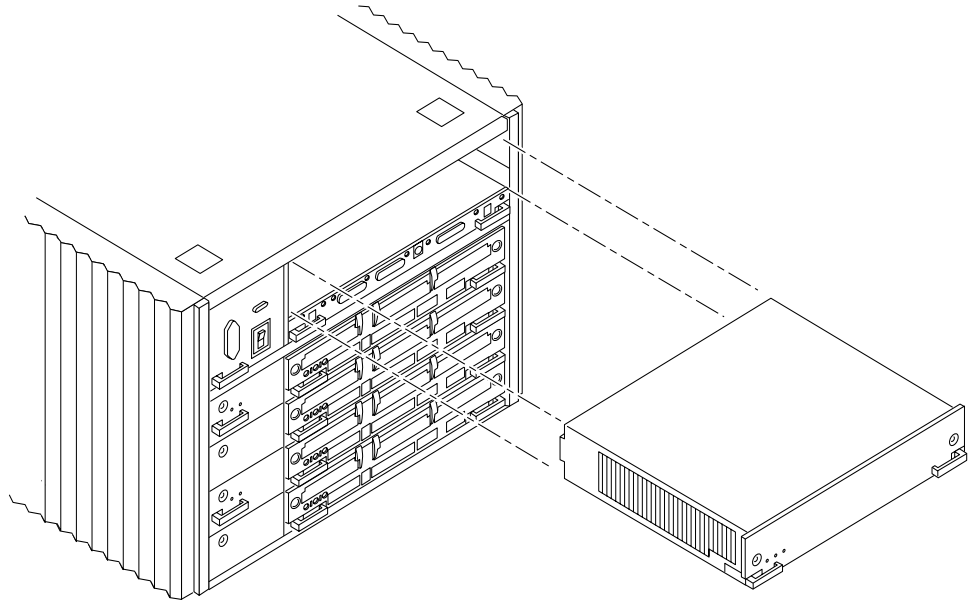


Figure 6-4 Replacing the Peripheral Power Supply in the Enterprise 4000 System

3. Pull out the power supply.

You will see a message similar to the following example on your system console:

```
WARNING: Peripheral 5.0 Volt Power Failing
WARNING: AC Power failure detected
WARNING: Peripheral 12 Volt Power Failing
WARNING: Auxiliary 5.0 Volt Power Failing
WARNING: Keyswitch fan failure detected
NOTICE: Peripheral Power Supply 0 Removed
WARNING: AC Box fan failure detected
```

4. Carefully insert the replacement power supply in the proper slot (extraction levers at the bottom) using the guide slots.

5. Slide the power supply toward the centerplane.

- Ensure that both extraction levers are in the outward position.
- Ensure that the arrows in the quarter-turn access slots point to the unlocked position.

The power supply will not seat fully unless the levers are in this starting position. See Figure 6-3 and Figure 6-4.



Caution – DO NOT FORCE the power supply into a slot; this can cause damage to the power supply and system.

The power supply should insert and seat smoothly. If it binds, remove it, and inspect the slot for any obvious obstructions. Do not damage the springfingers at the bottom of the power supply.

6. Use the extraction levers to seat the power supply.

Simultaneously swing both levers inward to the locked position. Do not press on the front panel of the power supply to seat it; doing so will damage the connector pins.

7. Mechanically lock the power supply to the system chassis by inserting a Phillips #1 screwdriver into each quarter-turn access slot and then turning to the locked position.

See Figure 6-2.

8. Be sure the green LED is lit.

If the green LED is not lit, the power supply may not be seated properly. Check to see if it is seated properly by repeating Step 4 to Step 8. If the green LED is still not lit, see Chapter 10, “Flow Diagrams for Troubleshooting,” for more information.

You will see a message similar to the following example on your system console:

```
NOTICE: Peripheral Power Supply 0 Installed
NOTICE: AC Power failure no longer detected
NOTICE: Peripheral Power Supply OK
NOTICE: Peripheral 5.0 Volt Power OK
NOTICE: Peripheral 12 Volt Power OK
NOTICE: Auxiliary 5.0 Volt Power OK
NOTICE: Peripheral 5.0 Volt Precharge OK
NOTICE: Peripheral 12 Volt Precharge OK
NOTICE: System 3.3 Volt Precharge OK
NOTICE: System 5.0 Volt Precharge OK
NOTICE: AC Box fans OK
NOTICE: Keyswitch fans OK
```

6.4 Power/Cooling Module (PCM)

The PCM provides sufficient power to the system for two boards. In addition, the power supply provides power to two fans that cool the two boards.

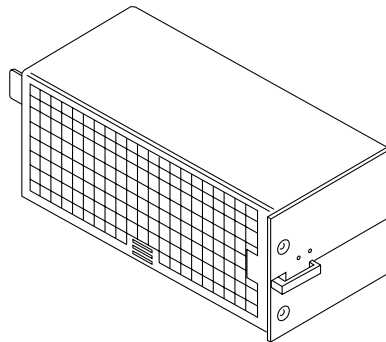


Figure 6-5 PCM

The PCM incorporates an AC inrush limit circuit and two precharge inputs (3.3V and 5V) that enable it to be hot-pluggable into a live centerplane. A current sharing scheme on the 2.0V, 3.3V, and 5V outputs enable the PCM to operate in a parallel redundant mode. A maximum of eight PCMs are used together in the redundant current sharing.

The 5V output is parallel in a system with all other PCMs and the 5V output of a peripheral power supply. The 2.0V and 3.3V outputs are parallel in a system with all other PCMs.

6.4.1 Power Requirements

In general, if a PCM fails, the system boards will continue to be powered and cooled by the other power supplies provided redundancy (an additional power supply) is present. For example, if an Enterprise system needs a minimum of three power supplies and four are present, then the system has redundancy.

However, fully configured Enterprise systems represent a different situation and are always hot-pluggable. That is, an Enterprise 5000 or 4000 system with seven or eight boards and four PCMs is hot-pluggable. (The peripheral power supply acts as the “extra” power supply.) Similarly, an Enterprise 6000 system with fifteen or sixteen boards and eight power supplies is also hot-pluggable. (Only seven PCMs are required to power sixteen active boards; the eighth PCM is “extra.” However, the eighth PCM is required for cooling purposes.) See Table 6-3.

Note – The presence of an additional (extra) PCM in the system provides redundancy and allows hot-plug of PCMs.

Table 6-3 Minimum and Redundant Working Power Supplies Required to Power Active Boards

Number of Boards	Enterprise 5000/4000 Systems		Enterprise 6000 System	
	Minimum Working Power Supplies	Redundant Working Power Supplies (Hot-pluggable)	Minimum Working Power Supplies	Redundant Working Power Supplies (Hot-pluggable)
1-2	1	2	1	2
3-4	2	3	2	3
5-6	3	4	3	4
7-8	3 + peripheral supply ¹	4 + peripheral supply	4	5
9-10			5	6
11-12			6	7
13-14			7	8
15-16			7 ²	8

1. System needs a fourth PCM for cooling purposes.

2. System needs an eighth PCM for cooling purposes.

Failed power supplies must be replaced as soon as practical. Otherwise, the Enterprise system will lose its redundancy and result in an outage at the next PCM failure.

6.4.2 Cooling Requirements

Note – In the Enterprise system, all boards must be adjacent to a PCM. The fans in the PCM cool the boards. The minimum configuration is one PCM for every two adjacent boards.

The power supplies incorporate redundant bulk fan power so that the fans continue to operate in a failed power supply with the redundant fan power from the peripheral power supply.

6.4.3 Troubleshooting a PCM

A green LED is lit on the power supply when it is operational. When a PCM fails, a yellow LED is lit on the power supply.

You will see a message similar to the following example on your system console when a PCM fails:

```
WARNING: Core Power Supply 2 Failing
WARNING: Redundant power lost
```

See Chapter 10, “Flow Diagrams for Troubleshooting,” for more information.

6.4.4 Replacing a PCM



Caution – Remove and replace the PCM in a running system. Do not replace a PCM while the system is in the low power mode. In the low power mode, the front panel and board LEDs are all off while the yellow LEDs are lit on the power supplies.

Replacing a PCM during low power mode will cause the system to power up immediately and result in a severe overload condition for that PCM (the other PCMs will remain in the low power mode).



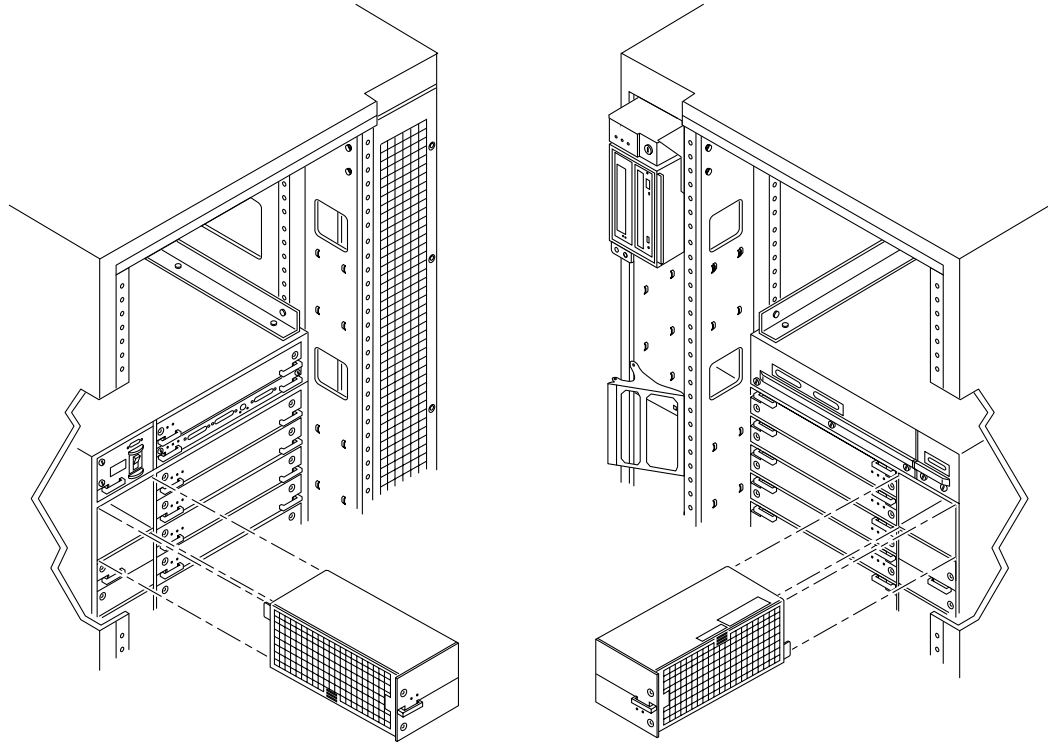
Caution – Replace the PCM within several minutes or risk overheating the board(s) cooled by the fans in that power supply.

Note – Remember the following rules when attempting the hot-plug replacement of a PCM:

- The peripheral power supply is providing precharge.
 - There is (power) redundancy in the system.
-

Use the `printdiag (1M)` command to determine if precharge current is present.

When replacing a PCM, be sure that the extraction lever is on the outside edge of the system. See Figure 6-6.



Orientation for installation in the back of the system chassis.

Orientation for installation in the front of the system chassis.

Figure 6-6 PCM - Front and Rear Installation

1. Mechanically release the power supply from the system chassis by inserting a Phillips #1 screwdriver into each quarter-turn access slot and then turning to the unlocked position. See Figure 6-7.

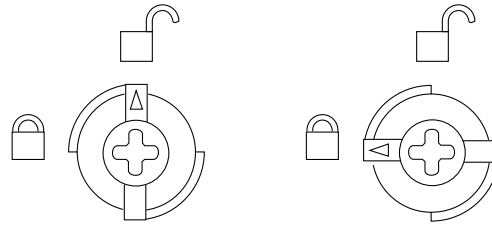


Figure 6-7 Quarter-turn Access Slots

- 2. Pull the end of the extraction lever outward to release the power supply from the centerplane.**

See Figure 6-8 and Figure 6-9.

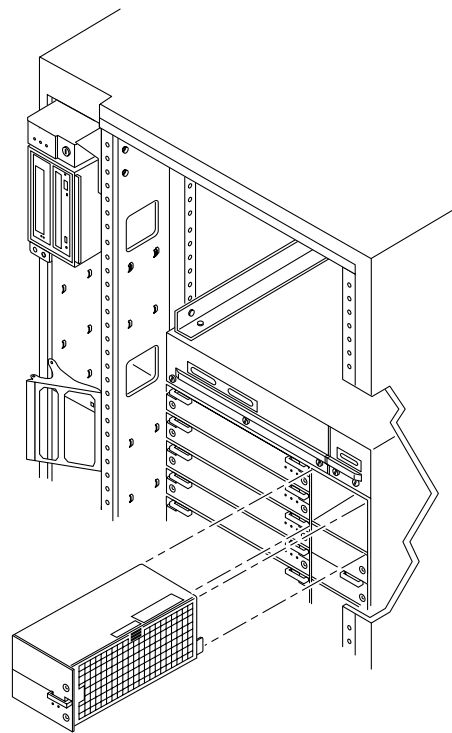


Figure 6-8 Replacing the PCM in the Enterprise 6000/5000 Systems

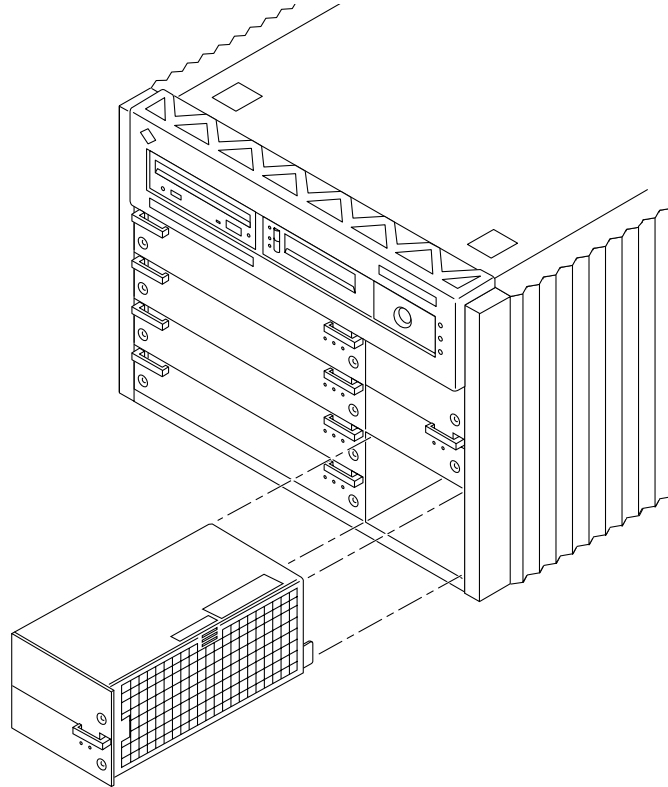


Figure 6-9 Replacing the PCM in the Enterprise 4000 System

3. Pull out the power supply.

You will see a message similar to the following example on your system console:

```
NOTICE: Core Power Supply 2 Removed
```

4. Carefully insert the replacement power supply in the proper slot.

Be sure that the extraction lever is on the outside edge of the system. See Figure 6-6.

5. Slide the power supply toward the centerplane.

- Ensure that the extraction lever is in the outward position.
- Ensure that the arrows in the quarter-turn access slots point to the unlocked position.

See Figure 6-8 and Figure 6-9. The power supply will not seat fully unless the lever is in this starting position.



Caution – DO NOT FORCE the power supply into a slot; this can cause damage to the power supply and system.

The power supply should insert and seat smoothly. If it binds, remove it, and inspect the slot for any obvious obstructions. Do not damage the springfingers at the bottom of the power supply.

6. Use the extraction lever to seat the power supply.

Swing the lever inward to the locked position. Do not press on the front panel of the power supply to seat it; doing so will damage the connector pins.

7. Mechanically lock the power supply to the system chassis by inserting a Phillips #1 screwdriver into each quarter-turn access slot and then turning to the locked position.

See Figure 6-7.

8. Check to be sure the green LED is lit.

If the green LED is not lit, the power supply is not seated properly. Repeat Step 4 to Step 8. If the green LED is still not lit, see Chapter 10, “Flow Diagrams for Troubleshooting” for more information.

You will see a message similar to the following example on your system console:

```
NOTICE: Core Power Supply 2 Installed
NOTICE: Core Power Supply 2 OK
NOTICE: Redundant power available
```


Internal SCSI and Storage Devices



<i>Tape and CD-ROM Drives</i>	<i>page 8-4</i>
<i>Multi-Tape Tray and SPARCstorage Library</i>	<i>page 8-10</i>
<i>External Disk Drives</i>	<i>page 8-10</i>

The following SCSI removable media devices are supported:

- CD-ROM Drive
- Tape Drive

The following storage devices are supported:

- Multi-tape Tray
- SPARCstorage™ Library
- SPARCstorage Array
- SPARCstorage RSM
- Differential SCSI tray

Figure 8-1 through Figure 8-3 show the location of devices in each Enterprise system.

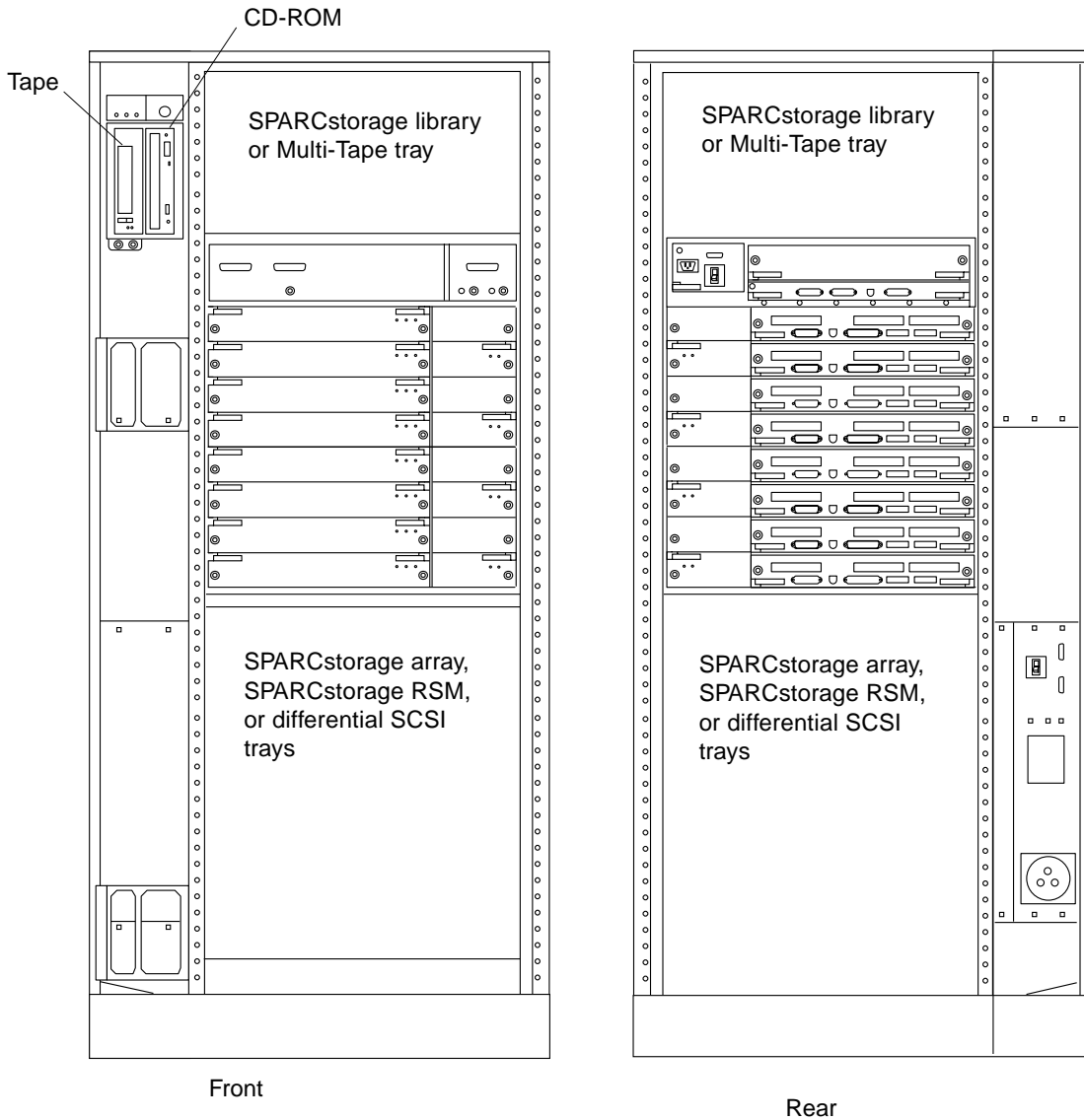


Figure 8-1 Enterprise 6000 System

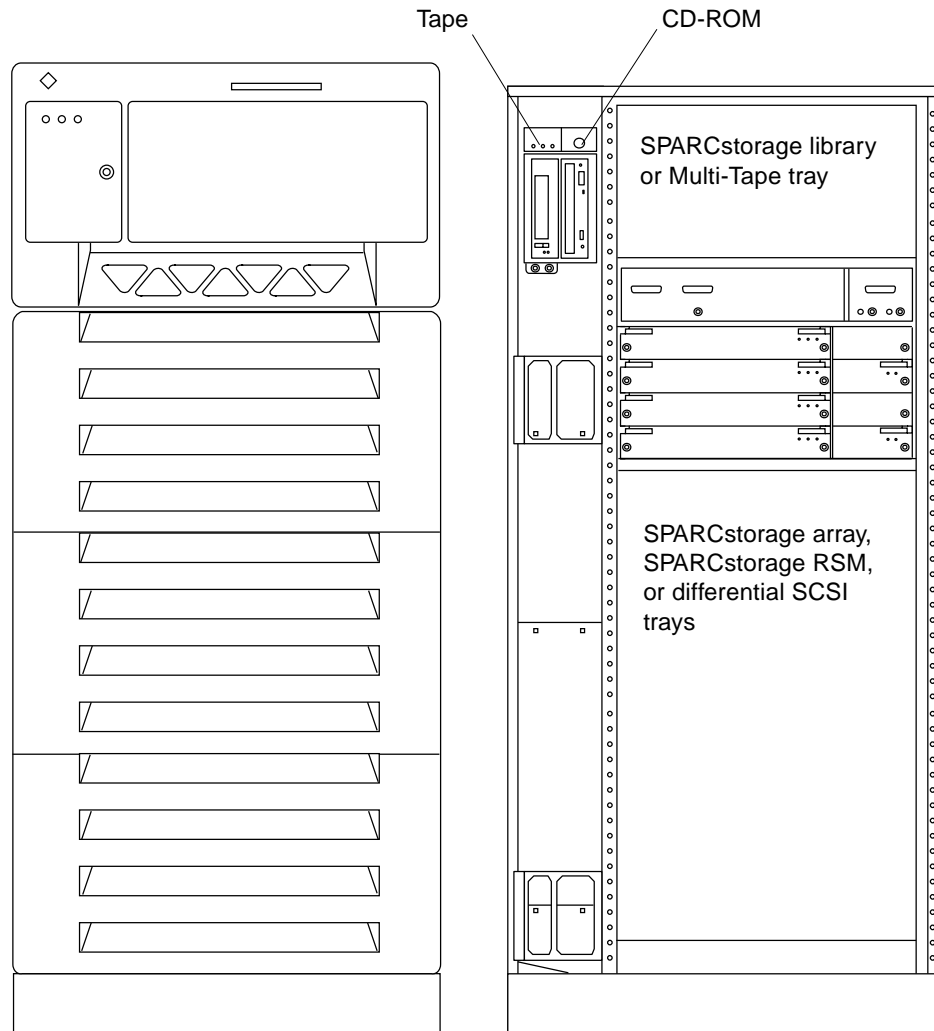


Figure 8-2 Enterprise 5000 System

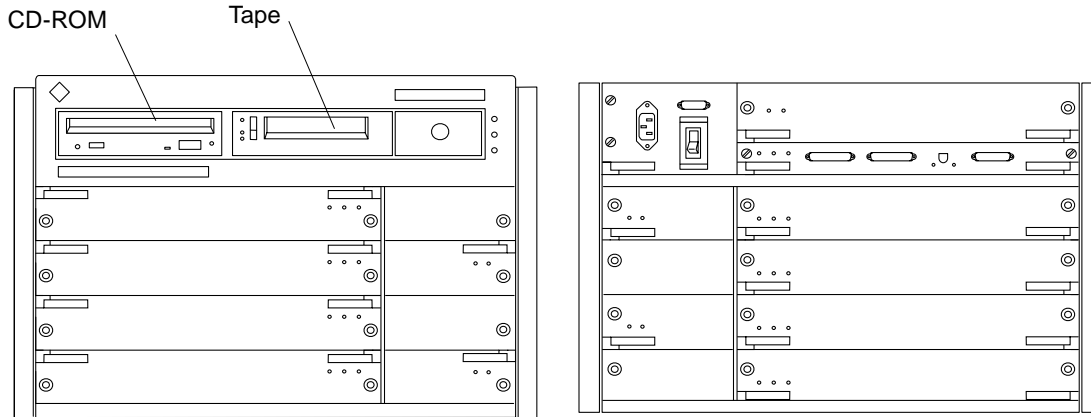


Figure 8-3 Enterprise 4000 System

Note – For cooling purposes, the tape drive in Enterprise 4000 configurations should be installed in the right bay, closest to the keyswitch and fan.

8.1 Tape and CD-ROM Drives

8.1.1 Use and Maintenance

Refer to the documentation that came with your device for information on use and maintenance. The procedures for the use and maintenance of these devices are the same for the different Enterprise systems, whether the devices are mounted horizontally (as in the Enterprise 4000 system) or vertically (as in the Enterprise 5000 and 6000 systems).

8.1.2 Removing/Replacing a Tape or CD-ROM Drive in Enterprise 6000/5000 Systems

To remove and replace an existing device, perform steps 1 through 5. To install a tape device for the first time, proceed to step 6.



Caution – To prevent breakage, do not grasp the panel by the bottom edge.

1. Remove the top panel.

Grasp the panel on both sides at the top and pull out far enough to just disengage the ball studs. See Figure 8-4.

2. Remove the panel and set it aside.

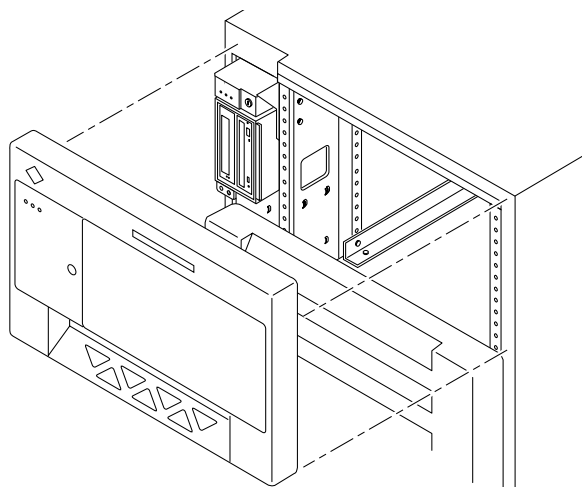


Figure 8-4 Removing the Top Front Panel

Note – It is not necessary to remove the SCSI tray to replace a device; only the device enclosure needs to be removed.

3. Release the device enclosure from the SCSI tray by removing three screws on the left-hand side as depicted in Figure 8-5.

You will then be able to move the device enclosure forward to release the data and power cables from the rear of each device.

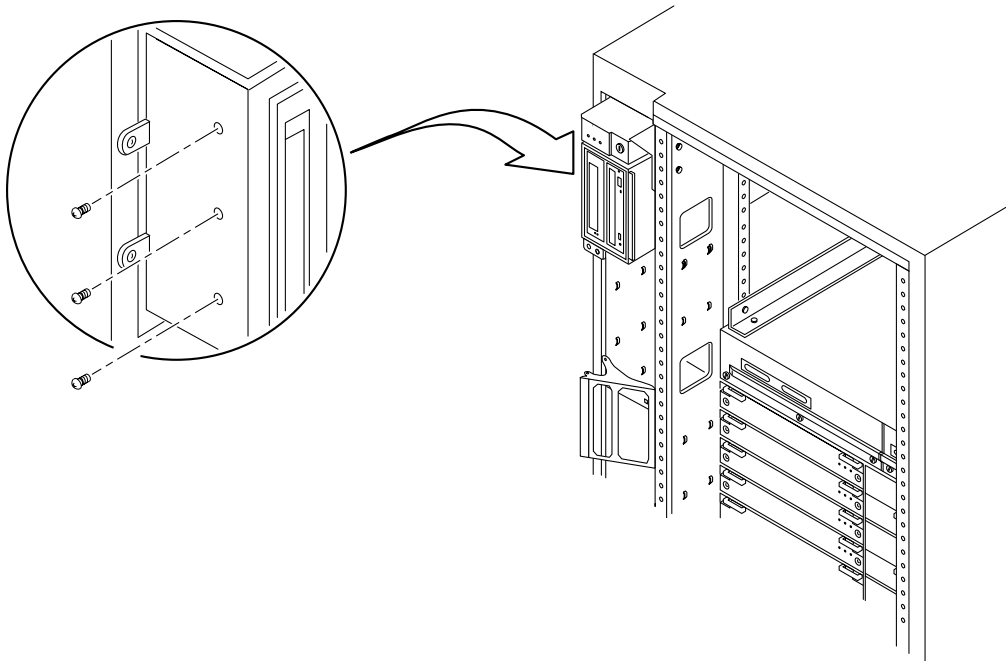


Figure 8-5 CD-ROM/Tape Drive Removal and Replacement

Note – If there are two devices in the enclosure, the data and power cables must be removed from both devices before pulling out the enclosure.

4. Once the cabling is removed, remove the device enclosure from the SCSI tray.
5. Remove the drive.
 - a. To remove a CD-ROM drive, remove two screws from each side where the device is secured to the device enclosure and then proceed to Step 7.
 - b. To remove a tape drive, remove 2 screws from each side where the tape is fastened to the device enclosure, and then remove 4 screws securing the device to the enclosure side plate. Proceed to step 7.

6. To install a tape drive for the first time, you must first remove the filler mechanism:
 - a. Remove the filler panel from the device enclosure by loosening and removing 4 screws.
 - b. Use the same 4 screws to secure the device to the device enclosure, two screws on each side.
7. Set the replacement device SCSI ID address to 6 for a CD-ROM drive and to 5 for a tape drive.
8. To complete installation of a CD-ROM or tape drive, reverse Step 1 through Step 4.

8.1.3 Removing/Replacing a Tape or CD-ROM Drive in an Enterprise 4000 System

To remove and replace an existing device, perform steps 1 through 5. To install a tape drive for the first time, proceed to step 6.

Note – For cooling purposes, the tape drive must be installed on the side nearest the keyswitch.

1. **Unlock and remove the front panel bezel.**
 - a. To unlock the bezel, apply inward pressure on the serrated edges at the lower left and right sides.
 - b. Tilt the bezel up 45 degrees to remove it.
See Figure 8-6.

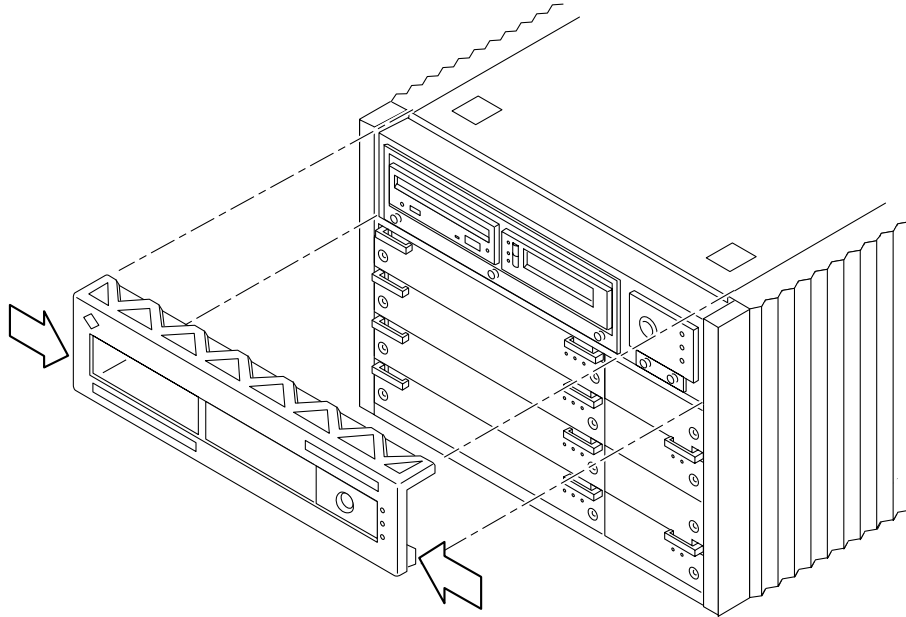


Figure 8-6 Front Panel Bezel

2. **Loosen the bottom three captive screws securing the SCSI tray to the chassis tray.**
See Figure 8-7.
3. **Insert a screwdriver in the notch at the top center of the SCSI tray to pull out the tray and separate it from the rear slip connectors.**

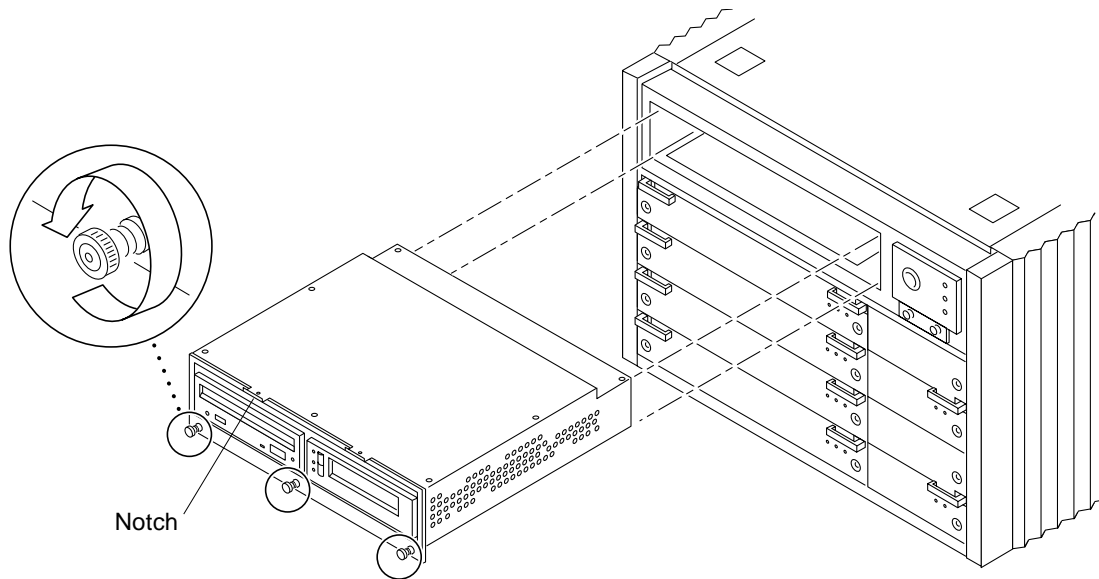


Figure 8-7 SCSI Tray Removal and Replacement

4. Remove the seven screws on top of the SCSI tray to lift off the tray cover to access CD-ROM and tape drives.
5. Remove a CD-ROM or a tape drive:
 - a. Loosen the three captive screws securing the device to the tray.
 - b. Remove the mounting plate of the device being replaced and attach it to the replacement device using the same screws.
 - c. Set the replacement device SCSI address to 6 for a CD-ROM drive, 5 for a tape drive.
 - d. Secure the replacement device to the caddy by tightening the three captive screws on the mounting plate.
 - e. To complete the replacement, reverse Step 1 and Step 2.

Note – The tape drive must be installed on the side nearest the keyswitch for cooling purposes.

- 6. To install a tape drive for the first time, you must first remove the filler mechanism:**
 - a. Remove the filler by loosening the three captive screws and then removing the unit.**
 - b. Separate the filler from what will become the device mounting plate by loosening and then removing the four screws; discard the remaining filler portion.**
 - c. Secure the mounting bracket to the new device.**
 - d. Set the SCSI address to 5.**
 - e. Secure the device with the mounting bracket to the SCSI tray using the three captive screws.**
 - f. To complete the install, reverse Step 1 through Step 3 of this procedure.**

8.2 Multi-Tape Tray and SPARCstorage Library

For use and maintenance of the Multi-tape Backup tray or the SPARCstorage Array Library, refer to the documentation that came with the device.

8.3 External Disk Drives

There are many types of external disk drives supported by Enterprise systems, including those contained in SPARCstorage arrays and Differential SCSI trays.

8.3.1 Use and Maintenance

For use and maintenance of individual drives, refer to the documentation that came with the drive.

8.3.2 Removing and Installing a Disk Drive

For removal and installation of a disk drive, refer to the documentation that came with the drive.

Part 3— Troubleshooting

Chapter 9, Troubleshooting Overview

page 9-1

Chapter 10, Flow Diagrams for Troubleshooting

page 10-1



9.1 Using a Terminal

If the system does not have a console, you can log in remotely through the network or attach a terminal directly to the system.

To attach a terminal to the system:

1. Halt the system and turn off power.

2. Connect the terminal to serial port A on the clock board.

The clock board is located at the back of system, above the card cage. Figure 9-1 shows the rear of an Enterprise 6000/5000 cabinet server. The same clock board is used in the 8-slot Enterprise 4000 standalone server.

3. Power on the terminal.

4. Set up the terminal.

Refer to the *OpenBoot Command Reference* for instructions for using the `set-defaults` and `printenv` commands.

The settings will vary with the terminal type, but these settings are often used:

- 9600 bps
- 8 data bits
- 1 stop bit
- Even parity
- Full duplex

5. Turn the keyswitch to the diagnostic position (ⓧ).

The system will turn on. The diagnostic position puts POST in interactive mode and enables extensive POST tests.

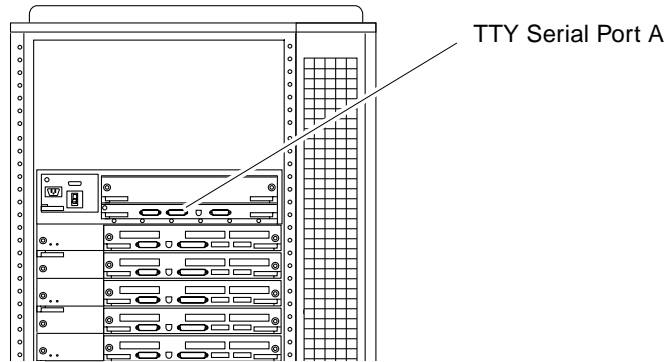


Figure 9-1 TTY Serial Port A

9.2 Hardware Indicators




Use the LEDs on the system front panel or the clock board to determine if the system is operating normally. Use the LEDs on individual boards and power supplies to locate specific malfunctions.

Many of the LED codes listed in Table 9-1 are common to the system front panel and various types of boards. See Table 9-2 for exceptions for LED codes for system boards.

9.2.1 System Front Panel LEDs

LEDs in the system are controlled by OpenBoot™ PROM programming (OBP). Table 9-1 lists the LED codes for system operations.

Table 9-1 System Status Codes

Power 	Service 	Cycling 	Condition
Off	Off	Off	No power or the key switch is in the Off position.
Off	On	Off	Failure mode. System has electrical power.
Off	Off	On	Failure mode. System has electrical power.
Off	On	On	Failure mode. System has electrical power.
On	Off	Off	System is hung, either in POST/OBP or in the operating system.
On	Off	On	Hung in OS.
On	On	Off	(Hung in POST/OBP) or (hung in OS and failed component in system).
On	On	On	(Hung in POST/OBP) or (hung in OS and failed component in system).
On	Off	Flashing	OS running. System is operating normally.
On	On	Flashing	OS running and failed component in system.
On	Flashing	Off	Slow flash = POST. Fast flash = OBP.
On	Flashing	On	OS or OBP error.

9.2.2 Clock Board LEDs

The clock board also displays system status. The LED codes are the same as for the front panel. See Table 9-1.

9.2.3 CPU/Memory and I/O Board LEDs

For hot-pluggable boards, most of the LED codes correspond to those shown in Table 9-1. The most important exception is the second code (Off-On-Off). For hot-pluggable boards, Off-On-Off indicates that the board is in low-power mode and is ready for removal.



Caution – If the left green LED is lit, do not remove the board. Electrical shorting will result, damaging the board and the system.

For the CPU/Memory and I/O boards:

- If the yellow LED (middle LED) is continuously lit (not flashing) the board requires service.
- If the left and right green LEDs are off, the board is ready for removal.
- If no LEDs are flashing, the system is hung.
- If no LEDs are lit, there is no electrical power to the board.

Table 9-2 summarizes LED codes for these boards. The symbols shown in the table are marked on the card cage frame.

Table 9-2 Board Status LED Codes

Power 	Service 	Cycling 	Condition
Off	Off	Off	Board has no electrical power.
Off	On	Off	Board is in low power mode, can be unplugged.
Off	Off	Flashing	Undefined.
Off	On	Flashing	Undefined.
On	Off	Off	System is hanging, either in POST/OBP or OS.
On	Off	On	Hung in OS.
On	On	Off	(Hung in POST/OBP) or (hung in OS and failed component on board).
On	On	On	(Hung in POST/OBP) or (hung in OS and failed component on board).
On	Off	Flashing	OS running. System is operating normally.
On	On	Flashing	OS running and failed component on board.
On	Flash	Off	Slow flash = POST. Fast flash = OBP.
On	Flash	On	OS or OBP error.

9.2.4 Disk Board LEDs

The board status LED codes correspond to those shown in Table 9-2 for the CPU/Memory and I/O boards. The Disk board has two additional LEDs on the opposite side of the board to show the status of the two onboard disk drives. The LED for disk drive 1 is nearer to the side of the Disk board, and the LED for disk drive 0 is closer to the center of the board.

9.2.5 Power Supplies

A system has one peripheral power supply and up to four or eight CPU/IO modular power supplies. All the power supplies have one green LED and one yellow LED.

The control and status signals of all power supply modules connect to the clock board. If the clock board LEDs indicate a problem, inspect the LEDs on the power supplies to locate a faulty module, if any.

9.2.5.1 Peripheral Power Supply

The green LED is to the right of the yellow LED on the peripheral power supply. The green LED indicates that the peripheral power supply is operating, but does not necessarily indicate that the DC outputs are within specification.

When the peripheral power supply module yellow LED is lit, a DC power output has malfunctioned or the voltage level is out of specification.

The peripheral power supply produces +5 VDC and +12 VDC current. The current is available for peripherals such as a tape drive and/or CD-ROM drive. In addition, the +5 VDC output of the peripheral power supply is available at the center plane for current sharing with the +5 VDC outputs of the power supply modules.

9.2.5.2 Power/Cooling Modules (PCMs)

For a PCM at the front of the card cage, the green LED is to the *left* of the yellow LED. At the back of the card cage, the LED positions are reversed and the green LED is to the *right* of the yellow LED. See Table 9-3.

When the yellow LED is lit, a fan or a DC output has malfunctioned. Each modular power supply contains two fans and three DC supplies (+3.3 VDC, +5 VDC, and +2 VDC).

The green LED indicates that the DC supplies are operating, but does not guarantee that the DC outputs are within specification.

Table 9-3 Modular Power Supply LED Codes

Green	Yellow	Condition
Off	Off	No AC input or keyswitch is turned off.
On	Off	Normal operation.
On	On	A fan has failed or one or more voltages are out of specification.
Off	On	One or more DC outputs have failed, or the voltages are out of specification, or the system is in the low power state.

The PCMs operate in redundant current share mode. If a module fails, the remaining modules may or may not provide enough current to continue system operation. The system’s ability to continue operations depends on the total demand for current.

9.2.6 Disk Tray Indicators

The availability and type of status information varies with the disk tray type used in a system. Refer to the disk tray user manual for specific status information.

9.3 Basic Definitions for the Card Cage

When locating a board slot in the 8-slot and 16-slot card cages, remember:

Slot numbers	<p>Even-numbered slots are at the front of the card cage. Odd-numbered slots are at the back.</p> <p>In the front of the card cage, even-numbered slots begin with slot 0 at the top. At the rear of the card cage, odd-numbered slots begin with slot 1 at the top.</p> <p>Install the boards with component side <i>down</i> in the front slots and with component side <i>up</i> in the rear slots.</p> <p>For specific slot numbers, see Appendix B, “Functional Description.”</p>
Slot functions	<p>All card cage slots are equivalent. However, for convenience in installing I/O cables, it is suggested that you install CPU/Memory boards at the front of the cage and install I/O boards at the back of the cage. When all slots are filled on one side of the cage, you can use the other side.</p> <p>Slot 1 should contain an I/O board connected to the boot disk. (This is not a requirement.)</p> <p>Slot 0 should contain a CPU/master board with at least one CPU. The POST diagnostics display more messages if slot 0 contains a CPU/Memory board and a CPU. For an explanation, see the next item, “Master board.”</p>
Master board	<p>There is no master board during normal system operations. The first CPU/Memory board (in slot 0) functions temporarily as a master board during some POST tests.</p>

9.4 Diagnosing Problems

When board LED codes indicate a hardware problem, several types of software programs are available to supply information about the problem.

9.4.1 Error Messages

Error messages and other system messages are saved in the file `/var/adm/messages`.

9.4.2 SunVTS

The latest version of SunVTS™ (on-line validation test suite) has several modes of testing, including low-impact testing, which can run with minimum affect on customer applications.

The SunVTS can also be used to stress-test Sun hardware, either in or out of the Solaris operating environment. By running multiple and multithreaded diagnostic hardware tests, the SunVTS software verifies the system configuration and functionality of most hardware controllers and devices.

SunVTS tests many board and system functions, as well as interfaces for Fibre Channel, SCSI, and SBus interfaces. SunVTS accepts user-written scripts for automated testing.

Refer to the *SunVTS User's Guide* for starting and operating instructions.

9.4.3 prtdiag(1M)

You can use the `prtdiag` command to display:

- System configuration, including information about clock frequencies, CPUs, memory, and I/O card types.
- Diagnostic information
- Failed field replaceable units (FRUs)

Refer to the `prtdiag` man page for instructions.

9.4.3.1 History Log Option

To isolate an intermittent failure, it may be helpful to maintain a `prtdiag` history log. Use `prtdiag` with the `-l (log)` option to send output to a log file in `/var/adm`.

9.4.3.2 Running prtdiag

To run `prtdiag`, type:

```
% /usr/platform/sun4u/sbin/prtdiag
```


9.4.4 *POST and OpenBoot*

POST and OpenBoot work together in the system to test and manage system hardware.

POST resides in the OpenBoot PROM on each CPU/Memory board, I/O board, and Disk board. When the system is turned on, or if a system reset is issued, POST detects and tests buses, power supplies, boards, CPUs, SIMMs, and many board functions. POST controls the status LEDs on the system front panel and all boards. POST displays diagnostic and error messages on a console terminal, if available.

Only POST can configure the system hardware, and only POST can enable hot-pluggable boards. If a new unit (board or modular power supply) is added to the card cage after the system has booted, the new unit will not work until the system is rebooted, at which time POST reconfigures the system, using the units that are found in the system at that time.

OpenBoot provides basic environmental monitoring, including detection of overheating conditions and out-of-tolerance voltages. For example, if an overheated board is found, OpenBoot issues a warning message. If the temperature passes the danger level, POST will put the overheated board(s) in low power mode.

OpenBoot also provides a set of commands and diagnostics at the `ok` prompt. For example, you can use OpenBoot to set NVRAM variables that reserve a board or a set of SIMMs for hot-sparing.

The following OpenBoot commands may be useful for diagnosing problems:

9.4.4.1 *show-devs Command*

Use the `show-devs` command to list the devices that are included in the system configuration.

9.4.4.2 *printenv Command*

Use the `printenv` command to display the system configuration variables stored in the system NVRAM. The display includes the current values for these variables, as well as the default values.

If the system cannot communicate with a 10BASE-T network, the Ethernet link test setting for the port may be incompatible with the setting at the network hub. See Section 9.5.1, “Failure of Network Communications,” for further details.

9.4.4.3 `probe-scsi` *Command*

The `probe-scsi` command locates and tests SCSI devices attached to the system. `probe-scsi` is run from the OpenBoot prompt.

When it is not practical to halt the system, you can use SunVTS as an alternate method of testing the SCSI interfaces.

9.4.4.4 *Reference Documents for POST/OpenBoot*

- OpenBoot 3.x Command Reference, part number 802-3242
- Writing FCode 3.x Programs, part number 802-3230

9.4.5 *Solstice SyMON*

The Solstice™ SyMON™ program monitors system functioning and features a graphical user interface (GUI) to continuously display system status. Solstice SyMON is intended to complement system management tools such as SunVTS.

Solstice SyMON is accessible through an SNMP interface from network tools such as Solstice™ SunNet Manager™.

Refer to the *Solstice SyMON User's Guide* manual, part number 802-5355, for starting and operating instructions.

9.5 Specific Problems and Solutions

9.5.1 Failure of Network Communications

Description of the Problem

The system cannot communicate with a network if the system and the network hub are not set in the same way for the Ethernet Link Integrity Test. This problem particularly applies to 10BASE-T network hubs, where the Ethernet Link Integrity Test is optional. This is not a problem for 100BASE-T networks, where the test is enabled by default.

If you connect the system to a network and the network does not respond, use the OpenBoot command `watch-net-all` to display conditions for all network connections:

```
ok watch-net-all
```

For SBus Ethernet cards, the test can be enabled or disabled with a hardware jumper, which you must set manually. For the TPE and MII onboard ports on the I/O board, the link test is enabled or disabled through software, as shown below.

Remember also that the TPE and MII ports are not independent circuits and as a result, both ports cannot be used at the same time.

Note – Some hub designs do not use a software command to enable/disable the test, but instead permanently enable (or disable) the test through a hardware jumper. Refer to the hub installation or user manual for details of how the test is implemented.

Determining the Device Names of the I/O Boards

To enable or disable the link test for an on-board TPE (`hme`) port, you must first know the device name for the I/O board. To list the device names:

- 1. Shut down the system and take the system into OpenBoot.**
- 2. Determine the device names of the I/O boards:**

a. Type:

```
ok show-devs
```

b. In the show-devs listing, find the node names.

Node names take the general form /sbus@3,0/SUNW,hme@3,8c00000.

Solution 1

Use this method while the operating system is running:

1. Become superuser.

2. Type:

```
# eeprom nvramrc="probe-all install-console banner apply disable-link-pulse device-name "  
  (Repeat for any additional device names.)  
# eeprom "use-nvramrc?"=true
```

3. Reboot the system (when convenient) to make the changes effective.

Solution 2

Use this alternate method when the system is already in OpenBoot:

1. At the monitor OpenBoot prompt, type:

```
ok nvedit  
0: probe-all install-console banner  
1: apply disable-link-pulse device-name  
  (Repeat this step for other device names as needed.)  
  (Press CONTROL-C to exit nvedit.)  
ok nvstore  
ok setenv use-nvramrc? true
```

2. Reboot to make the changes effective.

9.5.2 Resetting and Power Cycling the System from a Remote Console

It is possible to reset the system or cycle power from the remote console under these conditions:

- The console must be connected to port A on the clock board.
- The key switch must be in either the On or Diagnostic setting. If the key switch is in the Secure or Off position, the remote key sequences and button resets are ignored.
- Security features permit the use of the remote console.
- You must use a slow typing speed, not less than 0.5 seconds and not more than 5 seconds between characters.

Table 9-4 Remote Console Commands

Command	Enter this sequence
Remote power off/on	<CR> <CR> <~> <Control-Shift-p>
Remote system reset	<CR> <CR> <~> <Control-Shift-r>
Remote XIR (CPU) reset	<CR> <CR> <~> <Control-Shift-x>

Key:

<CR> = ASCII 0d hexadecimal,
<~> = ASCII 7e hexadecimal,
<Control-Shift-p> = 10 hexadecimal,
<Control-Shift-r> = 12 hexadecimal,
<Control-Shift-x> = 18 hexadecimal.

Note – The remote console logic circuit continues to receive power even if you have commanded system power off.

The remote system reset command is useful for resetting the system under general conditions. The remote XIR reset command is used for software development and debugging.

Flow Diagrams for Troubleshooting

10 

This chapter discusses solutions for these subjects:

<i>No AC or DC Power</i>	<i>page 10-2</i>
<i>System Cannot Boot</i>	<i>page 10-3</i>
<i>Defective CPU/Memory Board</i>	<i>page 10-4</i>
<i>Defective I/O Interface Board</i>	<i>page 10-5</i>
<i>Defective Disk Board</i>	<i>page 10-6</i>
<i>Defective Disk Drive</i>	<i>page 10-7</i>
<i>Defective Power Supplies</i>	<i>page 10-8</i>
<i>Defective Clock Board</i>	<i>page 10-9</i>

10.1 No AC or DC Power

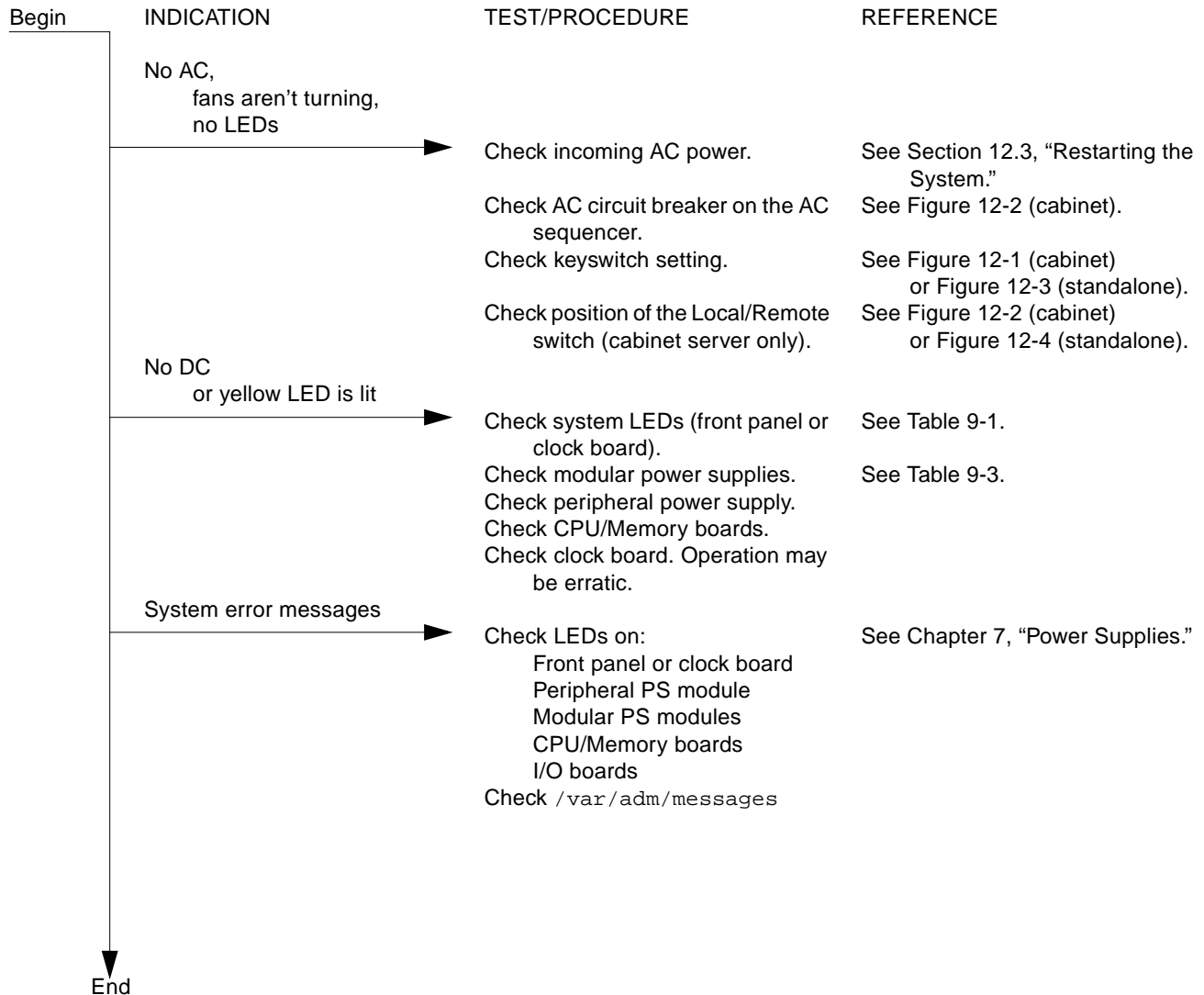


Figure 10-1 Diagnosing AC/DC Power Problems

10.2 System Cannot Boot

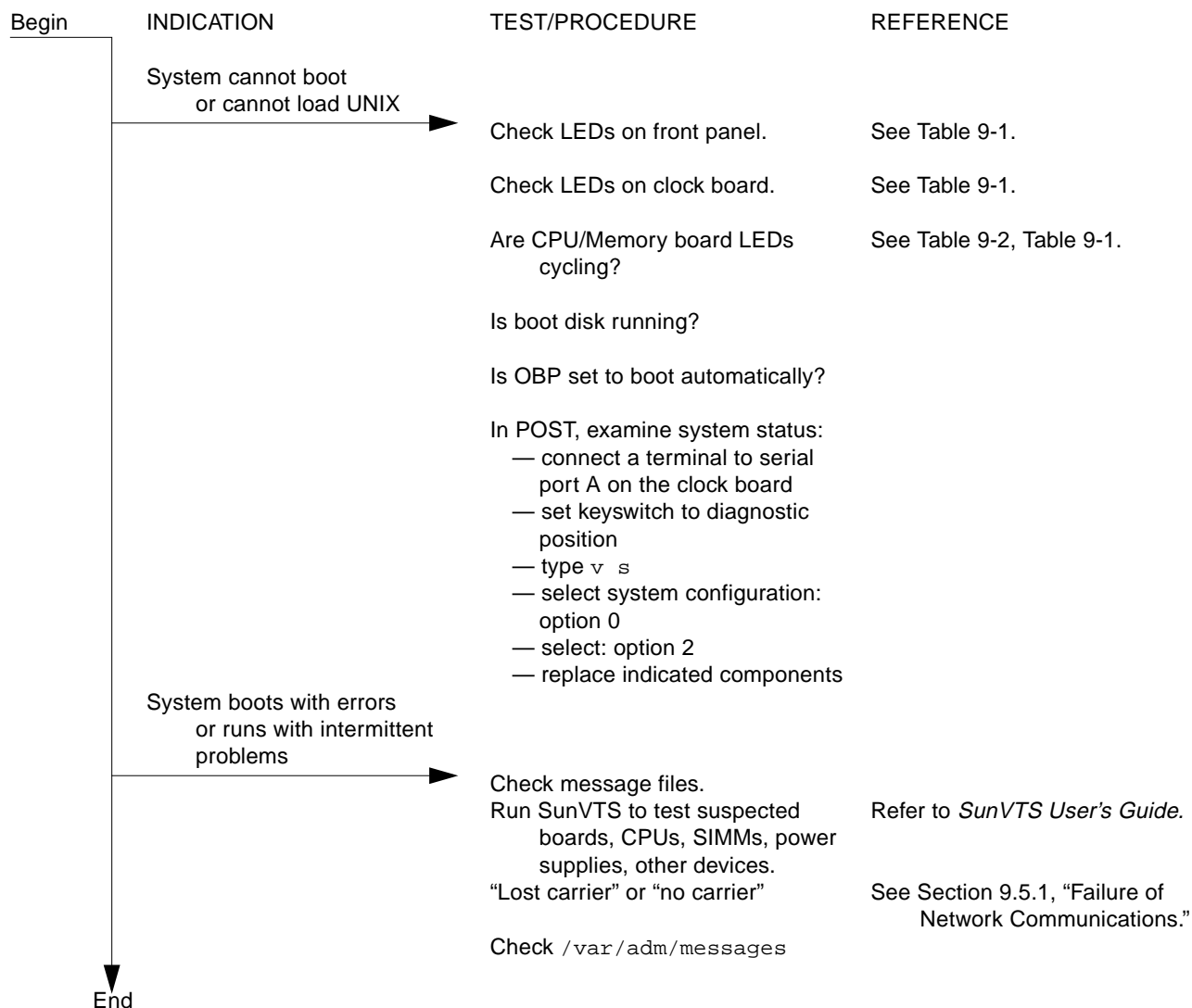


Figure 10-2 Diagnosing Operating System Problems

10.3 Defective CPU/Memory Board

CPU/Memory boards are hot-pluggable.

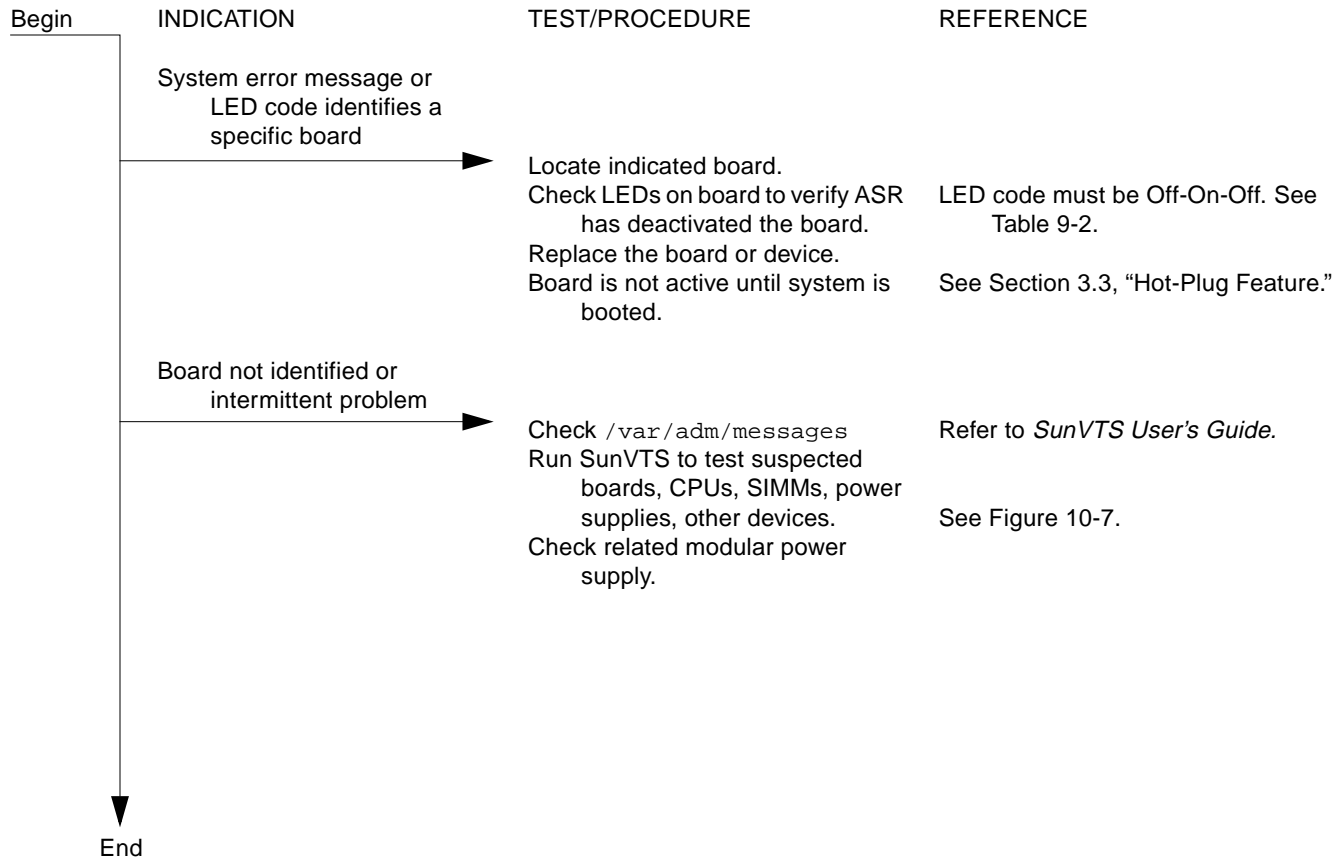


Figure 10-3 Diagnosing CPU/Memory Board Problems

10.4 Defective I/O Interface Board

Interface boards are hot-pluggable in many instances.

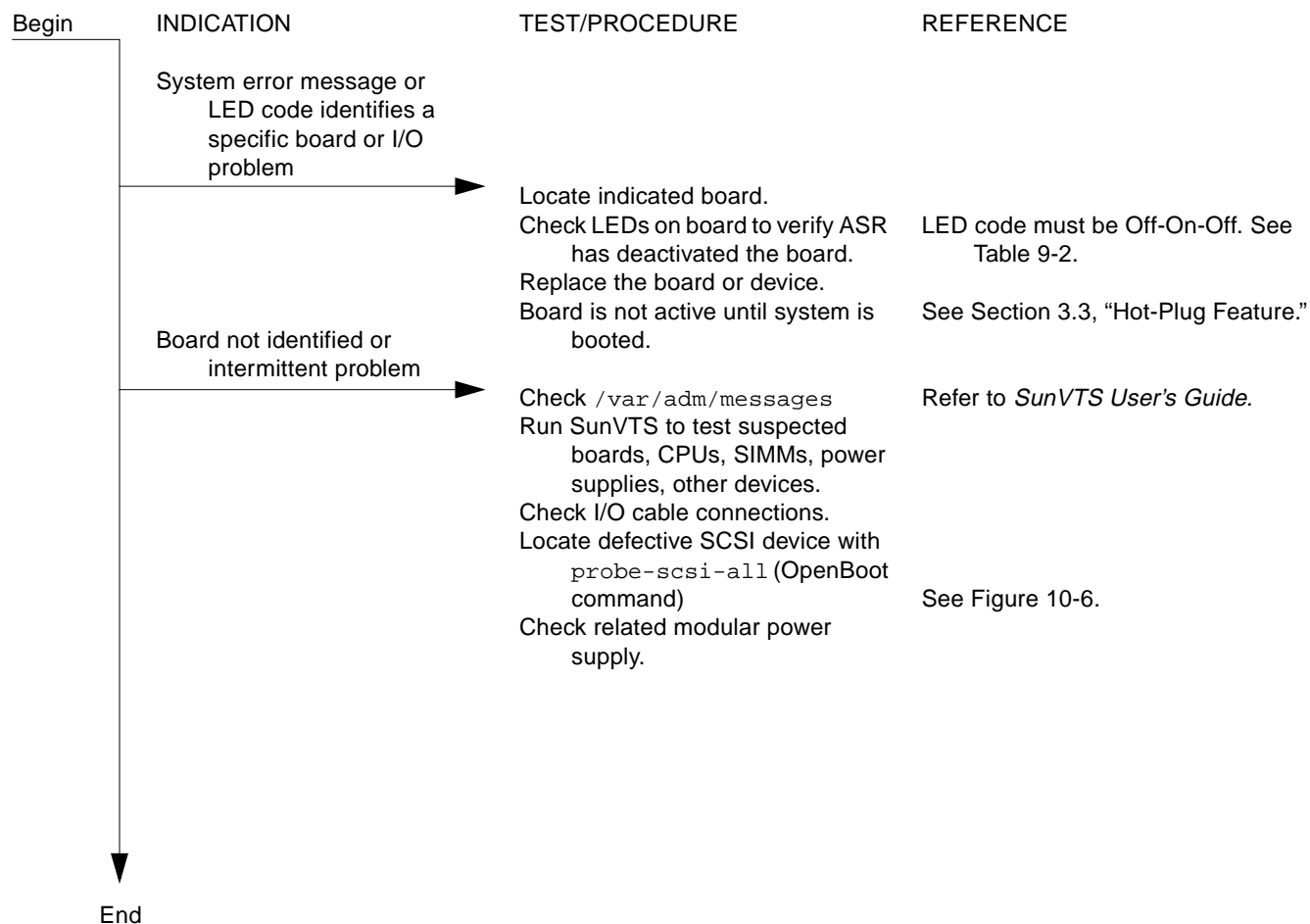


Figure 10-4 Replacing I/O Interface

10.5 Defective Disk Board

The disk board is hot-pluggable.

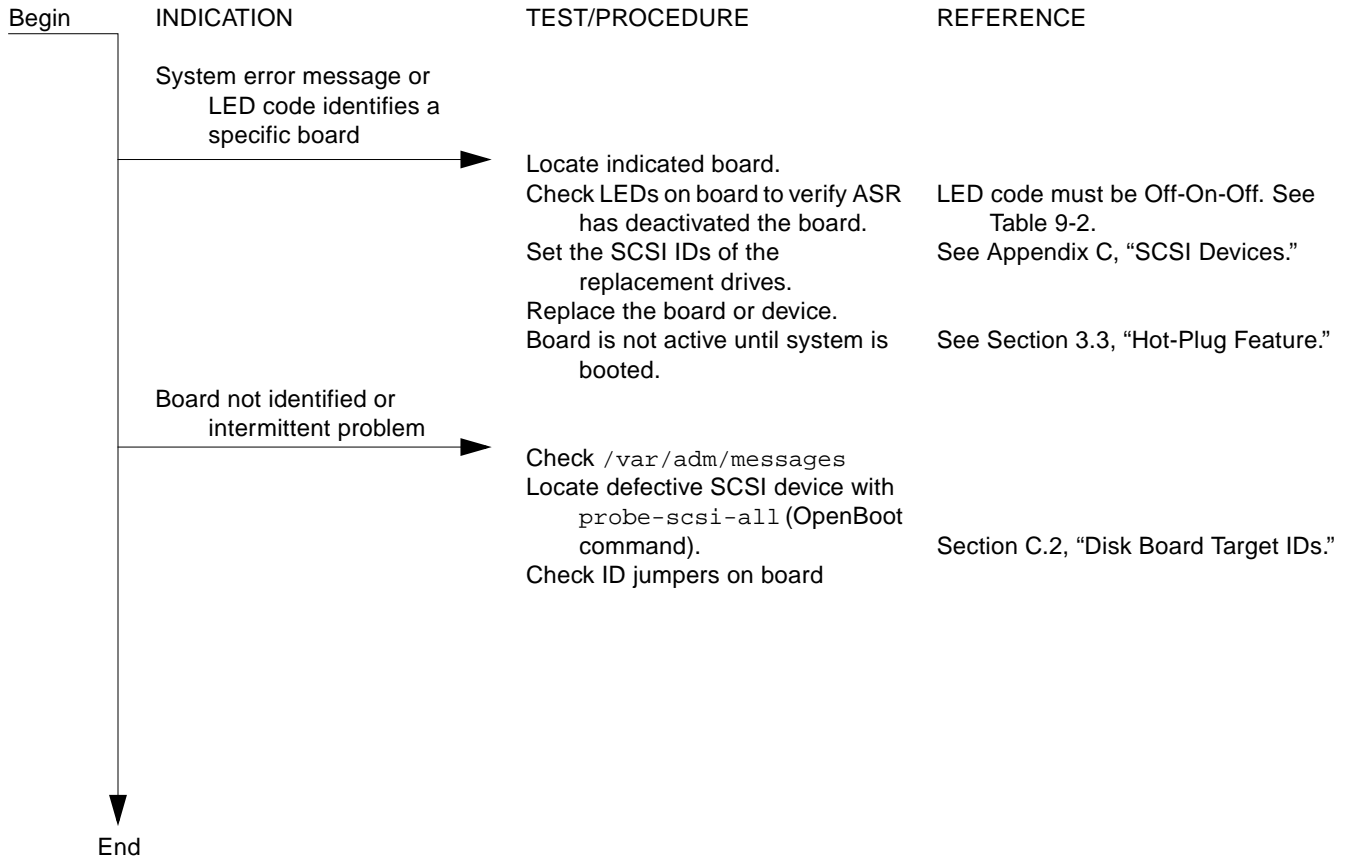


Figure 10-5 Diagnosing Disk Board Problems

10.6 Defective Disk Drive

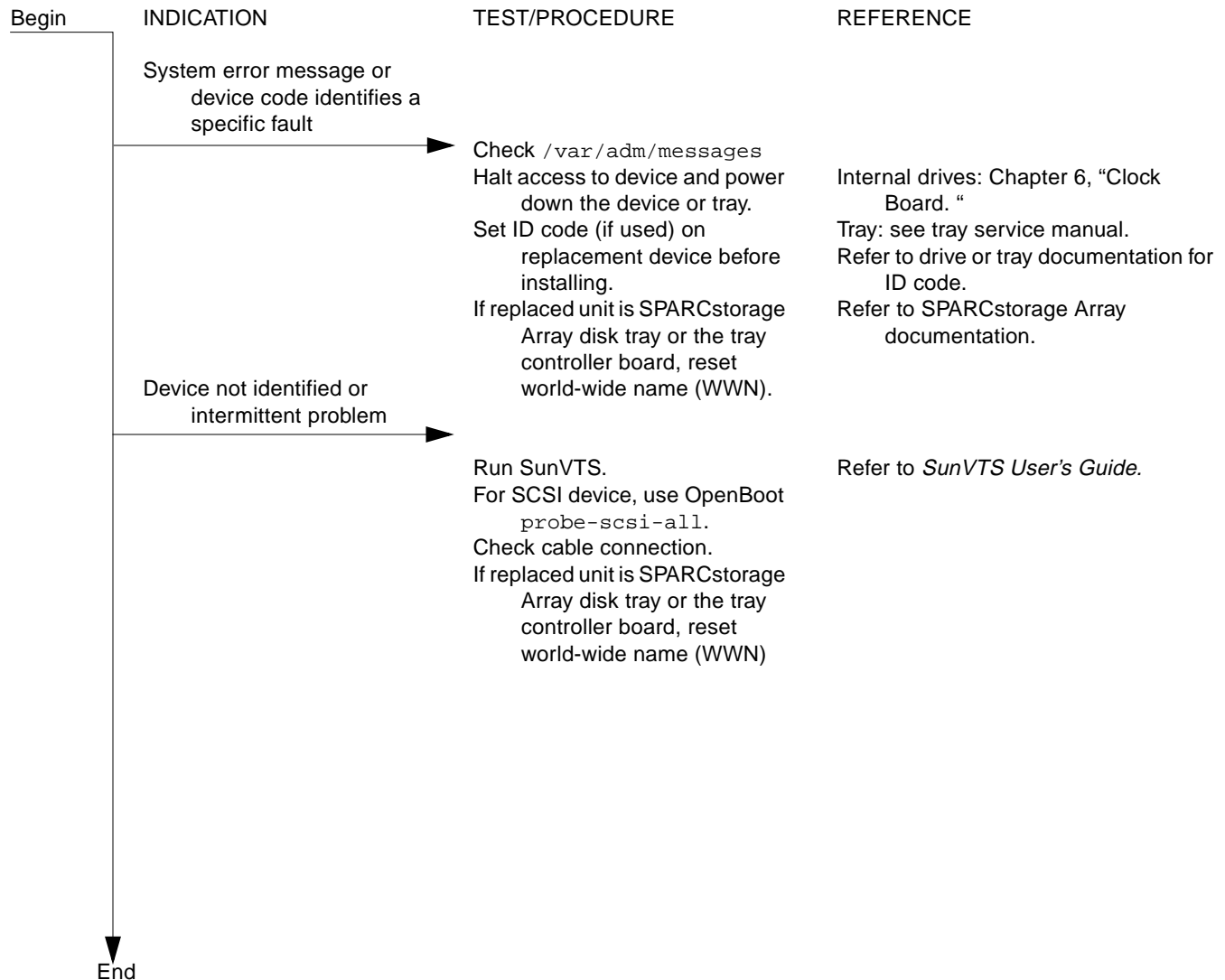


Figure 10-6 Diagnosing Disk Drive Problems

10.7 Defective Power Supplies

The peripheral power supply and power/cooling modules are hot-pluggable.



Caution – Boards in slots adjacent to a modular power supply may overheat if the supply is removed and not replaced. The modular power supply provides cooling air to two board slots.



Caution – Do not hot-plug boards or modules if the peripheral power supply is defective. The hot-plug feature requires a working peripheral power supply for precharge current.

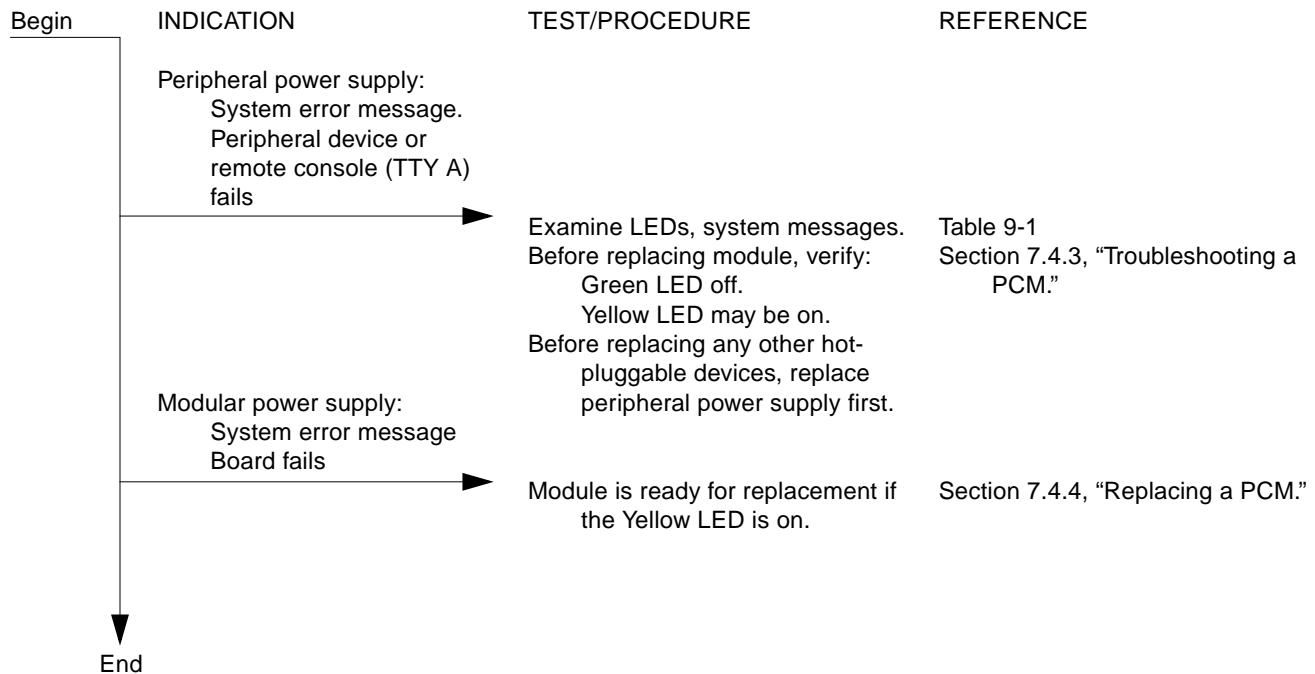


Figure 10-7 Diagnosing Power Supply Problems

10.8 Defective Clock Board

There is one clock board in the system.



Caution – The clock board is not hot-pluggable. You must halt the operating system and turn off AC power before replacing the clock board.

Begin	INDICATION	TEST/PROCEDURE	REFERENCE
	System will not boot.	Examine LED displays.	Table 9-1
	Clock board yellow “service” LED does not light during POST or remains lighted after POST.	Check clock board.	
	System and board LEDs do not flash, or fail POST repeatedly with random LED patterns.	Check clock board and power supplies.	See Figure 10-7.
	TTY port A does not respond.	Check settings for the port. Replace peripheral power supply.	Section 9.1, “Using a Terminal.”
End			

Figure 10-8 Diagnosing a Defective Clock Board

Part 4— Service Information

Chapter 11, Safety and Tools	page 11-1
Chapter 12, Powering Off and On	page 12-1
Chapter 13, Preparing for Service	page 13-1



11.1 Safety Precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Ensure that the voltage and frequency rating of the power outlet you use matches the electrical rating label on the equipment and video monitor.
- Use properly grounded power outlets only.
- Never push objects of any kind through openings in the equipment as they may touch dangerous voltage points or short out components that could result in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

To protect both yourself and the equipment, observe the following precautions:

Table 11-1 Safety Precautions

Item	Problem	Precaution
Springfingers	Personal injury	The springfingers have sharp edges. Use care when handling springfinger-equipped cabinet screens and system boards.
	RFI leakage	Keep springfinger-equipped screens and panels in place when the system is running. These assemblies suppress radio frequency interference (RFI) and are required by law in many localities.
	Damaged springfingers	Look for any broken or twisted springfingers and replace any damaged screen or board with a new assembly.

Table 11-1 Safety Precautions (Continued)

Item	Problem	Precaution
AC power cord	Electric shock	Unplug the AC cord from the AC wall socket before working inside the system chassis.
Wrist strap or Foot strap	ESD	Wear a conductive wrist strap or foot strap when handling printed circuit boards.
ESD mat	ESD	An approved ESD mat provides protection from static damage when used with a wrist strap or foot strap. The mat also cushions and protects small parts that are attached to printed circuit boards.
Cover panels	System damage and overheating	Attach all cabinet cover panels after performing any service work on the system.
Filler panels and load boards	System damage and overheating	Install card cage filler panels in all unused card cage slots. Open slots severely reduce the cooling capability of the system. NOTE: You must use load boards instead of filler panels in the 16-slot Enterprise 6000 system card cage.
SBus slot covers	System damage and overheating	Install SBus slot covers in all unused system board SBus slots. Openings on the backs of system boards reduce the cooling capability of the system.

11.2 Symbols

The following symbols mean:



WARNING

Hazardous voltages are present. To reduce the risk of electrical shock and danger to personal health, follow the instructions.



WARNING

Risk of personal injury. To reduce the risk, follow the instructions.













CAUTION




Risk of equipment damage. To reduce the risk, follow the instructions.



SURFACE

CAUTION: Hot surfaces. Avoid contact. Surfaces are hot and may cause personal injury if touched.

	AC	A terminal to which alternating current or voltage may be applied.
	ON	The principal and stand-by switches are in the ON position; the system is powered on.
	OFF	The principal switch is in the OFF position.
	STAND-BY	The system is in standby mode and the operating system is halted. The circuit breaker can be turned off.
	DIAGNOSTICS	System is powered on. If system is rebooted, POST will display extended diagnostic messages.
	CYCLING	System or board is operating normally.
	LOCKED	Board: 1/4-turn access slot is locked. System: running in secure mode and will not respond to commands from the console. The key can be removed.
	UNLOCKED	Board 1/4-turn access slot is unlocked.
	POWER	Board is receiving DC power.
	SERVICE	System has detected a hardware failure.

	PROTECTIVE EARTH	Earth ground.
	CHASSIS	Frame or chassis ground.
	FUSE REPLACEMENT MARKING	For continued protection against risk of fire and electric shock, replace ONLY with fuse of the same type and rating.

11.3 System Precautions

Ensure that the voltage and frequency of the power outlet to be used matches the electrical rating labels on the cabinet.

Wear antistatic wrist straps when handling any magnetic storage devices or system boards.

Only use properly grounded power outlets.



Caution – DO NOT make mechanical or electrical modifications to the cabinet. Sun Microsystems is not responsible for regulatory compliance of modified cabinets.



Caution – Power off the cabinet and all equipment connected to it before performing any of the procedures described in this book. The system chassis power must be turned off and the AC power cord must remain plugged in to ensure a proper ground.



Warning – This equipment contains lethal voltages. Accidental contact can result in serious injury or death.



Caution – Improper handling by unqualified personnel can cause serious damage to this equipment. Unqualified personnel who tamper with this equipment may be held liable for any resulting damage to the equipment.

Persons who remove any of the outer panels to access this equipment must observe all safety precautions and ensure compliance with skill level requirements, certification, and all applicable local and national laws.

All procedures contained in this document must be performed by qualified service-trained maintenance providers.



Caution – Before you begin, carefully read each of the procedures in this manual. If you have not performed similar operations on comparable equipment, *do not attempt* to perform these procedures.

11.4 Tools Required

This list represents the minimum of tools and test equipment required to service the system cabinet:

- Screwdriver, slotted, 3/16 inch
- Screwdriver, Phillips #2
- Screwdriver, Phillips #1
- Hex driver, M-4
- Hex driver, 3/16 inch
- Hex driver, 9 mm
- Hex driver, 3/32
- Wrench, 13 mm
- DIP/IC extraction tool
- ESD mat
- Grounding wrist strap
- Needlenose pliers

Powering Off and On

This chapter contains information necessary to prepare the system for service. Included are system power off and on, and external cable removal procedures.

<i>Powering Off the System</i>	<i>page 12-1</i>
<i>Removing the External Cables</i>	<i>page 12-5</i>
<i>Restarting the System</i>	<i>page 12-7</i>
<i>Reading Boot Messages</i>	<i>page 12-10</i>

12.1 Powering Off the System

Before turning off system power, halt the operating system as shown below. Failure to halt the operating system properly can cause the loss of disk drive data.

If you are troubleshooting system problems, you may find it convenient to reset the system or even cycle system power from the console. See Section 9.5.2, "Resetting and Power Cycling the System from a Remote Console," on page 9-13.

12.1.1 Enterprise 6000/5000 Cabinet Systems

- 1. Notify users that the system is going down.**
- 2. Back up the system files and data to tape, if necessary.**

3. **Halt the system using the appropriate commands. Refer to the *Solaris Handbook for SMCC Peripherals* that corresponds to your operating system.**
4. **Wait for the system-halted message and the boot monitor prompt.**
5. **Turn off the system power in this order:**
 - a. External drives and expansion cabinets (if any)
 - b. System cabinet
 - c. Terminal
6. **Turn the front panel key switch to the Standby position.**
See Figure 12-1.
7. **Turn the AC power sequencer power switch to Off.**
The power sequencer is at the rear of the cabinet. See Figure 12-2.



Caution – Before attempting to service the system cabinet, turn off the AC power on the rear of the system.

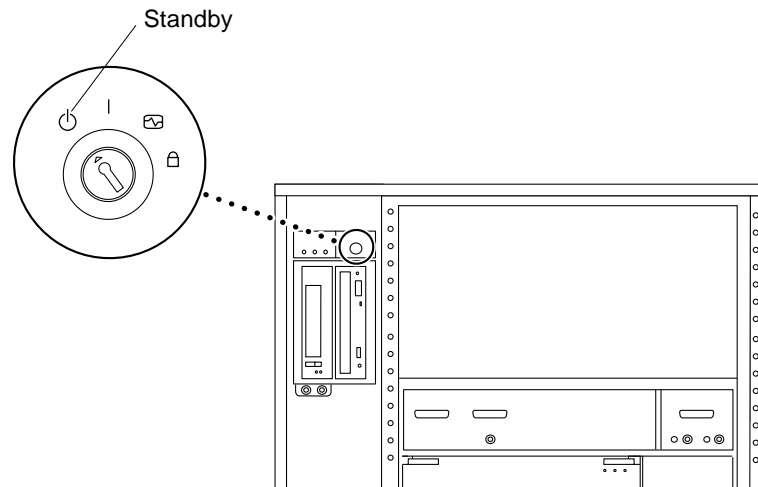


Figure 12-1 Keyswitch Standby Position (Cabinet System)

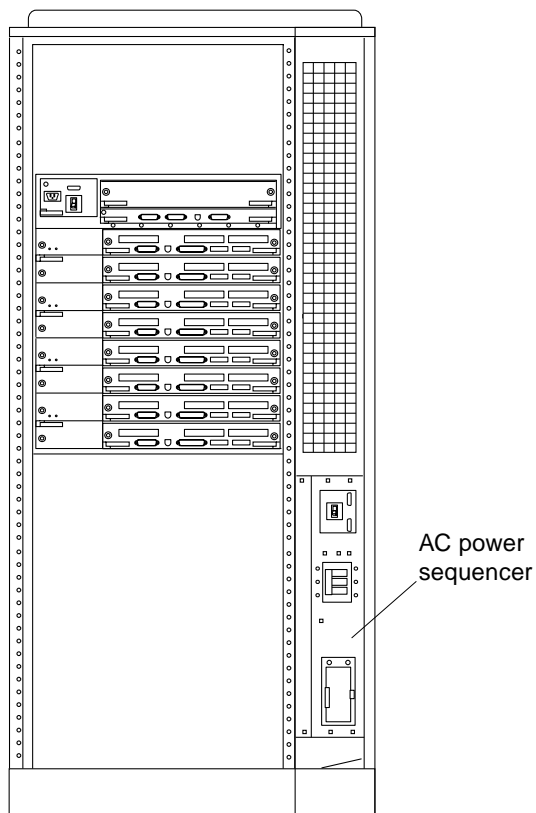


Figure 12-2 AC Power Switch (Cabinet Server)

12.1.2 Enterprise 4000 System

1. Notify users that the system is going down.
2. Back up the system files and data to tape, if necessary.
3. Halt the system using the appropriate commands. Refer to the *Solaris Handbook for SMCC Peripherals* that corresponds to your operating system.

4. Wait for the system-halted message and the boot monitor prompt.
5. Turn the key switch on the front panel of the server to the Standby position (fully counterclockwise).
See Figure 12-3.
6. Turn the AC power switch on the system rear off.
See Figure 12-4.

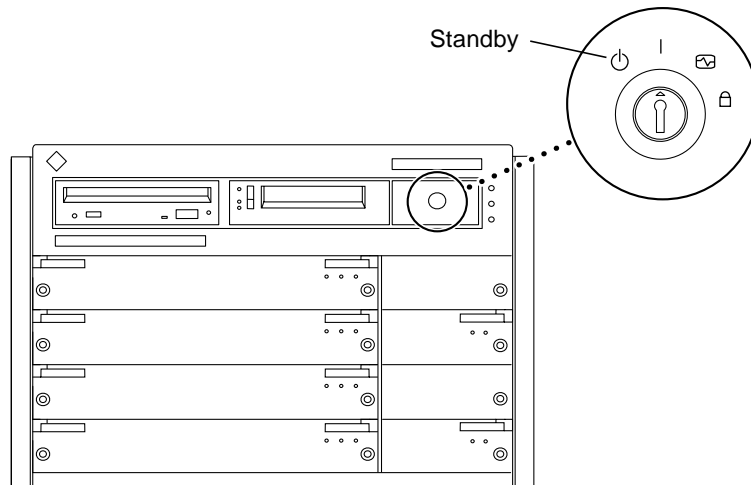


Figure 12-3 Keyswitch Standby Position (Standalone Server)

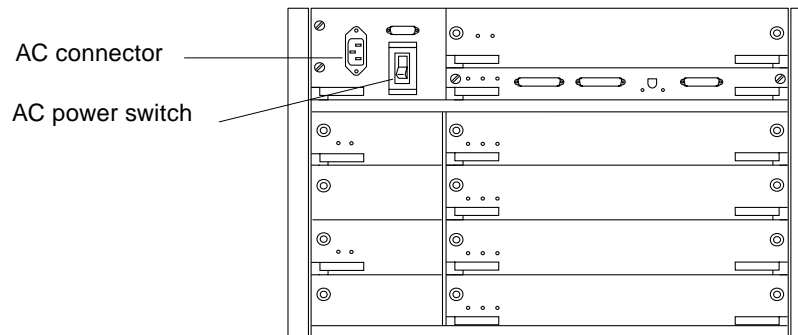


Figure 12-4 AC Power Switch and Power Receptacle
(Standalone Server)

12.2 Removing the External Cables

1. **Position the server for easy access to the rear.**
2. **Enterprise 6000/5000 systems only: remove the rear screen panel and the kick panel by loosening the screws.**
Both the rear screen panel and kick panel are attached with two screws. See Figure 12-5.

Note – If your system cabinet has a hinged rear door, use the sliding door latch to open the door, remove the kick panel (if necessary), and proceed to Step 3.

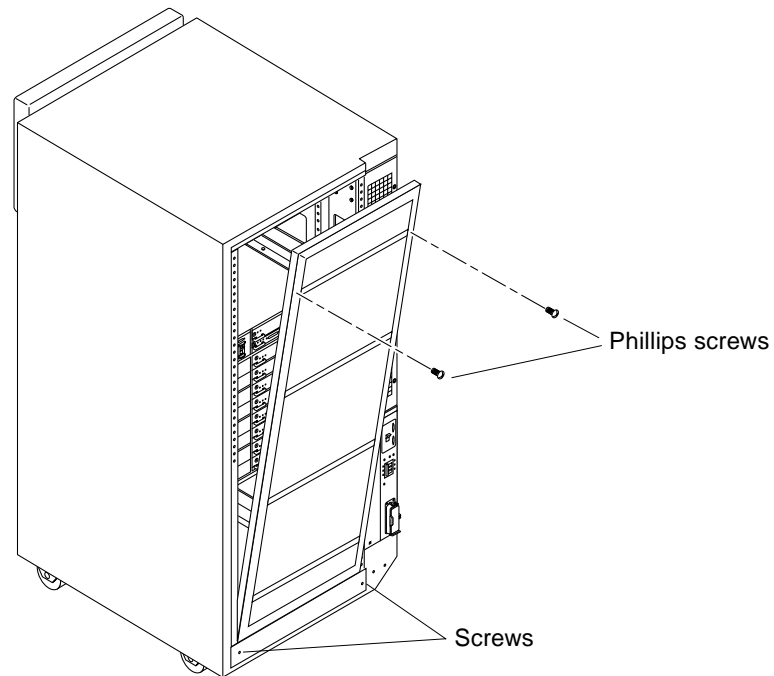



Figure 12-5 Rear Screen and Kick Panel

- 3. Disconnect each cable from the I/O boards carefully.**
Squeeze the locking tabs on the sides of the connector body, or loosen any retaining screws (if provided), and pull the connectors out.
- 4. Mark each cable for identification as you remove it.**
- 5. Remove any cable restraints.**
- 6. Clear the cables away from the server.**

12.3 Restarting the System

Note – As the system starts up, watch for error messages from the POST diagnostic program. If a terminal is not already part of the system, install a TTY terminal before continuing the startup. See Section 9.1, “Using a Terminal,” on page 9-1 for terminal settings.

1. The system key switch must be turned to  (the standby position).

See Figure 12-1 or Figure 12-3.



Caution – The outlet must be a 120-240 VAC 30-ampere circuit, intended solely for use by the server cabinet, as described in the site preparation instructions in the *Ultra Enterprise 6000/5000/4000 Systems Installation Guide*. The electrical receptacle must be grounded, and the grounding conductor serving this receptacle must be connected to the earth ground at the service equipment.

2. Enterprise 6000/5000 systems only: turn the Local/Remote switch down, to Local.


See Figure 12-6.

3. Turn on the AC power sequencer power switch.

See Figure 12-2 or Figure 12-4.

4. Turn on power to the terminal.

A terminal is required for viewing system messages. For setup instructions, see Section 9.1, “Using a Terminal,” on page 9-1.

5. Turn the key switch to  (the power on position).

See Figure 12-1 or Figure 12-3.

Several things will happen:

- The left front panel LED (green) turns on immediately to indicate the DC power supply is functioning.
- The middle front panel LED (yellow) lights immediately and should turn off after approximately 60 seconds.
- The right front panel LED (green) flashes after POST has ended to show that booting is successful and the operating system is running.
- The terminal screen lights up upon completion of the internal self test.

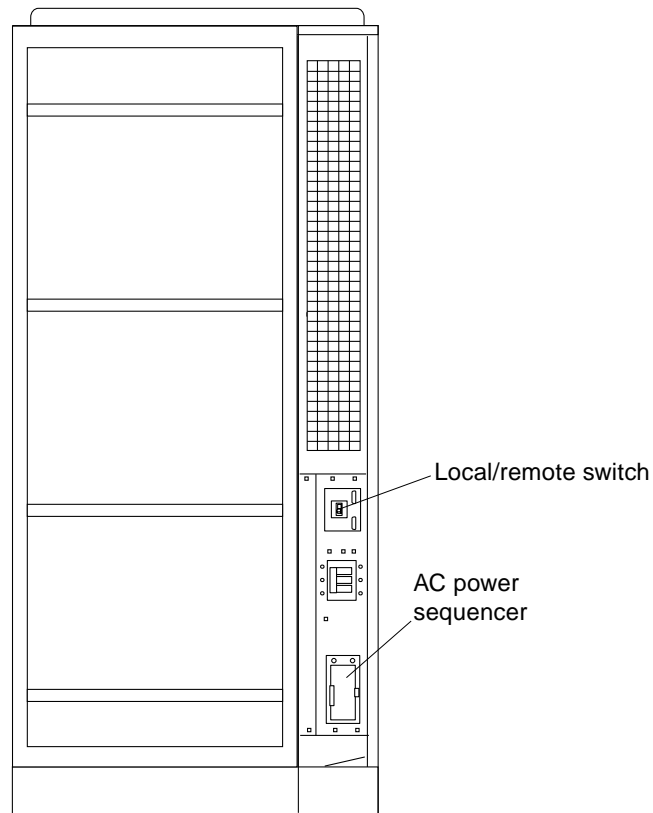


Figure 12-6 Local/Remote Switch



Warning – Never move the server or the expansion cabinets when system power is on. Excessive movement can cause catastrophic disk drive failure. Always power the system OFF before moving cabinets.

6. Watch the terminal screen for any POST error messages.

At the conclusion of testing, POST automatically configures the system, omitting any devices that have failed diagnostics. After POST ends, the system will boot using the new configuration.

Note – If the middle front panel LED (yellow) remains lit after the system has booted, the system has failed POST.

Note – POST does not test drives or internal parts of SBus cards. To test these devices, run OBP diagnostics manually after the system has booted. Refer to the *OpenBoot Command Reference* manual for instructions.

7. To start POST again, or if the system hangs, press the CPU reset switch on the clock board.

See Figure 12-7.

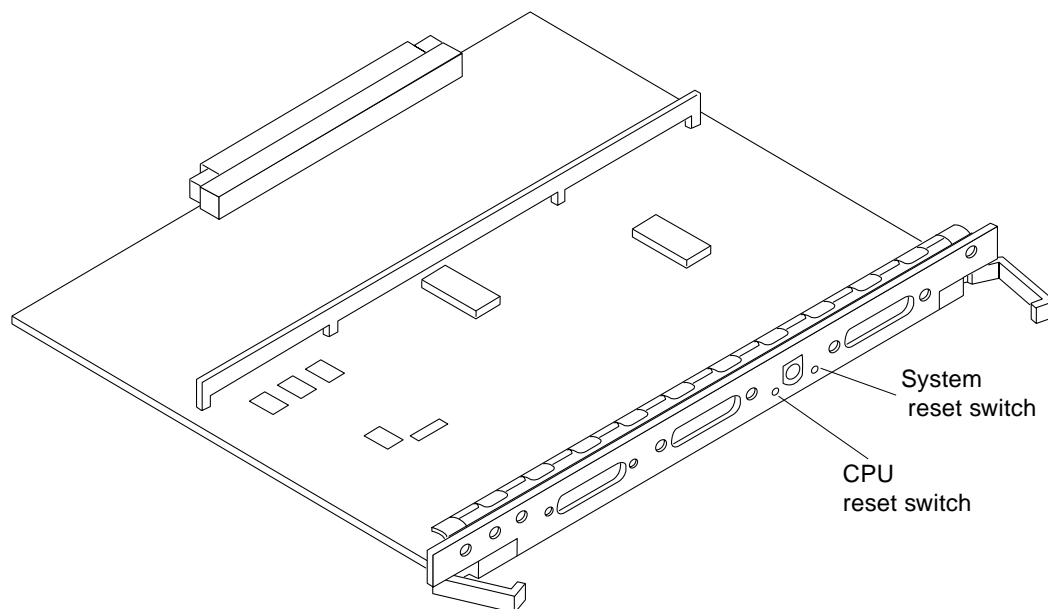


Figure 12-7 CPU Reset Switch on Clock Board

8. If the system displays “not responding” or “no carrier” messages, the Link Integrity Test may be set incorrectly. See “Link Integrity Test” on page 4-24.

12.4 Reading Boot Messages

- ◆ Use the boot software messages to verify the presence of options in the system. After POST completes the system self-test, a message similar to the following will appear on your screen. The message lists hardware detected in the system.

Note – The following screen display is only an example. The actual message displayed on the screen will vary with the software running on the system.

```
16-slot Ultra Enterprise 6000, Keyboard Present
OpenBoot -. FCS, --- MB memory installed, Serial #---.
Ethernet address -:-:---:--:---:---, Host ID: -----.
```

If there is no terminal on this system, you must check the system status by inspecting LEDs on the front panel. See Figure 12-8 and Figure 12-9.

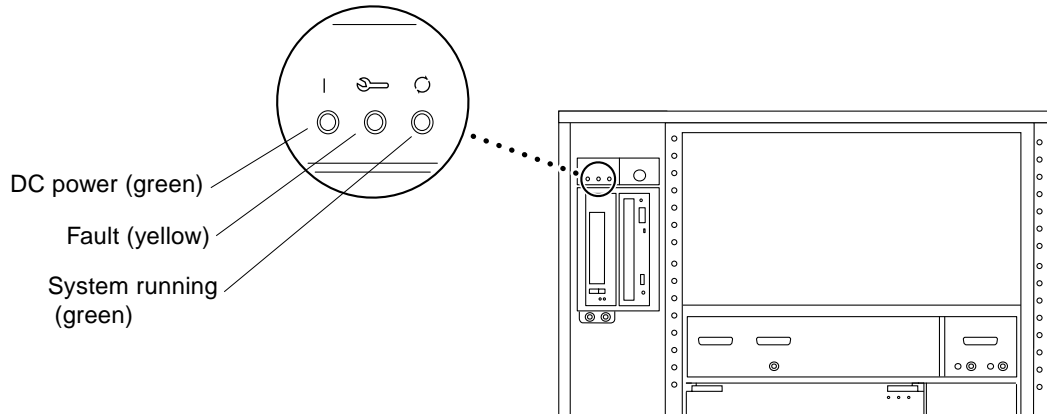


Figure 12-8 Front Panel Status LEDs (Cabinet Server)

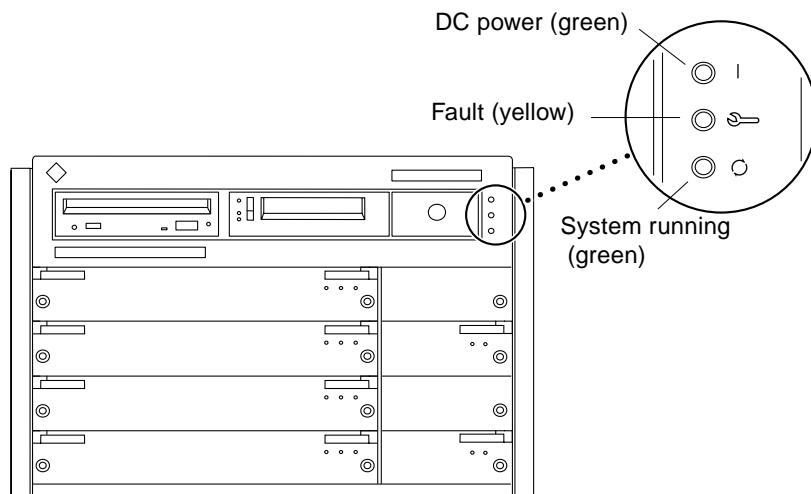


Figure 12-9 Front Panel Status LEDs (Standalone Server)

Table 12-1 summarizes the front panel LED status conditions during and after POST.

Table 12-1 LED Status Indicators

Location	LED	Condition
Front panel	Left/Top LED (green)	On — DC power supply is receiving AC current. Off — There is no DC power.
	Middle LED (yellow)	On flashing— (first 60 seconds) Self tests are running. Off — (after self tests end) No hardware failures. On — (after self tests end) Hardware failure was detected.
	Right/Bottom LED (green)	Off — (first 60 seconds) Self tests are running. On flashing— (after self tests end) System is running. Off — (after self tests end) System cannot run; repair is needed.

Preparing for Service

This chapter contains information about preparing the system for service after the system has been powered off.

<i>Servicing Hot-Pluggable Components</i>	<i>page 12-1</i>
<i>Powering Off the System</i>	<i>page 12-1</i>
<i>Internal Access - Enterprise 6000/5000 Systems</i>	<i>page 12-2</i>
<i>Internal Access - Enterprise 4000 System</i>	<i>page 12-12</i>
<i>Powering On the System</i>	<i>page 12-7</i>

12.1 Servicing Hot-Pluggable Components

Hot-pluggable components can be removed and replaced without powering off the system. For information about disconnecting and connecting hot-pluggable components that require service, see Section 3.3, “Hot-Plug Feature,” on page 3-4.

12.2 Powering Off the System

See Section 12.1, “Powering Off the System,” on page 12-1.

12.3 Internal Access - Enterprise 6000/5000 Systems

The Enterprise 6000/5000 system cabinet panels, shown in Figure 12-1 through Figure 12-7, consist of the following:

- CD/Tape device door
- Top bezel
- Front panels - hinged door consisting of three vented panels
- Rear screen panel
- Two side panels
- Fan tray screen cover
- Kick panel
- Stabilizer bar

12.3.1 Outer Cover Reference Guide

Use Table 12-1 as a guide to determine which panels to remove to access replaceable parts for the Enterprise cabinet systems.

Table 12-1 Cover Removal by Assembly

	CD/Tape Device Door	Top Bezel	Front Hinged Door (3 Vented Panels)	Rear Screen	Left Side Panel	Right Side Panel	Kick Panel	Fan Tray Screen Cover
SCSI Compartment	X							
Tape Tray or Tape Library		X						
Fan Tray								X
Control Board			X					
Centerplane		X	X	X				
AC power sequencer							X	
External Cables				X			X	
CPU/Memory Board (Front load)			X					
I/O or Disk Boards (Rear load)				X				
Differential SCSI Trays			X	X				

12.3.2 CD-ROM/Tape Device Door

The small door to the left of the top panel can contain a CD-ROM drive and/or a tape drive.

To open the door:

- ◆ **Push on the top right corner of the door. The clasp will release and the door will spring open.**

To close the door:

- ◆ **Press gently to engage the clasp.**

12.3.3 Top Front Bezel

The top front bezel is retained by chassis-mounted ball studs that mate with catches on the panel backside.



Caution - To prevent breakage, do not grasp the bezel by the bottom edge.

To remove the bezel:

- 1. Grasp the bezel on both sides at the top and pull out far enough to just disengage the ball studs.**
See Figure 12-1.
- 2. Remove the bezel. Set the bezel aside.**

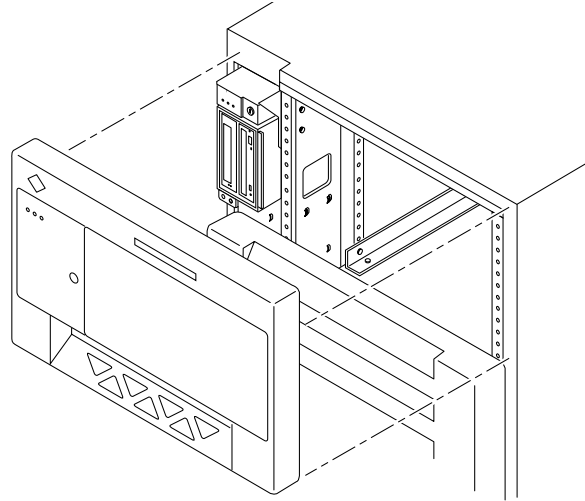


Figure 12-1 Removing the Front Bezel

To replace the bezel:

- ◆ **Place the bezel against the chassis with ball studs aligned with the catches on the bezel, and tap or press both sides of the bezel into place.**

12.3.4 Front Panels Hinged Door

To open the hinged door:

- 1. Grasp the door handle (purple extruded strip on vent edge) on the right side of the first panel, and firmly pull toward you.**

See Figure 12-2.

The door, which consists of three panels, is secured closed by clips and ball-studs at the side opposite of the hinge. The door is released and swings open if pulled firmly.

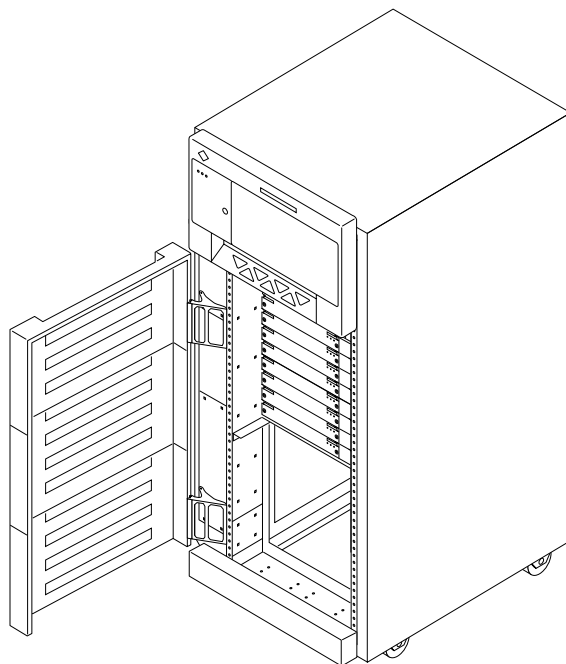


Figure 12-2 Opening the Three-panel Hinged Door

To remove the hinged door:

- 1. Remove the top bezel. See Section 12.3.3, “Top Front Bezel.”**
The top bezel must be removed to provide clearance.
- 2. Open the three-panel hinged door wide, past the bracket, and lift it free of the bracket. Set the door aside.**

12.3.5 Rear Screen Panel

To remove the rear screen panel:

1. **Remove the two #10 Phillips screws securing the panel to the frame.**
See Figure 12-3.
2. **Tilt the panel top out and lift it free of the chassis. Set the panel aside.**
There is a flange on the bottom of the rear screen.

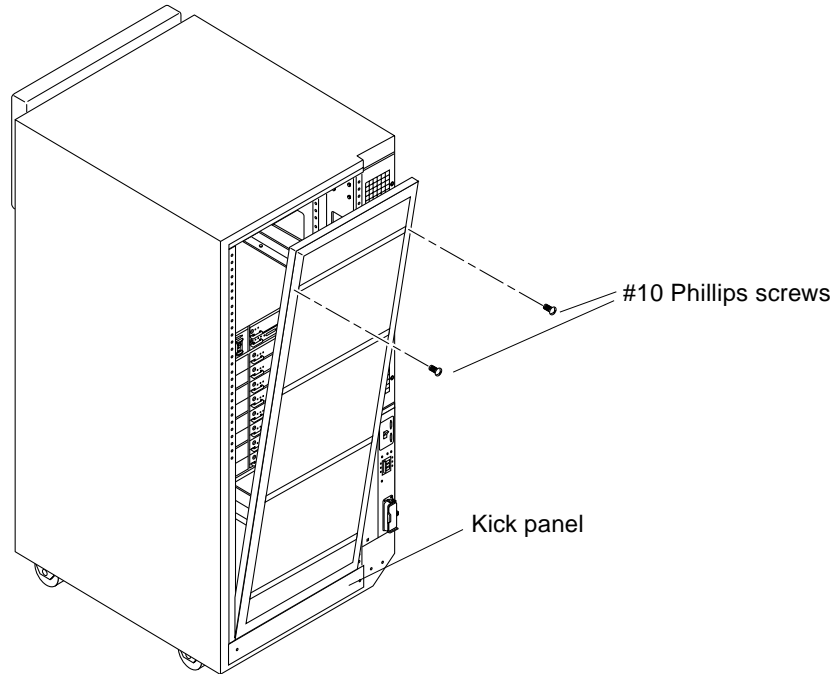


Figure 12-3 Removing the Rear Screen Panel

Note – If your cabinet has a hinged rear door, remove the pins from the hinges and lift the door free of the chassis. Reverse this procedure to replace the door.

To replace the rear screen panel:

1. **Insert the panel so the bottom flange engages behind the top of the kick panel.**
2. **Tilt the panel flush against the frame and secure using Phillips screws.**

12.3.6 Side Panels

To remove the left and right side panels:

- 1. Loosen two slot-head captive screws near the panel base.**
- 2. Tilt the panel bottom out.**
- 3. Lift the panel up until free of the tabs at the top of the chassis.**
Set the panel aside.

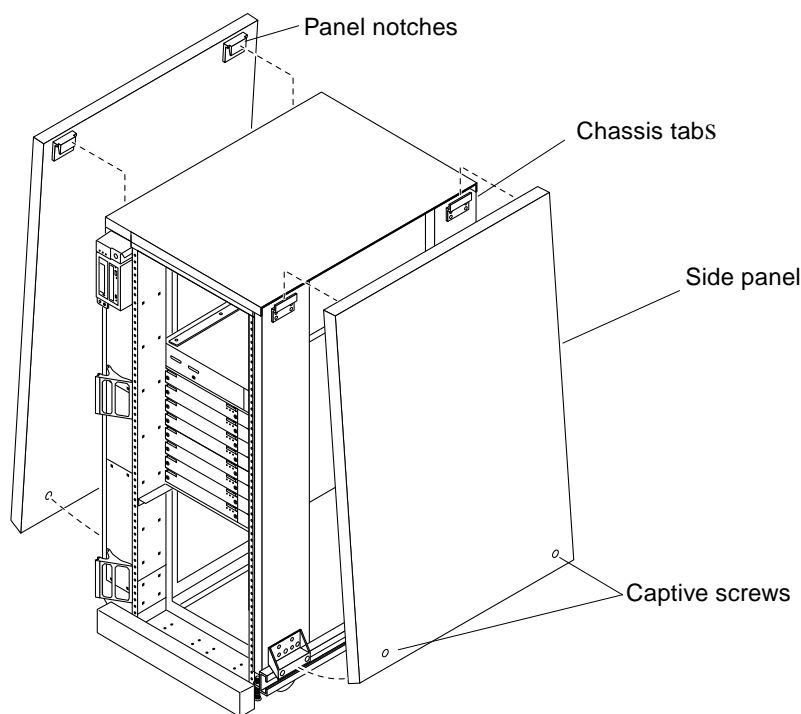


Figure 12-4 Removing the Side Panels

To replace the side panels:

- 1. Place the panel against the cabinet so the notches on the panel inside align with tabs at the chassis top.**
- 2. Lower the panel into place and allow it to hang flush against the chassis.**
- 3. Tighten the two captive screws at the panel base.**

12.3.7 Fan Tray

To remove the screen protecting the fan tray cables:

1. Loosen the top screw on the left and the three screws on the right.

It is not necessary to remove these four screws since the screen has slotted screw holes.

2. Remove the two bottom screws on the left.

Removing these screws will ensure adequate clearance.
See Figure 12-5.

3. Lift the screen up until the slotted screw holes clear the screw heads.

Lift out the screen and set it aside.

To replace the fan tray screen cover, reverse these instructions.

To remove the fan tray:

1. Loosen the two captive fasteners at the top and bottom of the tray.

2. Pull the fan tray back, tilting the top out so that it clears the chassis.

Lift the fan tray out.

3. Remove the power cable and fan fail cable.

To keep the cables out of the way, feed them down through the opening below the fan tray area.

To replace the fan tray, reverse these instructions.

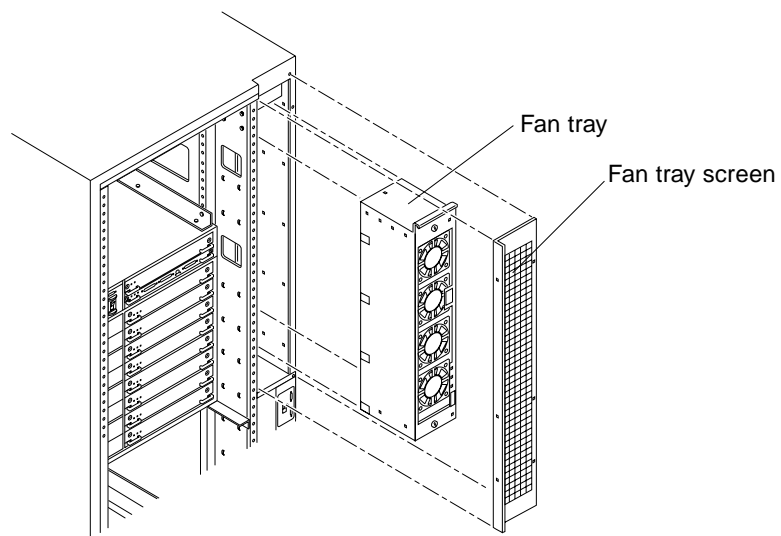


Figure 12-5 Removing the Fan Tray Screen and Fan Tray

12.3.8 Kick Panel

To remove the kick panel:

1. **Loosen the two screws.**
See Figure 12-6.

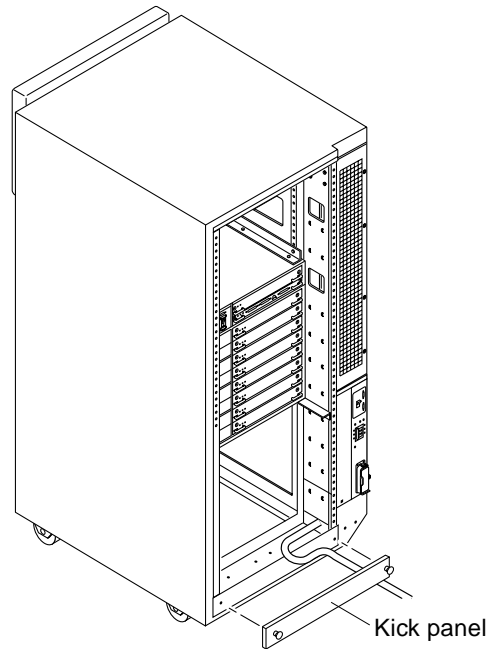


Figure 12-6 Removing the Kick Panel

To replace the kick panel:

1. **Arrange cables (if applicable) neatly behind the kick panel, then fasten the two screws to secure the panel in place.**

12.3.9 Stabilizer Bar



Warning – Always extend the stabilizer bar before pulling the disk drive trays out for servicing.

The cabinet has six levelling pads. Four pads on the cabinet frame are lowered to touch the floor and prevent the cabinet from rocking. Two levelling pads are part of the stabilizer bar and should not touch the floor.

1. Extend the stabilizer bar fully from the bottom of the cabinet.

See Figure 12-7.

2. Screw the two stabilizer bar levelling pads down until they are $\frac{1}{8}$ - to $\frac{1}{4}$ -inch (3 to 6 mm) above the floor.

Ensure both pads are at equal heights. This clearance allows the stabilizer bar to slide in and out easily, yet catch the cabinet if it should begin to tilt.

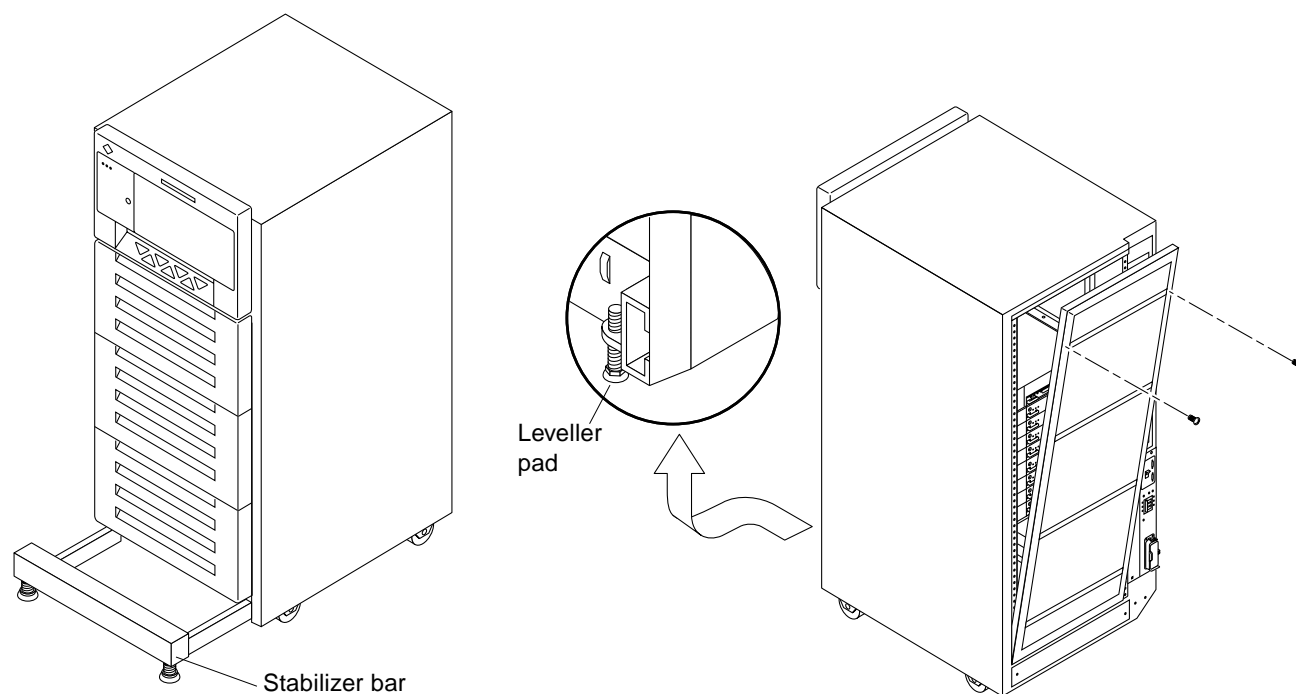


Figure 12-7 Stabilizer Bar and Levelling Pads

12.4 Internal Access - Enterprise 4000 System

The Enterprise 4000 system has a top bezel that must be removed to access the SCSI tray and the keyswitch tray.

12.4.1 Top Bezel

To remove the top bezel:

- 1. Grasp the bottom corners of both sides of the top bezel and pull it toward you.**
Apply inward pressure to release the snap locks on each side.
- 2. Tilt the top bezel upward to a 45° angle and remove the bezel.**
Set the bezel aside. See Figure 12-8.

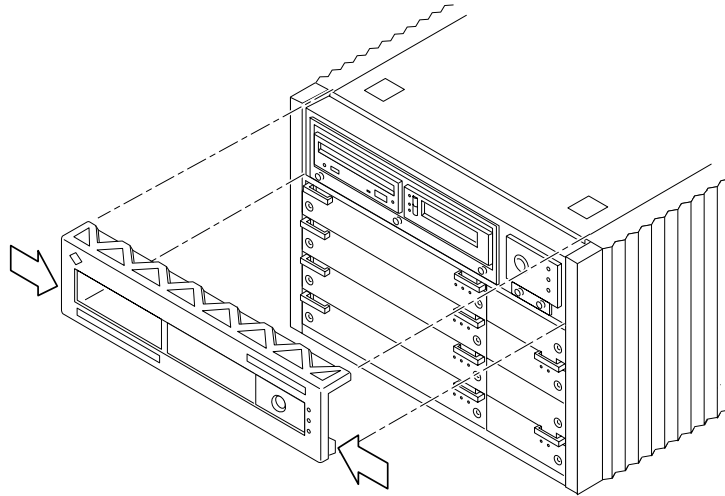


Figure 12-8 Removing the Top Bezel/Panel

To replace the top bezel, reverse these instructions.

12.4.2 SCSI Tray

To remove the SCSI tray:

- 1. Remove the top bezel.**
- 2. Loosen the three captive screws that hold the tray in place.**
Insert a screwdriver in the notch at the top center of the SCSI tray to pull out the SCSI tray. See Figure 12-9.
- 3. Remove the seven screws on top of the SCSI tray to lift off the tray cover to access CD and tape drives.**
See Figure 12-9.

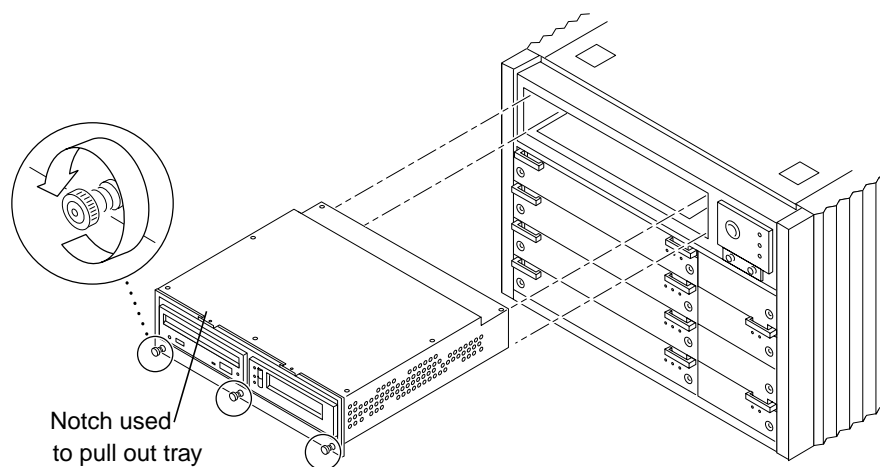


Figure 12-9 Removing the SCSI Tray

To replace the SCSI tray, reverse these procedures.

12.5 Powering On the System

See Section 12.3, “Restarting the System,” to power-on after all panels have been replaced.

Part 5— Appendixes

Appendix A, Specifications	page A-1
Appendix B, Functional Description	page B-1
Appendix C, SCSI Devices	page C-1
Appendix D, General Rules for System Configuration	page D-1
Appendix E, Chassis Field Replaceable Units (FRUs)	page E-1
Appendix F, Illustrated Parts Breakdown (IPB)	page F-1
Appendix G, Connectors	page G-1



Specifications



A.1 Physical Specifications

Table A-1 Cabinet Server Physical Specifications

	U.S.	Metric
Height	56 in	143 cm
Width	30 in	77 cm
Depth	39 in	99 cm
Weight	800 lb, approx	360 kg, approx
Power cord	15 ft	4.6 m

Table A-2 Cabinet Server Clearance and Service Access

	U.S.	Metric
Front	48 in	122 cm
Rear	36 in	92 cm
Left	2 in	5 cm
Right	2 in	5 cm

Table A-3 Cabinet Server Shipping Specifications

	U.S.	Metric
Height	62.0 in	157 cm
Width	39 in	99 cm
Depth	44.5 in	113 cm
Weight	875 lb, approx	400 kg, approx

Table A-4 Standalone Server Physical Specifications

	U.S.	Metric
Height	13.5 in	34 cm
Width	19.7 in	50 cm
Depth	22 in	56 cm
Weight	150 lb, approx	68 kg, approx
Power cord	6 ft	1.8 m

Table A-5 Standalone Server Clearance and Service Access

	U.S.	Metric
Front	18 in	47 cm
Rear	18 in	47 cm
Left	6 in*	16 cm*
Right	6 in*	16 cm*

***Although 6 in (16 cm) clearance is sufficient to prevent blocking the in and out airflow of a single system, to avoid exhaust air recirculation, a minimum space of 36 in (92 cm) is recommended between systems sitting side by side.**

Table A-6 Standalone Server Shipping Specifications

	U.S.	Metric
Height	19.0 in	48 cm
Width	23.8 in	60 cm
Depth	26.8 in	68 cm
Weight	160 lb, approx	72 kg, approx

A.2 *Electrical Specifications*

Table A-7 Cabinet Server Electrical Specifications

Parameter		Value
Input current	Voltage range	200-240 Vac
	Current, maximum	24A
	Current frequency range	47-63 Hz
Input power rating	Total continuous power	3500W (with 3 drive trays)
Volt-Ampere rating		3700 VA
BTU rating		12,000 BTU
Power factor		0.92 - 0.96
Plug type	U.S.	NEMA L6-30P for 200-240 Vac
	International	32A, single phase IEC 309, connected for 220-240 Vac

Table A-8 Standalone Server Electrical Specifications

Parameter		Value
Input current	Voltage range	100-120 Vac or 200-240 Vac
	Current, maximum	12A
	Current frequency range	47-63 Hz
Input power rating	Total continuous power	1370W
Volt-Ampere rating		1440 VA

Table A-8 Standalone Server Electrical Specifications (Continued)

Parameter	Value
BTU rating	4680 BTU
Power factor	0.92 - 0.96
Plug type	U.S. NEMA 5-15P
	International 10A, single phase IEC 320, connected for 220-240 Vac

A.3 Environmental Requirements

Table A-9 Cabinet Server Temperature, Humidity, and Altitude Limits

	Operating	Nonoperating
Temperature	41 [°] F to 95 [°] F (5 [°] C to 35 [°] C)*	-4 [°] F to 140 [°] F (-20 [°] C to 60 [°] C)
Humidity	20% to 80% RH noncondensing, 27C max wb	93% RH
Altitude	9,843 ft (3 km)	39,370 ft (12 km)

*Maximum operating temperature is 95[°]F (35[°]C) when using tape media.

Table A-10 Standalone Server Temperature, Humidity, and Altitude Limits

	Operating	Nonoperating
Temperature	41 [°] F to 104 [°] F (5 [°] C to 40 [°] C)*	-4 [°] F to 140 [°] F (-20 [°] C to 60 [°] C)
Humidity	20% to 80% RH noncondensing, 27C max wb	93% RH
Altitude	9,843 ft (3 km)	39,370 ft (12 km)

*Maximum operating temperature is 95[°]F (35[°]C) when using tape media.

Functional Description



B.1 System Overview

The 16-slot and 8-slot Enterprise 6000 and 5000 cabinet servers, and the 8-slot Enterprise 4000 standalone server, all use variations of the same general card cage design. All systems feature shared-memory multiprocessors and use the same boards, power/cooling modules (PCMs), and operating software.

B.1.1 Board Types

All systems use the same board types, with the exception of load boards and filler panels.

1. The CPU/Memory board supports up to two UltraSPARC modules and 16 SIMM slots.
2. The SBus I/O board includes two separate SBuses, each controlled by a separate ASIC. The board provides a total of three SBus slots for plug-in cards, two slots for fiber interface modules. The remaining slots are used for onboard devices.
3. The Graphics I/O board provides an SBus with two SBus slots and several onboard devices. This board also has a specialized slot for devices such as the graphics (UPA) card, a high performance frame buffer.
4. In the Enterprise 6000 system, empty board slots require load boards (part number 501-3142) to reduce the possibility of RFI generation. The Enterprise 5000 and 4000 systems use filler panels (part number 540-2592).

Enterprise card cages feature a high-speed (2.6 Gbyte per second) centerplane bus. Boards at the front of the centerplane must be installed component side down, while boards at the back must be installed component side up. The boards are oriented this way to allow for minimum signal trace lengths and optimum system performance.

Figure B-1 illustrates the logical organization of Enterprise systems.

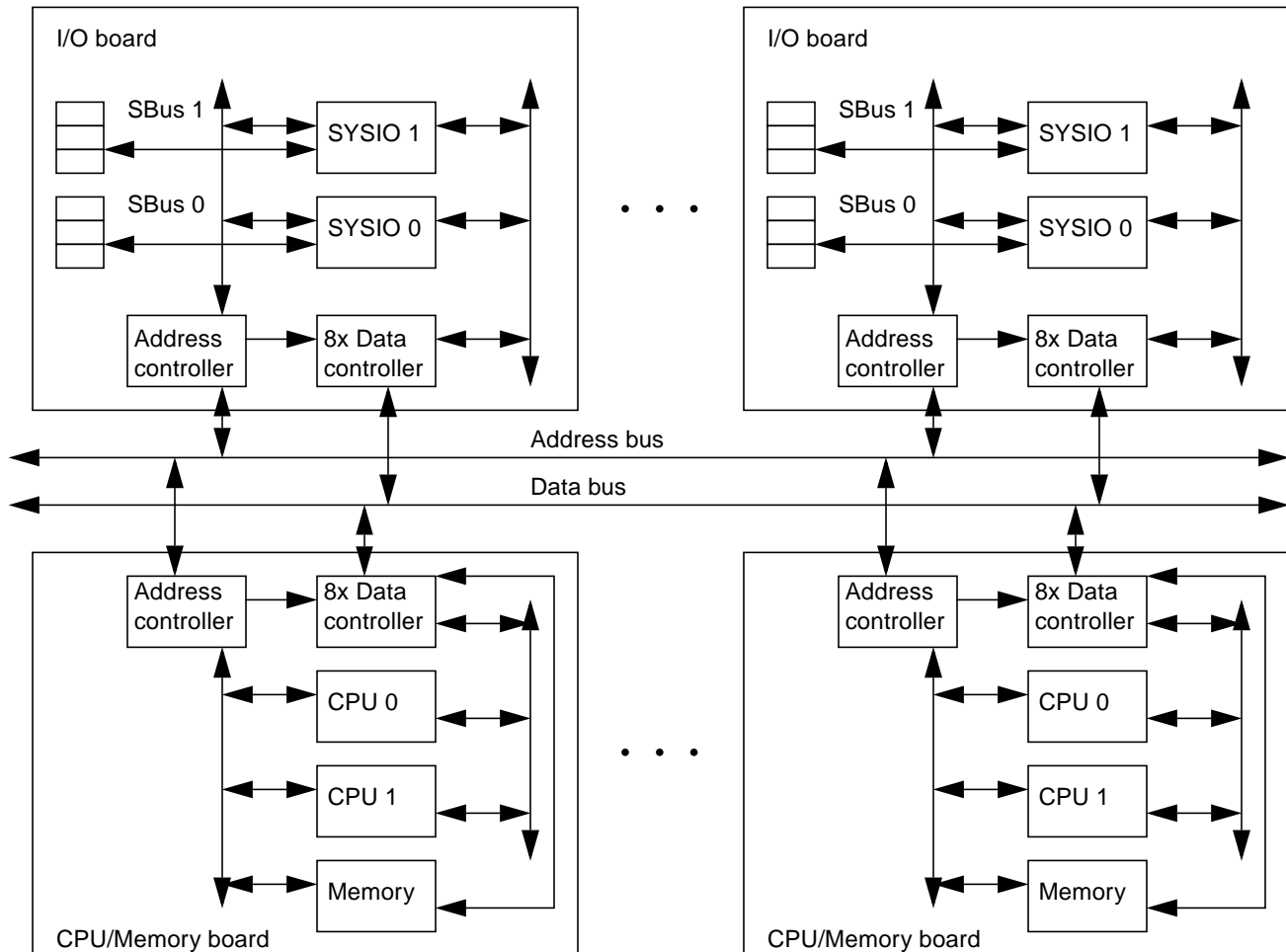


Figure B-1 Enterprise System Logical Organization

There are few differences between board slots and each slot can accept any board type. However, slot 1 connects directly to the internal SCSI tray through the centerplane and related cables. The internal tape and/or CD-ROM or other optional internal SCSI drives cannot be used unless an I/O board is present in slot 1.

Although the remaining slots are equivalent, I/O boards should be located on the back side of the centerplane for easy access to interface cables at the rear of the cabinet.

B.2 System Packaging

This section describes the features of the system enclosures.

B.2.1 Enterprise 6000 Server

The Enterprise 6000 server features a 16-slot card cage in a 56-inch data center system cabinet. See Figure B-2.

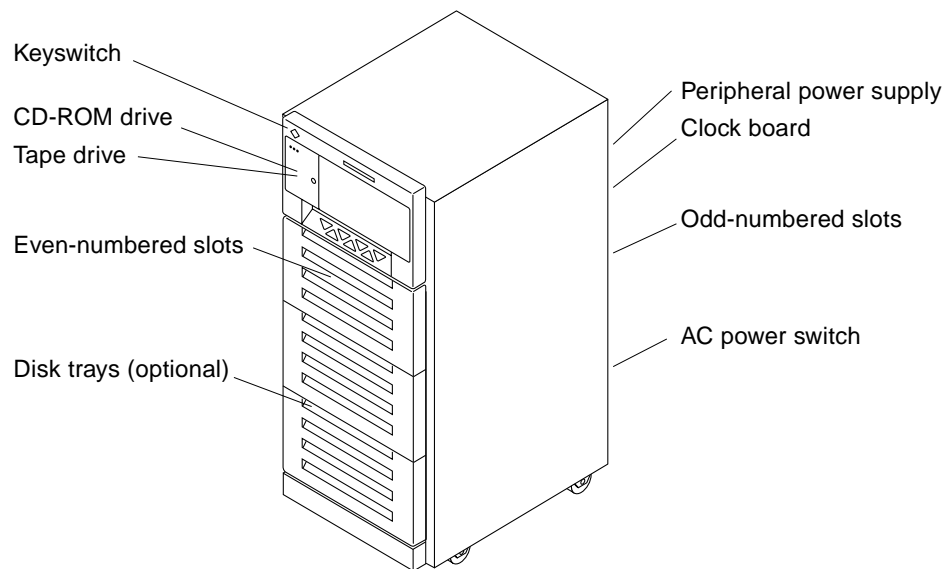


Figure B-2 Ultra Enterprise System Cabinet

The front of the cabinet contains the CD-ROM/tape tray, the keyswitch, the even-numbered board slots, and the even-numbered power/cooling module (PCM) slots.

The rear of the cabinet contains the AC power switch, the peripheral power supply, the clock board, the odd-numbered board slots, and the odd-numbered PCM slots.

For slot numbers in the 16-slot card cage, see Figure 3-6.

Air circulation is provided by the power/cooling modules. The PCMs (PCM 0 through PCM 7) have two fans each. The fans provide cooling for the PCM, plus two adjacent board slots.

All empty board slots must be blocked by load boards for proper airflow, cooling, and EMI protection. Other types of empty slots must be blocked by filler panels.

B.2.2 Enterprise 5000 Server

The Enterprise 5000 server is similar to the Enterprise 6000 system but features a shorter, 8-slot, card cage. See Figure B-2 on page B-3.

For slot numbers in the 8-slot card cage, see Figure B-3.

Functionally, the 16-slot and 8-slot cabinet servers are the same, with the only difference being the board capacity and amount of internal space available below the card cage. All boards are interchangeable between the two versions.

All empty slots must be blocked by filler panels for proper airflow, cooling, and EMI protection.

Note – The load board that is required for the 16-slot Enterprise 6000 server is not required for the Enterprise 5000.

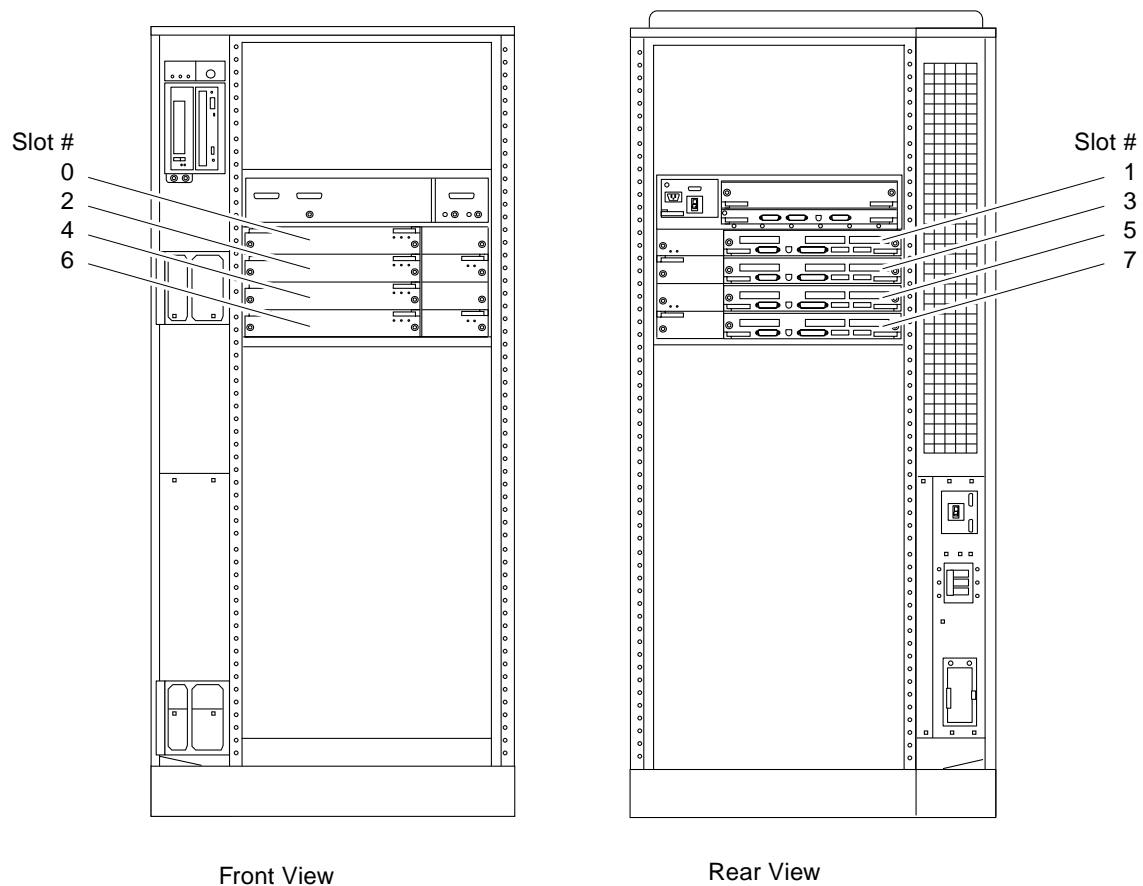


Figure B-3 Enterprise 5000 Server

B.2.3 Enterprise 4000 Standalone Server

The Enterprise 4000 server uses the 8-slot card cage that is used for the Enterprise 5000, but the card cage is in a standalone cabinet. See Figure B-4.

Also note that several areas of the card cage that are covered by filler panels in the cabinet version are used in the standalone version. These areas include the SCSI CD-ROM/tape tray, keyswitch, and AC switch. See Figure B-4.

The power/cooling modules (PCM 0 through PCM 3) each have two fans. The fans provide cooling for the PCM and the two adjacent board slots.

All empty slots must be blocked by filler panels for proper airflow, cooling, and EMI protection.

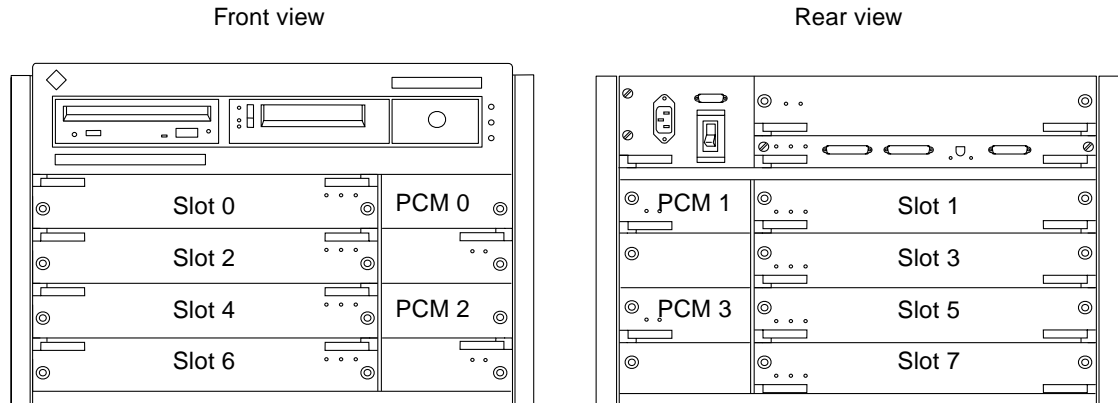


Figure B-4 Enterprise 4000 Standalone Server

B.3 Software

The Enterprise software includes two diagnostic packages, Solstice SyMON and SunVTS. Refer to the online manuals for operating instructions.

B.4 Board Hot-Plug Procedures

The CPU/Memory board and the I/O board are hot-pluggable under certain conditions. If the operating system detects a hardware failure in the board, the system powers down the corresponding board slot and turns off the left green status LED on the board. (See Table 9-2 for LED codes.)

When the left green LED is off, it is safe to remove the board even though the system continues running.

B.5 CPU/Memory Board

The CPU/Memory board supports up to 2 CPU modules and 16 SIMMs. The CPU/Memory board is shown in Figure B-5.

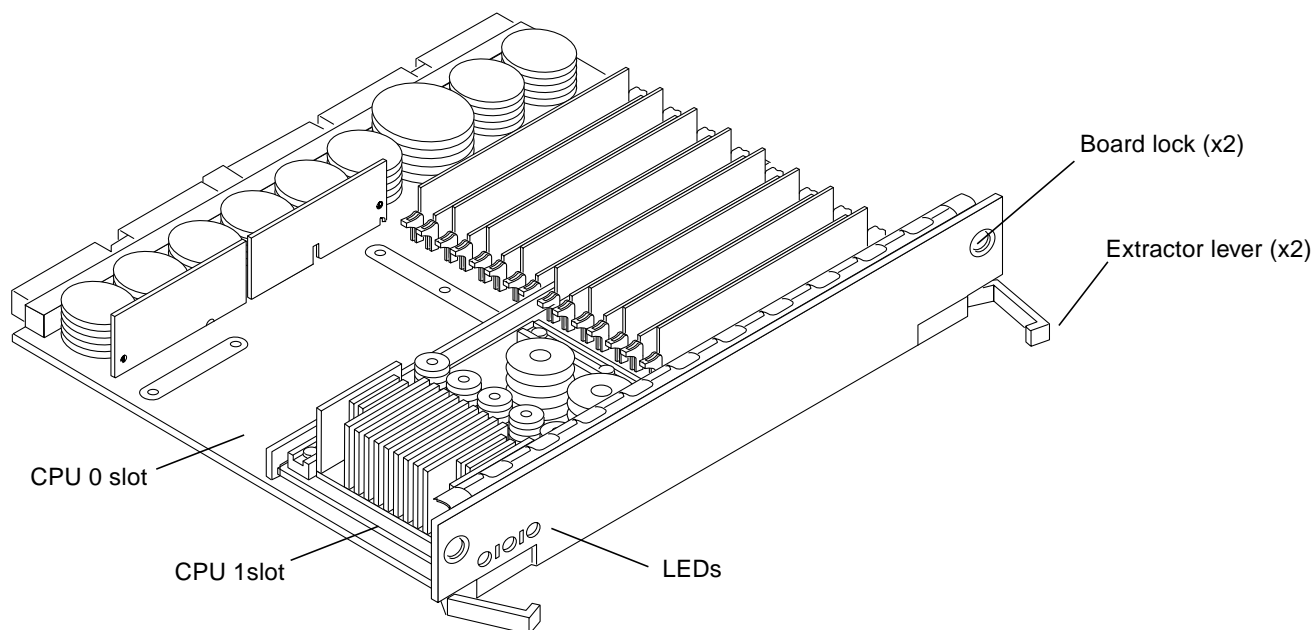


Figure B-5 CPU/Memory Board

The CPU/Memory board should be installed from the smallest even-numbered slot (0) to the largest even-numbered slot (14). The even-numbered slots are located at the front of the cabinet. When located in these slots, the component side of the board is down. If the front slots are filled, you can use slots at the rear of the cabinet, with the exception of slot 1. Slot 1 requires an I/O board because the slot connects to the SCSI tray in the front of the cabinet.

All empty slots must have a filler panel or load board installed.

Note - The 16-slot Enterprise 6000 card cage requires load boards to reduce the potential for RFI generation. The 8-slot Enterprise 5000 and 4000 card cages use filler panels, which do not have load circuits.

B.5.1 CPU Modules

Each CPU/Memory board has two sets of CPU connectors, marked “PROC 0” and “PROC 1”.

B.5.2 System Master Board

A system master board is temporarily selected for some POST tests, primarily to test I/O boards. The system master is normally the lowest-numbered slot containing a board with a functional CPU. There is no system master during normal system operation.

B.5.3 SIMMs

B.5.3.1 Slot Locations

The CPU/Memory board has 16 slots for SIMMs. SIMMs must be installed in full banks of 8. Figure B-6 shows the slots by bank and connector number.

Key: B0 = bank 0, B1 = bank 1

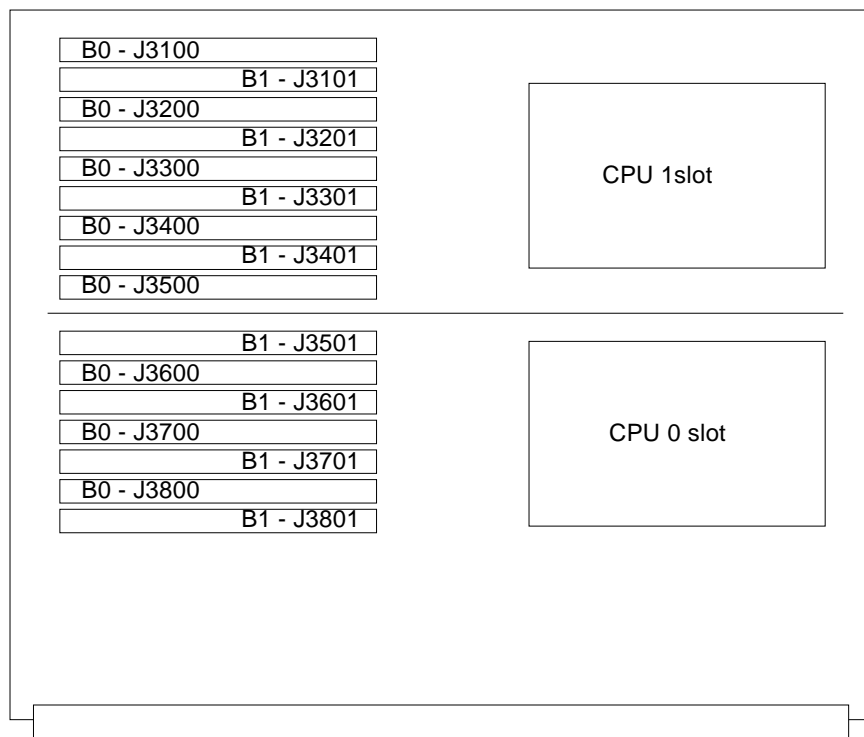


Figure B-6 SIMM Slot Locations

B.5.3.2 SIMM Selection

SIMMs are available in 8, 32, or 128 Mbyte capacities. All are 168-pin SIMMs. Do not mix different capacities in a bank.



Caution – The Enterprise systems SIMMs operate at 3.3V — do not substitute other voltage ratings.

B.6 I/O Boards

There are several types of I/O boards.

The **SBus I/O board** includes two ASICs. Each ASIC provides two SBuses. Three SBus slots are available on this board for plug-in boards. The remaining SBus slots are used for onboard devices such as 10/100 Mbit/second twisted-pair Ethernet, Fast/Wide SCSI, and Fiber Channel interfaces. See Figure B-7.

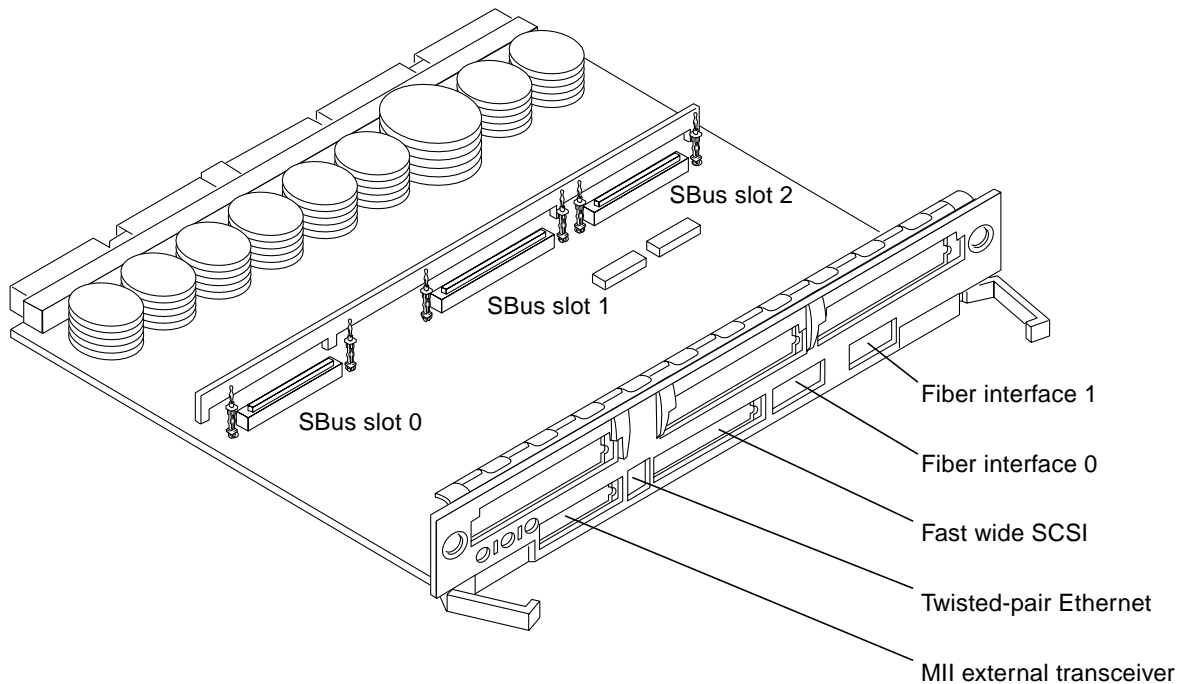


Figure B-7 SBus I/O Board

The **Graphics I/O board** includes one UPA-64 Slave Frame Buffer and one SYSIO ASIC that provides one SBus for two SBus slots for two plug-in cards. The remaining SBus slots are used for onboard devices such as 10/100 Mbyte/second twisted-pair Ethernet, Fast/Wide SCSI, and Fibre Channel interfaces. See Figure B-8.

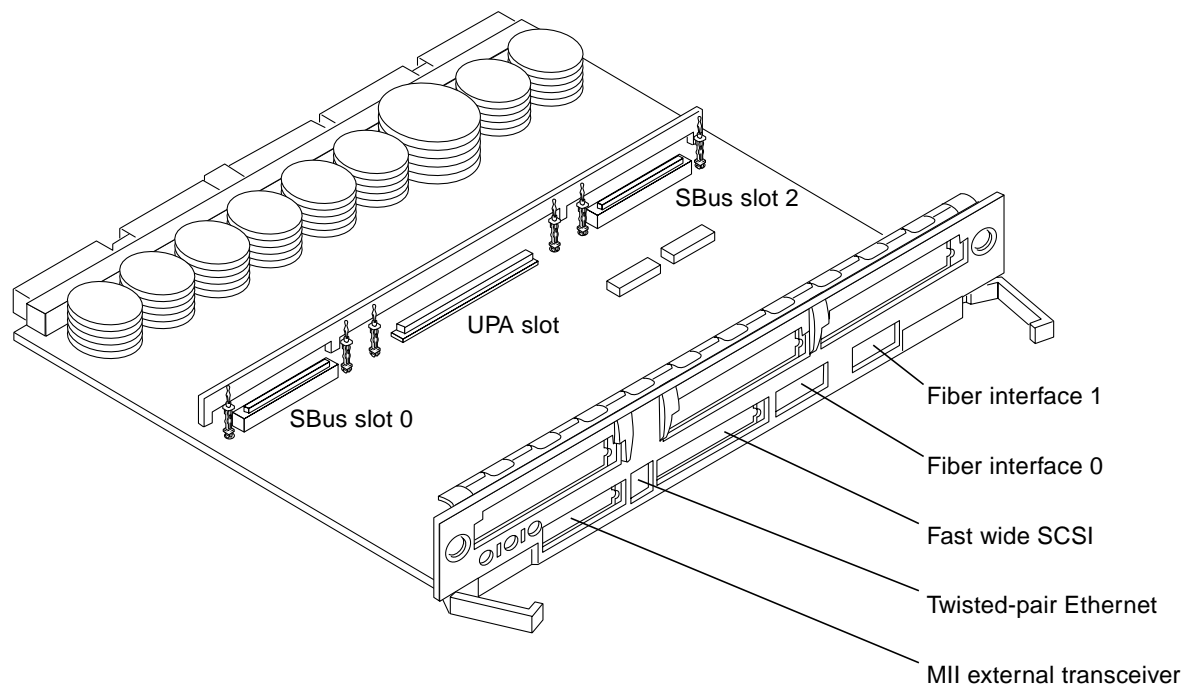


Figure B-8 Graphics I/O Board

Note – Slot 1 requires an SBus I/O board or Graphics I/O board because slot 1 connects with the internal SCSI tray. If slot 1 does not contain an I/O board, the drives in the SCSI tray will not function.

For easy access to I/O cables, I/O boards should be installed in the rear of the cabinet, with CPU/Memory boards in the front of the cabinet. I/O boards should be installed from the smallest odd-numbered slot (1) to the largest odd-numbered slot (7 or 15). The odd-numbered slots are located at the rear of the cabinet. When located in these slots, the board is oriented so that the component side is up.

If the rear slots are filled, you can use slots at the front of the cabinet. When located in a front slot, the board is oriented so that the component side is down.

Note – All empty card cage slots must contain a load board (Enterprise 6000 server) or filler panel (Enterprise 5000 or 4000 servers).

B.7 Network Interfaces

Each SBus I/O board and Graphics I/O board has onboard connectors for 10BASE-T or 100BASE-T Ethernet. The two sockets (RJ-45 and 40-pin MII) connect to the same interface circuit, so that only one socket is active at any time.

Additional network interfaces can be added in the form of SBus cards. The SBus I/O board will support up to three SBus interface cards. The Graphics I/O board will support up to two SBus interface cards.

B.8 Disk Board

The Disk board (with two SCSI disks) is an available option for the Enterprise systems. The Enterprise 6000 system supports two Disk boards (*only* in slots 14 and 15); the Enterprise 5000 and 4000 systems support four Disk boards.

The ID settings of the two disks on the Disk board vary according to the card cage slot location. See Appendix C, “SCSI Devices.”

B.9 Power Supplies

There are two types of power supplies in the Enterprise 6000, 5000, and 4000 systems. The power/cooling modules (PCMs) provide DC current and cooling air to boards in the card cage.

The peripheral power supply provides current for peripheral devices (such as a tape or CD-ROM drive) in the SCSI tray.

B.9.1 Power/Cooling Modules (PCMs)

The DC power to the centerplane is supplied by one or more PCMs. Each PCM also provides cooling air for two board slots. If a slot contains a board, the adjacent PCM slot must contain a PCM to supply cooling air.

Current from individual PCMs is shared on the centerplane.

With automatic system reconfiguration (ASR), a PCM can be taken offline and replaced without halting the system. There are two restrictions:

1. The remaining power/cooling modules must provide sufficient electrical power. As a general rule, the number of boards must be less than half the number of PCMs.
2. The PCM should be replaced quickly so that any adjacent boards will not overheat from lack of fan cooling.

B.9.2 Peripheral Power Supply

A system has one peripheral power supply. This power supply provides DC power for the CD-ROM/tape tray and precharge power for hot-plugging boards and power/cooling modules. The +5 VDC output of the peripheral power supply is current shared with the +5 VDC outputs of the power/cooling modules.

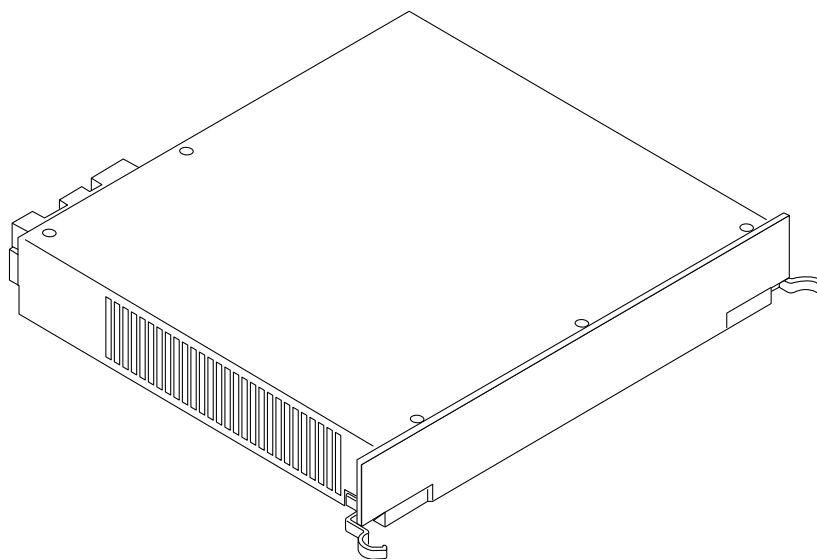


Figure B-9 Peripheral Power Supply

B.10 Clock Board

The clock board is located at the rear of the system, directly below the peripheral power supply. When replacing the clock board, orient the board with the component side up. See Figure B-10.

The clock board provides 16 pairs of system clocks, 32 pairs of processor clocks.

All processors run at the same clock speed. The system clock and the processor clocks are derived from a single clock source. The frequency of the clock source as well as the processor and system clocks are programmable and set by firmware. The processor clock frequency is set to match the lowest-frequency processor in the system.

The clock board also includes central devices including serial ports, keyboard and mouse, and a time of day (TOD) chip.

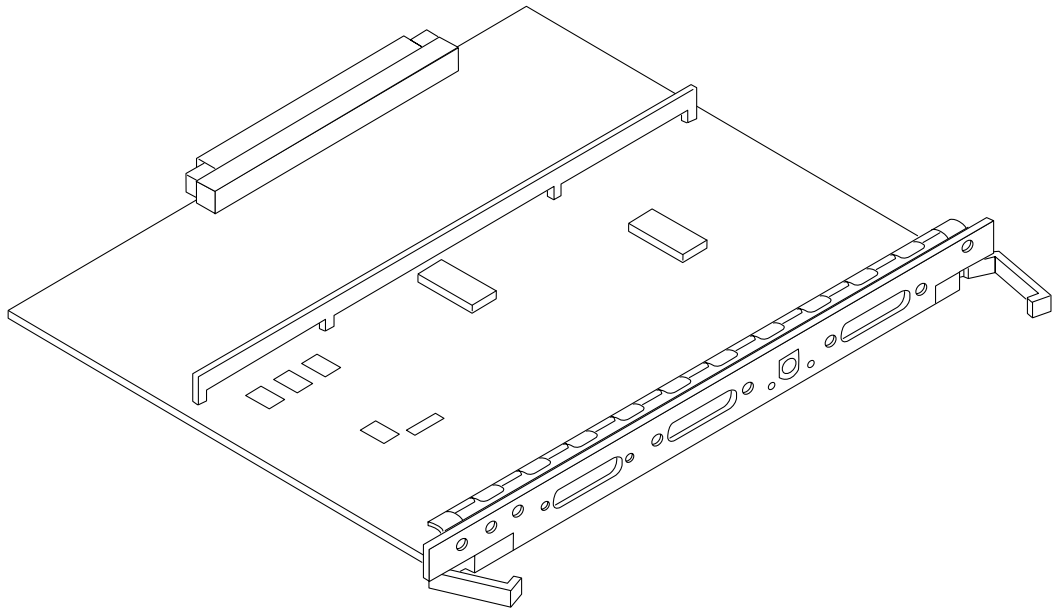


Figure B-10 Clock Board

B.11 Disk Trays

Enterprise systems support Fibre Channel and/or SCSI disk trays.

- The 16-slot Enterprise 6000 cabinet server has a capacity of three internal trays.
- The 8-slot Enterprise 5000 cabinet server has a capacity of four internal trays.
- The 8-slot Enterprise 4000 standalone server does not have a capacity for internal trays.

B.12 CD-ROM/Tape Tray

All Enterprise servers include a tray for one CD-ROM drive and one tape drive. The drives connect to the wide SCSI connector of the first I/O board (in card cage slot 1).

Enterprise 6000/5000

Cabinet servers: The tray is located in the front upper left part of the rack, and the drives are mounted vertically.

Up to four additional SCSI drives may be mounted in the area to the right of the CD-ROM/tape tray.

Enterprise 4000

Standalone server: The tray is located in the front, immediately above the card cage, and the drives are mounted horizontally.

The standalone server does not have space for additional internal drives.

SCSI Devices



B.1 SCSI Tray Target IDs

The default SCSI ID numbers for devices in the SCSI tray are:

Table B-1 SCSI Tray Default SCSI ID Numbers

Device	ID
CD-ROM	6
Tape drive	5

B.2 Disk Board Target IDs

Note – Default disk drive ID numbers are chosen so that IDs 4, 5, 6, and 7 are unlikely to be assigned to disk drives. These IDs are in slots 0 and 1, which are normally taken by a CPU/Memory board (slot 0) and an I/O board (slot 1).

The default SCSI ID numbers for disk drives located on the disk boards are based on the board slot number as depicted in Table B-2. You can override the default IDs by jumpers on each disk board. Each disk has an ID_ENABLE jumper and four ID jumpers. If the ID_ENABLE jumper is not installed, the disk drive uses the default SCSI ID. If the ID_ENABLE jumper is installed, the disk drive uses the ID specified by the four ID jumpers located on the disk board (an installed jumper indicates a logical 1).

Table B-2 Disk Board Default SCSI Disk Drive ID Numbers

Board Slot	Disk 0,1	Board Slot	Disk 0,1
0	4,5	1	6,7
2 or 14*	0,1	3 or 15*	10,11
4	2,3	5	12,13
6	8,9	7	14,15

***Enterprise 6000 systems: Disk boards can only be installed in slots 14 and 15.**

B.3 SCSI Cable Length

The maximum combined length for a string of SCSI cables is six meters for non-differential cables. For differential SCSI cables, the maximum is 25 meters.

To calculate the total length of a SCSI string, include external cables, internal cables, and printed traces. Table B-3 lists measurements for Enterprise servers.

Table B-3 Internal SCSI Lengths (Approximate)

Location	Internal Length	Comments
Enterprise 6000 slot 1	3.7 meters	Includes I/O board traces and cables to SCSI tray
Enterprise 5000 slot 1	3.7 meters	Includes I/O board traces and cables to SCSI tray
Enterprise 4000 slot 1	1.4 meters	Includes I/O board traces and cables to SCSI tray
SBus I/O board	0.43 meter	Includes board traces only
Graphics I/O board	0.43 meter	Includes board traces only
Disk board	0.64 meter	Includes board traces only

B.4 SCSI Termination

The I/O board in slot 1 of any Enterprise server must be terminated. This slot connects to the SCSI tray through cables and a connector on the centerplane.

An I/O board in any other slot does not require termination if no devices connect to the SCSI bus on that board.

Rules for System Configuration



Some of the following rules are suggestions for optimizing your system. Other rules are strictly required and are marked with the notation: **(Requirement)** or **(Maximum)**.

C.1 Card Cage

As a general rule, all board slots in the card cage are interchangeable. However, the requirements and limitations in the following sections apply when you install boards.

C.1.1 CPU/Memory Boards

1. Install CPU/Memory boards at the front of the system, starting with the top slot (slot 0). If you reserve the rear slots for I/O boards, I/O cable attachments will be made easier.
2. After the front slots are filled, you may add CPU/Memory boards at the rear of the system, below the I/O boards.

C.1.2 I/O Boards

1. An I/O board must always be in slot 1. This is the only slot that allows access internally to the internal SCSI devices (tape and CD-ROM drives.) **(Requirement)**

2. Install I/O boards at the rear of the system to facilitate I/O cable attachments.
3. If you require additional slots, you may use those at the front of the card cage, preferably below the CPU/Memory boards.
4. Up to four graphics (UPA) cards are supported in a system. **(Maximum)**
5. The I/O board in slot 1 of any Enterprise server must be terminated because it connects to the SCSI tray. **(Requirement)**
6. An I/O board in a slot other than slot 1 does not require termination if no devices connect to the SCSI bus on that board.

C.1.3 Disk Board

1. The 16-slot Enterprise 6000 system supports up to two Disk boards. **(Maximum)**
 - a. Disk boards are supported only in slots 14 and 15.
 - b. Slot 15 must be used when installing only one Disk board.
2. The 8-slot Enterprise 5000 and 4000 systems support up to four disk boards. **(Maximum)**
3. The disk board has a capacity of two disk drives. In addition to the three status LEDs found on other types of boards, the disk board has two LEDs to show the status of the individual disk drives. LEDs 1 and 2 represent drives 0 and 1, respectively.

C.1.4 Power Supplies and Fan Cooling

1. The fans in the power/cooling modules (PCMs) provide cooling air only for the two adjacent board slots. Do not install a board in a slot that is not cooled by a PCM. **(Requirement)**
2. You must fill all empty slots (board slots and power supply slots) to avoid loss of cooling air to the active boards. **(Requirement)** For further information on this subject, see Section C.1.5, “Filler Panels and Load Boards.”

3. Under some circumstances, you may remove a power/cooling module from an active system for a short time. However, if the boards in the adjacent slots create large quantities of heat, it is safer to halt and power off the system first.

C.1.5 Filler Panels and Load Boards

1. All empty board slots must be filled with filler panels or load boards. For Enterprise 6000 systems, use load boards. **(Requirement)** A load board (part number 501-3142) is identified by the presence of connector sockets and passive circuitry, which reduces electrical noise at the center plane. *Do not substitute filler panels, which do not have load circuits.*
2. For Enterprise 5000 and 4000 systems, use filler panels (part number 540-2592). **(Requirement)**
3. Filler panels are required for all unused PCM bays. **(Requirement)**

C.2 SBus Modules

1. Install double-wide SBus cards only on the SBus I/O board, at SBus slots 1 and 2. The location of SBus slot 0 prevents its use with double-wide cards.
2. Double-wide SBus cards cannot be used with the Graphics I/O board. The middle card connector does not fit SBus cards.

C.3 CPU Modules

1. Each CPU/Memory board has two sets of CPU connectors, marked “PROC 0” and “PROC 1”.
2. Do not mix CPU speeds—all CPUs run at the lowest common frequency.
3. To run 250 MHz CPU modules, the following are **requirements**:
 - a. **The system must have clock board part number 501-4286.**
 - b. **The system must not have 250 MHz CPU modules with CPU modules of a different speed.**

4. The order of filling CPU slots is not critical. However, to optimize heat dissipation in the system:
 - Fill all “PROC 0” locations on all CPU/Memory boards before filling any “PROC 1” locations. To receive the maximum quantity of diagnostic information, fill “PROC 0” on board 0.
 - After all “PROC 0” locations are filled, you can begin filling the “PROC 1” locations, again starting from the lowest slot number to the highest.

Table C-1 shows slot locations for an example of five CPUs on three CPU/Memory boards.

Table C-1 Example of CPU Placement

Slot Number	“PROC 0”	“PROC 1”
0	in	in
2	in	in
4	in	—

C.4 Memory Modules

1. The SIMMs are 168-pin, JEDEC-standard devices. Do not use other types of memory modules.
2. All SIMMs in a bank (eight SIMMs) must have the same capacity. Do not mix 8, 32, or 128 Mbyte SIMMs in the same bank. **(Requirement)**
3. All SIMMs in a bank should have the same speed rating. If SIMMs of different speeds are mixed in a bank, the bank will function, but at the lowest speed.

C.5 Power Supplies

Only the peripheral power supply provides precharge current to the system. The peripheral power supply must be fully functional if you replace a hot-pluggable board or PCM. If the peripheral power supply cannot supply precharge current, the hot-pluggable unit will be damaged. **(Requirement)**

C.6 Disk Drive Trays

1. The disk drive tray containing the boot disk should be connected to the I/O board in card cage slot 1.
2. Additional drive trays may be attached to I/O boards in any other card cage slot.
3. In the Enterprise 6000 and 5000 systems, optional disk trays may be mounted under the card cage. The maximum number of trays varies with the server type and the physical size of the trays.

C.7 CD-ROM/Tape Drive Tray

1. For the 8-slot Enterprise 4000 system, the optional CD-ROM and tape drives are mounted horizontally in a SCSI tray that is attached to the card cage.
2. For the 16-slot Enterprise 6000 and 8-slot Enterprise 5000 cabinets, the optional CD-ROM and tape drives are mounted vertically in a SCSI tray that is attached to the rack. Note that the 8-slot card cage is the same unit as is used in the 8-slot standalone unit, but with filler panels in the unused card cage SCSI tray and keyswitch compartments.
3. The Enterprise 6000 and 5000 systems have space above the card cage for an optional multi-tape backup tray or tape library unit.

C.8 Connecting Cables

C.8.1 SCSI

1. The maximum length for a chain of non-differential SCSI cables is 6.0 meters (20 feet). **(Maximum)**
2. The maximum length for a chain of differential SCSI cables is 25 meters (82 feet). **(Maximum)**

C.8.2 Ethernet

1. The main Ethernet should be connected to the I/O board in slot 1.

2. Additional Ethernet connections may be made to I/O boards in any other card cage slot.

C.8.3 Video Interface

1. A system that is operated with a monitor may use a graphics adapter mounted on either a Graphics I/O board or an SBus I/O board. The Sun Creator and Creator 3D Graphics I/O boards are available.
2. Up to four Graphics I/O boards are supported in a system.

Non-Chassis Field Replaceable Units (FRUs)



Refer to the following pages to remove and replace system subassemblies:

Table E-1 List of Field Replaceable Units

FRU List Items	Part Number	Page Number
Assembly, cable, CD tray data, cabinet	530-2224	page E-7
Assembly, cable, CD tray power, cabinet	530-2223	page E-7
Assembly, system cabinet AC input, domestic	530-2265	page E-4
Assembly, system cabinet AC input, international	530-2266	page E-4
Centerplane, Enterprise 6000/5000	501-2699/501-2978	page E-23
Centerplane, Enterprise 4000	501-2978	page E-31
Fan tray assembly, 100/240V	370-1811	page E-26
Fan tray assembly, 200/240V	370-1812	page E-21
Fan tray assembly, system cabinet	540-2709	page E-2
Key switch adapter assembly	370-2073	page E-20
Key switch tray, Enterprise 6000/5000	370-2161	page E-11
Key switch tray, Enterprise 4000	370-1810	page E-28
Power sequencer, universal, system cabinet	300-1290	page E-6
SCSI tape adapter PCS assembly	540-2713	page E-18

E.1 Enterprise 6000/5000 Systems

E.1.1 System Cabinet Fan Tray Assembly

You must remove the fan tray screen to reach the assembly.

To remove the fan tray screen:

- 1. Locate the system cabinet fan tray assembly at the right rear of the cabinet.**
- 2. Loosen the top screw on the left and the three screws on the right of the fan tray screen.**
It is not necessary to remove these four screws since the screen has slotted screw holes.
- 3. Remove the two bottom screws on the left of the fan tray screen.**
Removing these screws will ensure adequate clearance.
- 4. Lift the screen up until the slotted screw holes clear the screw heads, and set it aside.**

To remove the fan tray assembly:

- 1. Remove the power cable and fan cable assembly.**
- 2. Loosen the two captive screws at the top and bottom of the fan tray assembly.**
See Figure E-1.

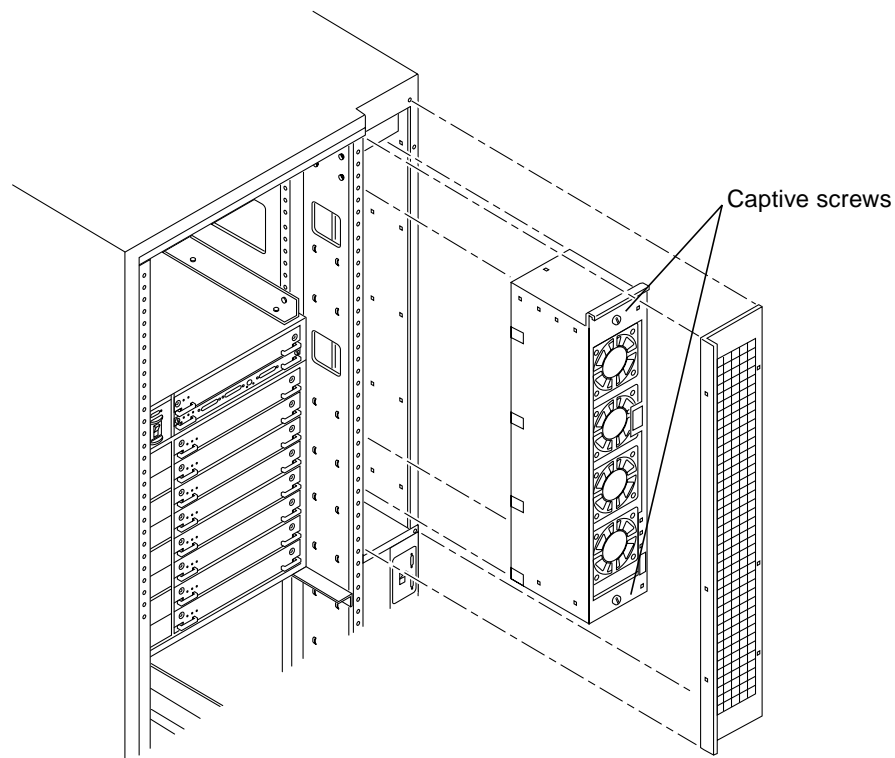


Figure E-1 Replacing the Fan Tray Assembly
in the Enterprise 6000/5000 Systems

- 3. Tilt the fan tray assembly back slightly so that it clears the top of the cabinet.**
- 4. Remove the fan tray assembly.**

To replace the fan tray assembly:

- 1. Tilt the fan tray assembly inward and lower it behind the upper sequencer bracket.**
- 2. Push the fan tray into the cabinet until the fan tray cannot be inserted any further.**

3. **Tighten the two captive screws at the top and bottom of the fan tray.**
See Figure E-1.
4. **Replace the power cable and fan fail cable.**

To replace the fan tray screen:

1. **Replace the screen so that the slotted screw holes clear the screw heads.**
2. **Tighten the top screw on the left and the three screws on the right.**
3. **Replace the two bottom screws on the left.**

E.1.2 Domestic and International System Cabinet AC Input Cable Assembly

To remove the AC input cable assembly:

1. **Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, “Powering Off and On.”
2. **Disconnect the AC power cord from the power outlet.**
3. **Push back and release the latch attaching the power cord to the power inlet.**
See Figure E-2.
4. **Unplug the AC power cord from the power inlet.**
Close the power connector cover over the power inlet.

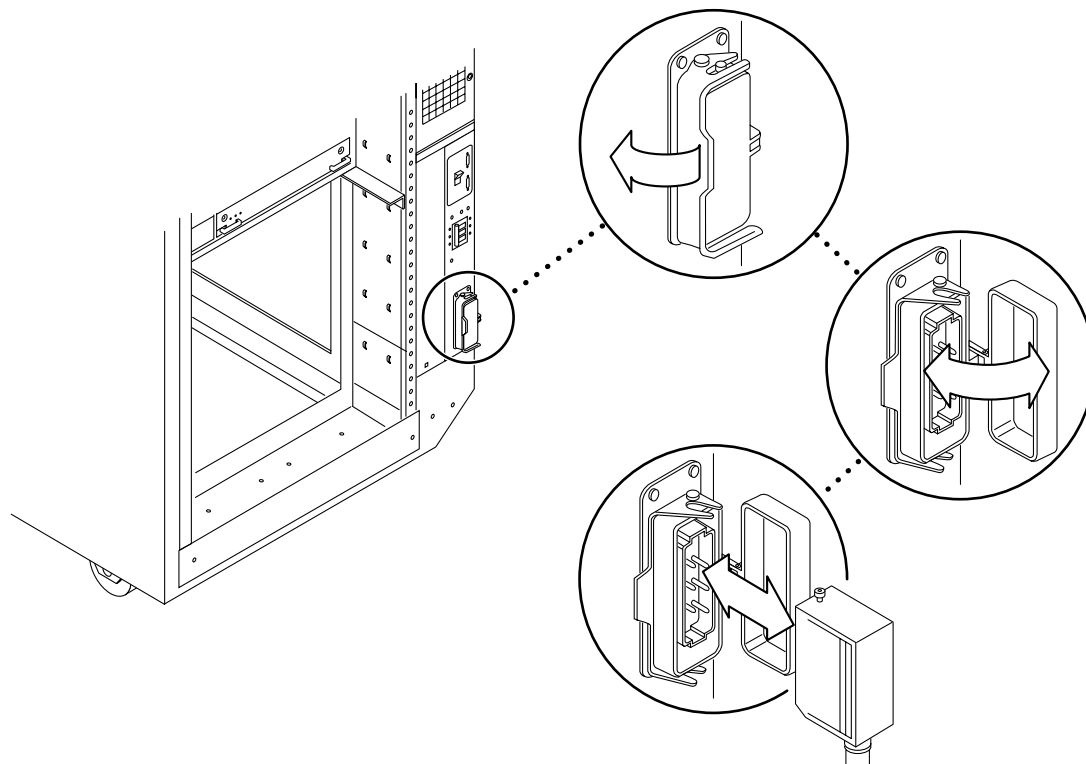


Figure E-2 Opening the Power Connector Cover

To replace the AC input cable assembly:

- 1. Pull back the power connector cover to expose the power inlet.**
- 2. Connect the AC power cord into the power inlet.**
See Figure E-2.
- 3. Pull the latch over the AC power cord.**
- 4. Connect the AC power cord to the power outlet.**
- 5. Power on the Enterprise system.**
See the power on instructions in Chapter 12, "Powering Off and On."

E.1.3 Universal System Cabinet Power Sequencer

To remove the power sequencer:

- 1. Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, "Powering Off and On."
- 2. Remove the power cord assembly from the back of the power sequencer.**
See Section E.1.2, "Domestic and International System Cabinet AC Input Cable Assembly," for information on removing the power cord.
- 3. Remove the side panel closest to the power sequencer.**
See Chapter 13, "Preparing for Service," for information on removing the side panel.
- 4. Disconnect all the cable assemblies from the front of the power sequencer.**
Reach through the space uncovered by the side panel to disconnect these cable assemblies.
- 5. Remove the two screws at the top of the power sequencer.**
See Figure E-3.

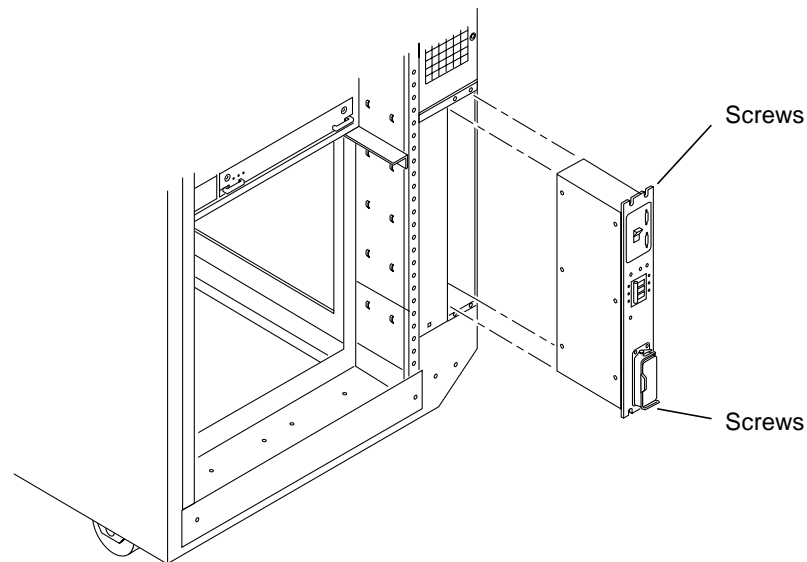


Figure E-3 Replacing the Power Sequencer

- 6. Remove the two screws at the bottom of the power sequencer.**
- 7. Tilt the power sequencer slightly so that it clears the top and lift it up and out of the cabinet.**
You may use the power inlet to obtain a grip on the power sequencer.

To replace the power sequencer:

- 1. Tilt the power sequencer inward and seat the bottom in the cabinet opening.**
There are two retainers at the bottom of the power sequencer which rest on the sheet metal at the bottom of the cabinet opening.
- 2. Tilt the power sequencer so that it is flush against the cabinet.**
- 3. Replace the two screws at the bottom of the power sequencer.**
See Figure E-3.
- 4. Replace the two screws at the top of the power sequencer.**
- 5. Connect all the cable assemblies to the front of the power sequencer.**
Reach through the space uncovered by the side panel to replace these cable assemblies.
- 6. Replace the side panel closest to the power sequencer.**
See Chapter 13, "Preparing for Service," for information on replacing the side panel.
- 7. Replace the power cord assembly at the back of the power sequencer.**
See Section E.1.2, "Domestic and International System Cabinet AC Input Cable Assembly," for information on replacing the power cord.
- 8. Power on the Enterprise system.**
See the power on instructions in Chapter 12, "Powering Off and On."

E.1.4 CD Tray Power and Data Cable Assemblies

To remove the cable assembly:

- 1. Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, "Powering Off and On."

2. Grasp the front bezel on both sides at the top and pull out far enough to disengage the ball studs.



Caution – To prevent breakage, do not grasp the bezel by the bottom edge.

See Figure E-4.

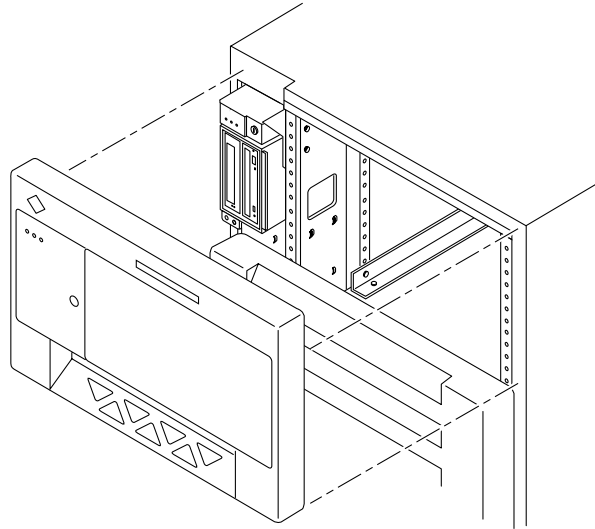


Figure E-4 Removing the Front Bezel

3. Remove the bezel and set it aside.
4. Open the hinged door on the front panel by grasping the handle (purple extruded strip on the vent edge) on the right side of the second panel, and pulling it firmly toward you.
The door is released and swings open if pulled firmly.
5. Remove the side panel closest to the key switch assembly.
See Chapter 13, “Preparing for Service,” for information on removing the side panel.
6. Remove the fan tray shelf cover.
Remove the 10 screws attaching the cover to the cabinet.

7. Disconnect the CD tray power or data cable assembly from the back of the SCSI tray.

See Figure E-5.

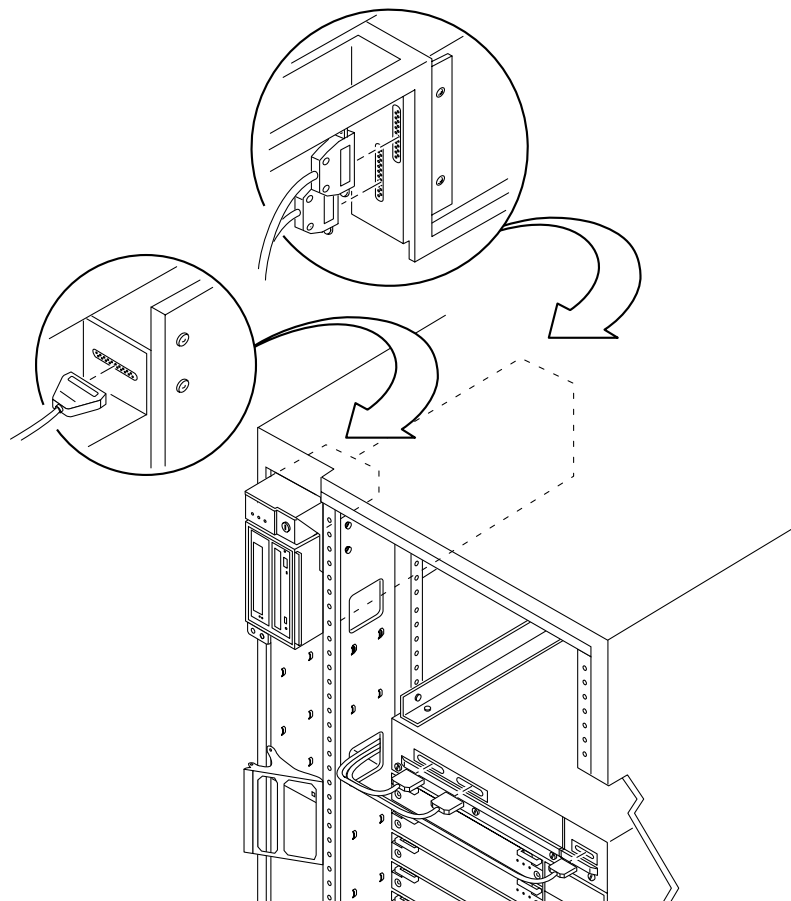


Figure E-5 Removing the Cable Assemblies
From the Back of the SCSI Tray

8. Pull the cable assembly through the opening in the cabinet to the front of the card cage.

The cable assembly runs through the front of the fan tray shelf and the system cabinet pillar to the SCSI adapter assembly.

9. Disconnect the cable assembly from the front of the SCSI adapter assembly and remove the cable assembly.

See Figure E-6.

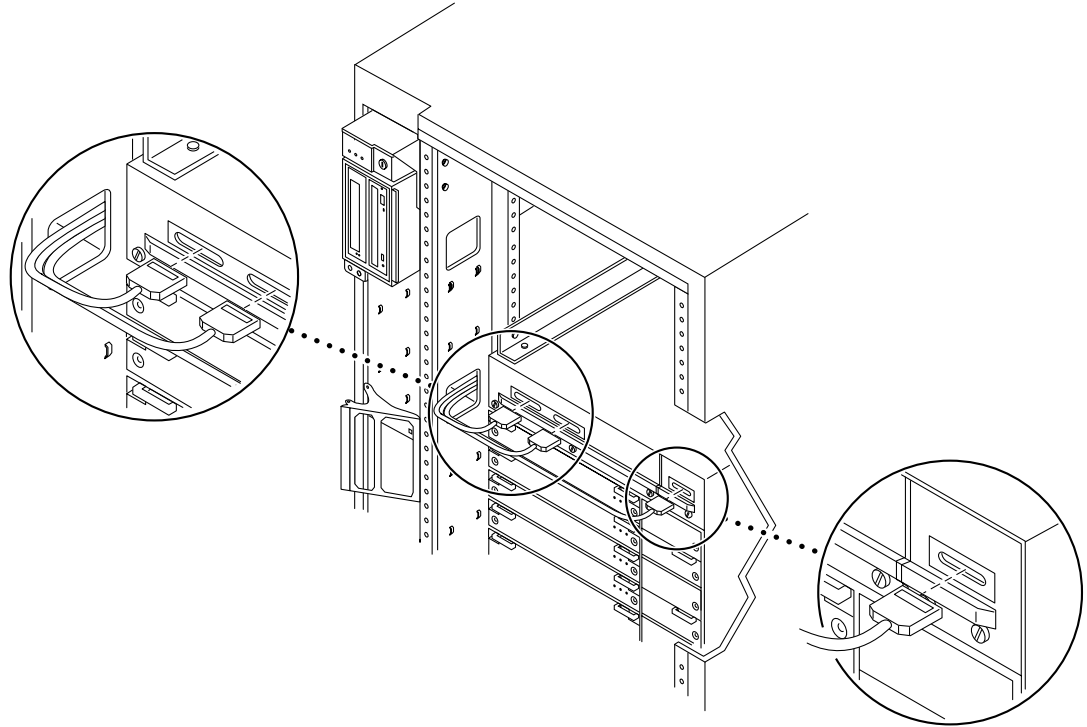


Figure E-6 Removing the Cable Assemblies
From the Front of the SCSI Adapter Tray

To replace the cable assembly:

- 1. Connect the CD tray power or data cable assembly into the back of the SCSI tray.**
See Figure E-5.
- 2. Pull the cable assembly through the opening in the cabinet to the front of the card cage.**
The cable assembly runs through the front of the fan tray shelf and the system cabinet pillar to the SCSI adapter assembly.
- 3. Connect the cable assembly into the front of the SCSI adapter assembly.**
See Figure E-6.

- 4. Replace the fan tray shelf cover.**
Replace the 10 screws and attach the cover to the cabinet.
- 5. Replace the side panel.**
See Chapter 13, “Preparing for Service,” for information on replacing the side panel.
- 6. Close the hinged door on the front panel by grasping the door handle on the right side of the second panel and securing the door to the cabinet.**
- 7. Place the front bezel against the cabinet with the ball studs aligned with the catches on the bezel.**
Tap or press both sides of the bezel into place.
See Figure E-4.
- 8. Power on the Enterprise system.**
See the power on instructions in Chapter 12, “Powering Off and On.”

E.1.5 Key Switch Assembly

To remove the key switch assembly:

- 1. Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, “Powering Off and On.”
- 2. Remove the side panel closest to the key switch assembly.**
See Chapter 13, “Preparing for Service,” for information on removing the side panel.
- 3. Remove the fan tray shelf cover.**
Remove the 10 screws attaching the cover to the cabinet.
- 4. Disconnect the CD tray power and data cable assemblies from the back of the SCSI tray.**
See Figure E-5.
- 5. Remove the two screws that attach the SCSI tray to the flange on the side of the fan tray shelf.**
See Figure E-7.

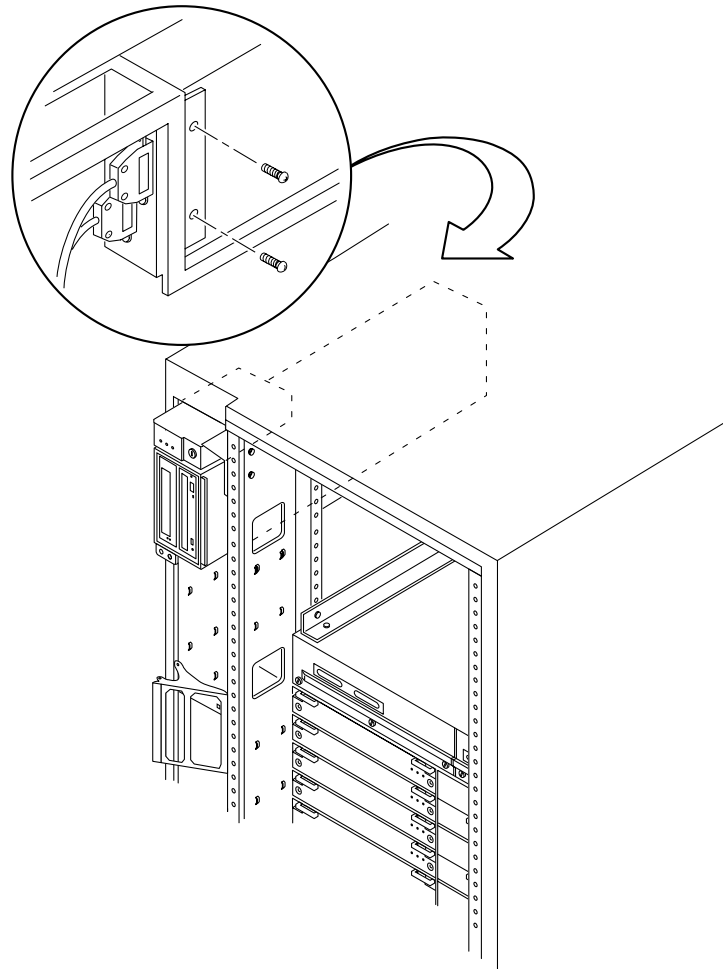


Figure E-7 Removing the Two Screws That Attach the SCSI Tray to the Flange

6. Remove the two screws that attach the SCSI tray to the cabinet pillar.
See Figure E-8.

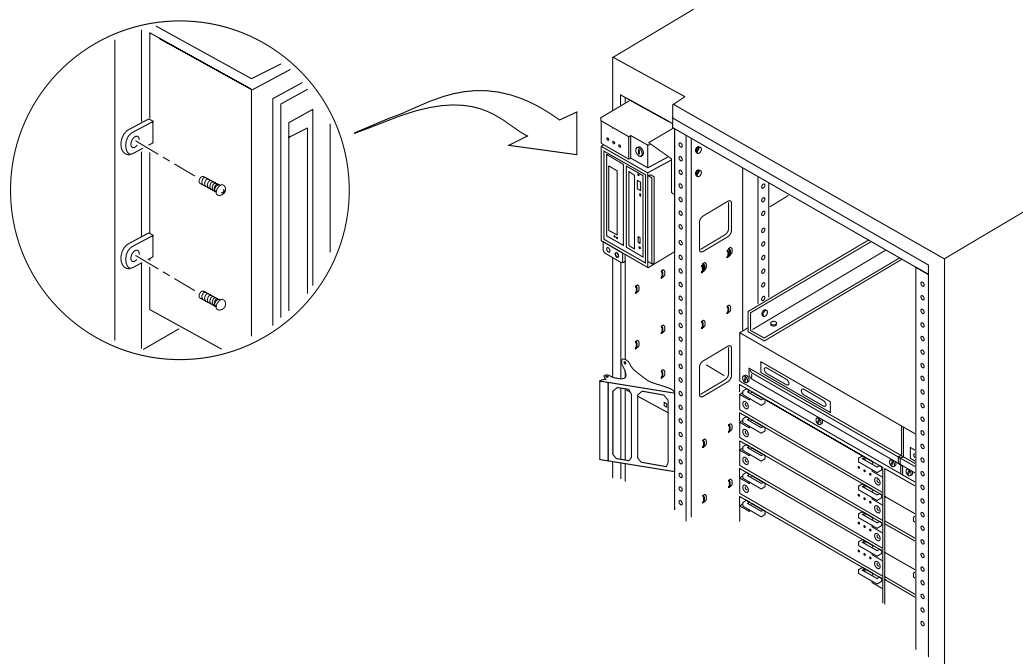


Figure E-8 Removing the Two Screws That Attach the SCSI Tray to the Cabinet Pillar

- 7. Gently pull and remove the SCSI tray from the cabinet.**
Set the SCSI tray to the side. See Figure E-9.

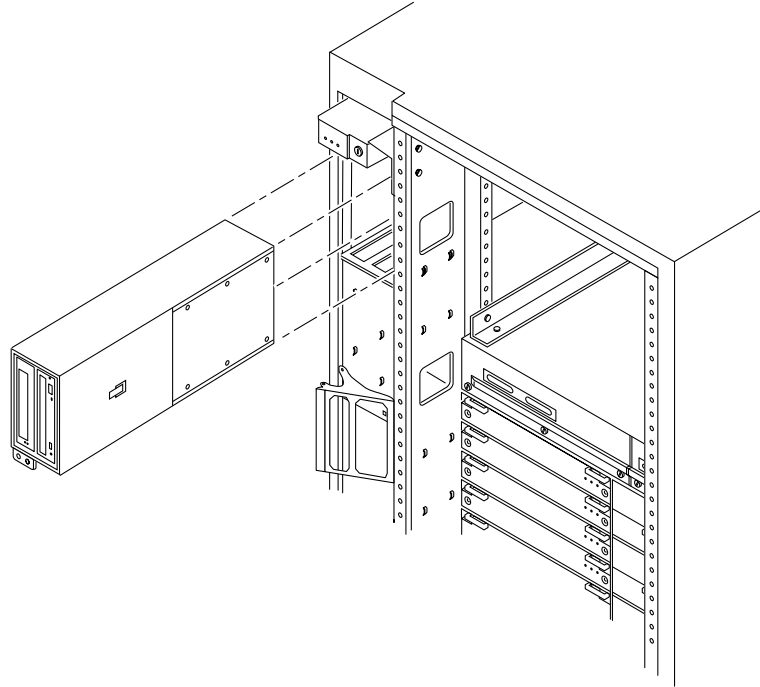


Figure E-9 Removing the SCSI Tray in the Enterprise 6000/5000 Systems

- 8. Disconnect the cable from the back of the key switch assembly.**

- 9. Remove the screw on the left side that attaches the key switch assembly to the cabinet pillar.**
See Figure E-10.

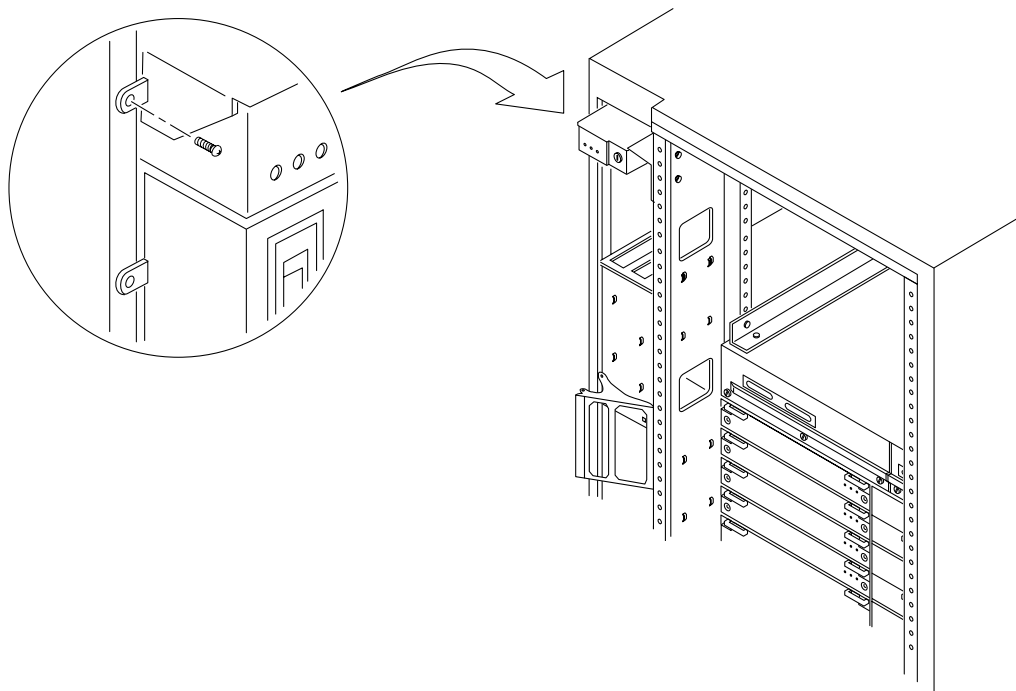


Figure E-10 Removing the Screw That Attaches the Key Switch Assembly to the Left Side of the Cabinet Pillar

10. Remove the two screws on the right side that attach the key switch assembly to the cabinet pillar.

You can access the two screws through the space previously occupied by the SCSI tray. See Figure E-11.

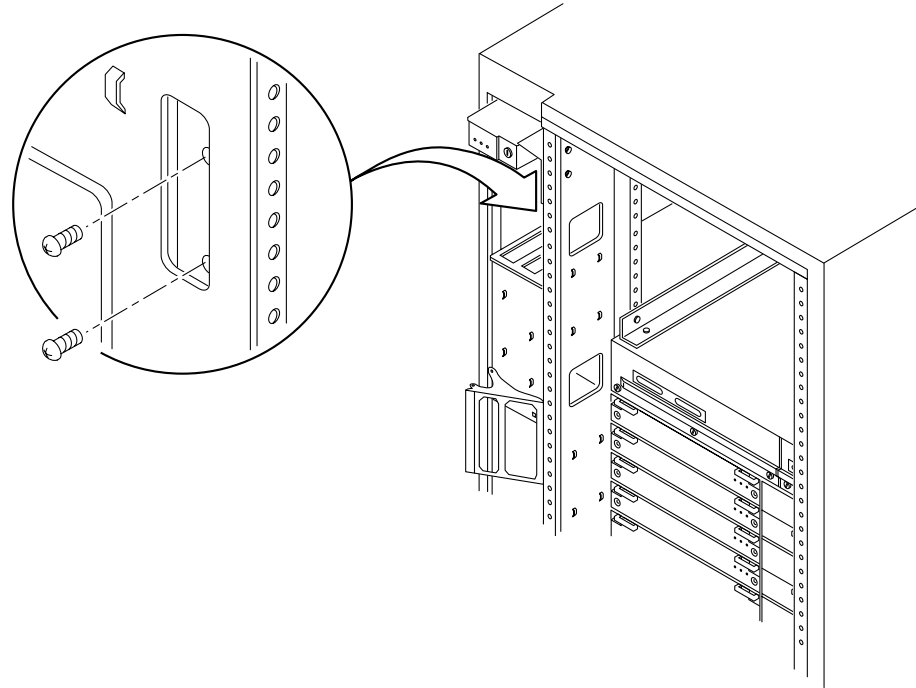


Figure E-11 Removing the Two Screws That Attach the Key Switch Assembly to the Right Side of the Cabinet Pillar

11. Gently remove the key switch assembly from the cabinet.

Pull out the right side first and gently rock the assembly until the left flange clears the cabinet. See Figure E-12.

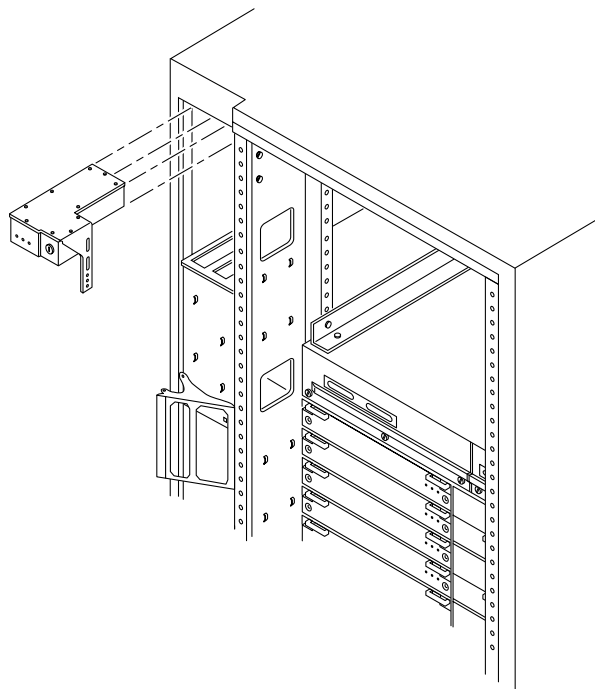


Figure E-12 Replacing the Key Switch Assembly in the Enterprise 6000/5000 Systems

To replace the key switch assembly:

- 1. Insert the key switch assembly into the cabinet until it is seated properly.**
The key switch assembly is seated properly when the screw holes align with the cabinet pillar. See Figure E-12.
- 2. Replace the two screws on the right side that attach the key switch assembly to the cabinet pillar.**
You can access the two screws through the space previously occupied by the SCSI tray. See Figure E-11.

- 3. Replace the screw on the left side that attaches the key switch assembly to the cabinet pillar.**
See Figure E-10.
- 4. Connect the key switch cable assembly into the back of the key switch assembly.**
- 5. Replace the SCSI tray into the cabinet using the support system cabinet CD shelf as a guide.**
When seated properly, the SCSI tray is flush with the key switch assembly in the cabinet. See Figure E-9.
- 6. Replace the two screws that attach the SCSI tray to the cabinet pillar.**
See Figure E-8.
- 7. Replace the two screws that attach the SCSI tray to the flange on the side of the fan tray shelf.**
See Figure E-7.
- 8. Connect the CD tray power and data cable assemblies into the back of the SCSI tray.**
See Figure E-5.
- 9. Replace the fan tray shelf cover.**
Replace the 10 screws and attach the cover to the cabinet.
- 10. Replace the side panel closest to the key switch assembly.**
See Chapter 13, "Preparing for Service," for information on replacing the side panel.
- 11. Power on the Enterprise system.**
See the power on instructions in Chapter 12, "Powering Off and On."

E.1.6 SCSI Tape Adapter PCS Assembly

To remove the SCSI adapter assembly:

- 1. Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, "Powering Off and On."
- 2. Disconnect the two cable assemblies from the front of the SCSI adapter assembly.**
See Figure E-6.

3. Loosen the three captive screws on the bottom that secure the SCSI adapter assembly to the cabinet.

See Figure E-13.

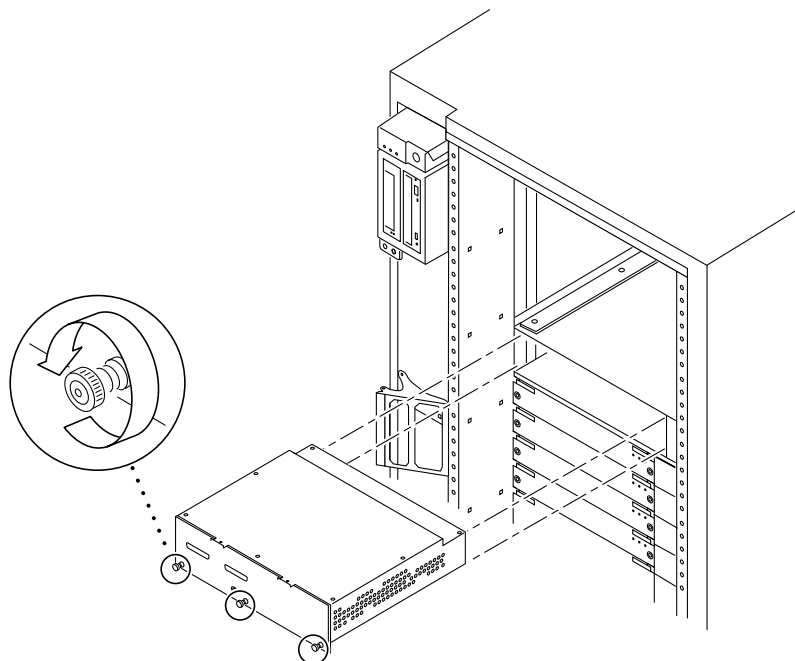


Figure E-13 Removing the SCSI Tape Adapter PCS Assembly in the Enterprise 6000/5000 Systems

4. Pull and slowly remove the SCSI adapter assembly from the cabinet.

To replace the SCSI adapter assembly:

1. Carefully insert the SCSI adapter assembly into the front of the Enterprise system.



Caution – DO NOT FORCE the SCSI adapter assembly into the slot; this can cause damage to the assembly and system.

The SCSI adapter assembly should insert and seat smoothly. If it binds, remove it, and inspect the slot for any obvious obstructions. Do not damage the springfingers at the bottom of the assembly.

2. Tighten the three captive screws on the bottom that secure the SCSI adapter assembly to the cabinet.

See Figure E-13.

3. Connect the two cable assemblies to the front of the SCSI adapter assembly.

See Figure E-6.

4. Power on the Enterprise system.

See the power on instructions in Chapter 12, “Powering Off and On.”

E.1.7 Key Switch Adapter Assembly

To remove the key switch adapter assembly:

1. Completely power off the Enterprise 6000 system.

See the power off instructions in Chapter 12, “Powering Off and On.”

2. Disconnect the cable assembly from the front of the key switch adapter assembly.

3. Loosen the two captive screws on the bottom that secure the key switch adapter assembly to the cabinet.

4. Pull and slowly remove the key switch adapter assembly from the cabinet.

To replace the key switch adapter assembly:

1. Carefully insert the key switch adapter assembly into the front of the Enterprise 6000 system.



Caution – DO NOT FORCE the key switch adapter assembly into the slot; this can cause damage to the assembly and system.

The key switch adapter assembly should insert and seat smoothly. If it binds, remove it, and inspect the slot for any obvious obstructions. Do not damage the springfingers at the bottom of the assembly.

- 2. Tighten the two captive screws on the bottom that secure the key switch adapter assembly to the cabinet.**
- 3. Connect the cable assembly to the front of the key switch adapter assembly.**
- 4. Power on the Enterprise 6000 system.**
See the power on instructions in Chapter 12, “Powering Off and On.”

E.1.8 Fan Tray Assembly, 200/240V

To remove the fan tray assembly:

- 1. Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, “Powering Off and On.”
- 2. Locate the fan tray assembly at the back of the system.**
Viewed from the rear of the system, the fan tray is on the left side of the cabinet. It includes two connectors and a switch.
- 3. Disconnect the cables from the fan tray assembly.**
- 4. Loosen the two captive screws on the left side that secure the fan tray assembly to the cabinet.**
- 5. Pull and slowly remove the fan tray assembly from the cabinet.**
See Figure E-14.

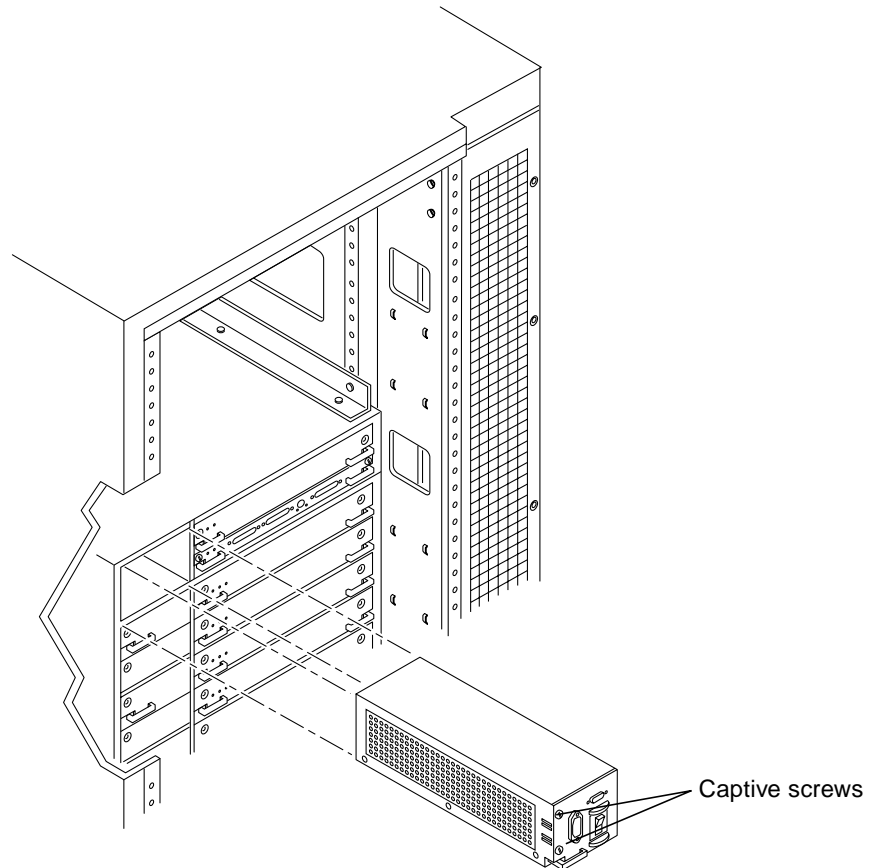


Figure E-14 Removing the 200/240V Fan Tray Assembly

To replace the fan tray assembly:

1. Carefully insert the fan tray assembly into the cabinet.

Viewed from the rear of the system, the fan tray is on the left side of the cabinet. See Figure E-14.



Caution – DO NOT FORCE the fan tray assembly into the slot; this can cause damage to the fan tray assembly and system.

The fan tray assembly should insert and seat smoothly. If it binds, remove it, and inspect the slot for any obvious obstructions. Do not damage the springfingers at the bottom of the fan tray assembly.

- 2. Tighten the two captive screws to secure the fan tray in place.**
- 3. Reconnect the cables.**
- 4. Power on the Enterprise system.**
See the power on instructions in Chapter 12, “Powering Off and On.”

E.1.9 Centerplane

To remove the centerplane:

- 1. Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, “Powering Off and On.”
- 2. Remove the front bezel, hinged door and rear screen panel.**
See Chapter 13, “Preparing for Service,” for information on removing these assemblies.
- 3. Remove any assemblies above and below the Enterprise system.**
Refer to the respective service manuals for further information.
- 4. Remove all the boards and power supplies.**
See Chapters 3-6 for information on removing the boards and Chapter 7, “Power Supplies,” for information on removing power supplies.
- 5. Remove the SCSI adapter assembly, the key switch adapter assembly, and the 200/240V fan tray assembly.**
See Section E.1.6, “SCSI Tape Adapter PCS Assembly,” Section E.1.7, “Key Switch Adapter Assembly, and Section E.1.8, “Fan Tray Assembly, 200/240V” for information on removing these assemblies.
- 6. Disconnect any remaining cables from the Enterprise system main cabinet.**
- 7. Remove the two screws on each side of the system cabinet that attach the top rails to the system cabinet.**

8. **Loosen the four screws on each side of the system cabinet that attach the top rails to the main chassis.**
9. **Remove the top rails and set them aside.**
Guide the four screws through the key slots in each top rail.
10. **Remove the four screws on each side of the system cabinet that attach the bottom rails to the main chassis.**



Warning – Use care when removing the Enterprise system chassis. It weighs approximately 100 pounds.

11. **Carefully slide the Enterprise system chassis out toward the front and place it front side down onto a surface.**
12. **Remove the screws around the center of the main chassis.**
 - For the Enterprise 6000 system, there are a total of 32 screws, 8 per side.
 - For the Enterprise 5000 system, there are a total of 26 screws.
13. **Lift and remove the rear chassis and set it aside.**
14. **Remove the screws that hold the centerplane to the front chassis.**
 - For the Enterprise 6000 system, there are a total of 27 screws, 20 screws around the side and 7 in the interior section.
 - For the Enterprise 5000 system, there are a total of 20 screws.

Note – Remember the proper orientation of the centerplane when removing it from the front chassis.

15. **Lift the centerplane out and set it aside.**

To replace the centerplane:

1. **Place the centerplane in the front chassis.**
Be sure the centerplane has the proper orientation when placed in the front chassis.
2. **Replace the screws that hold the centerplane to the front chassis.**
 - For the Enterprise 6000 system, there are a total of 27 screws, 20 screws around the side and 7 in the interior section.
 - For the Enterprise 5000 system, there are a total of 20 screws.

3. Place the rear chassis on the front chassis.

4. Replace the screws around the center of the main chassis.

- For the Enterprise 6000 system, there are a total of 32 screws, 8 per side.
- For the Enterprise 5000 system, there are a total of 26 screws.



Warning – Use care when lifting the Enterprise system chassis. It weighs approximately 100 pounds.

5. Slide the main chassis into the system cabinet.

Use the bottom rails as a guide.

6. Replace the four screws on each side of the system cabinet that attach the bottom rails to the main chassis.

7. Replace the top rails.

- a. Tighten the four screws on each side attaching the top rail to the main chassis.**
- b. Replace the two screws on each side attaching the top rail to the system cabinet.**

8. Replace the SCSI adapter assembly, the key switch adapter assembly, and the 200/240V fan tray assembly.

See Section E.1.6, “SCSI Tape Adapter PCS Assembly,” Section E.1.7, “Key Switch Adapter Assembly, and Section E.1.8, “Fan Tray Assembly, 200/240V” for information on replacing these assemblies.

9. Replace all the boards and power supplies.

See Chapters 3-6 for information on replacing the boards and Chapter 7, “Power Supplies,” for information on replacing power supplies.

10. Connect any remaining cables to the Enterprise system main cabinet.

11. Replace any assemblies above and below the Enterprise system.

Refer to the respective service manuals for further information.

12. Replace the front bezel, hinged door and rear screen panel.

See Chapter 13, “Preparing for Service,” for information on replacing these assemblies.

13. Power on the Enterprise system.

See the power on instructions in Chapter 12, “Powering Off and On.”

E.2 Enterprise 4000 System

E.2.1 Fan Tray Assembly, 100V/240V

To remove the fan tray assembly:

1. Completely power off the Enterprise system.

See the power off instructions in Chapter 12, “Powering Off and On.”

2. Locate the fan tray assembly at the rear of the system.

Viewed from the rear of the system, the fan tray is on the left side of the enclosure. It includes the power cord connector and the AC power switch.

3. Disconnect the power cable from the fan tray assembly.

4. Loosen the two captive screws on the left side that secure the fan tray assembly to the enclosure.

See Figure E-15.

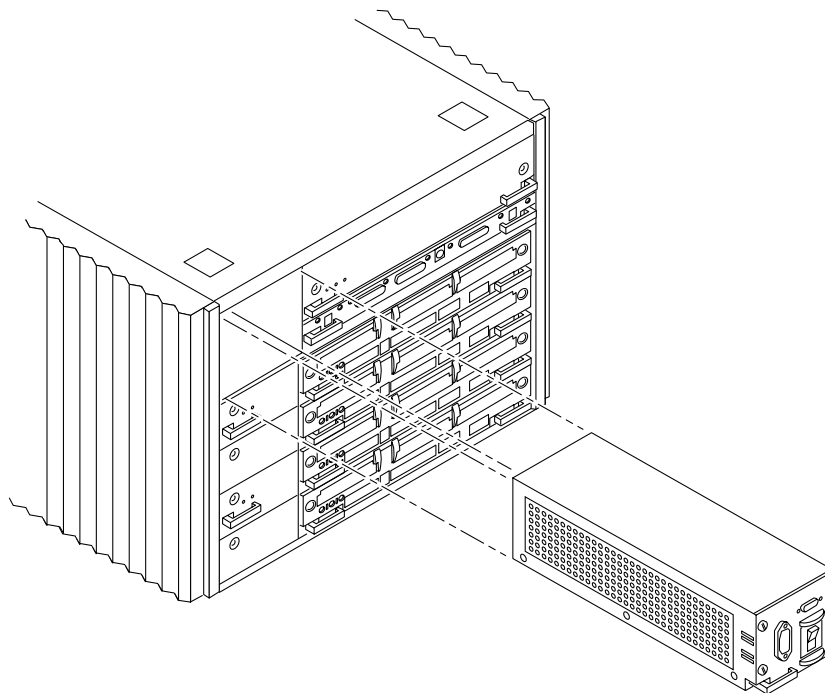


Figure E-15 Removing the Fan Tray in the Enterprise 4000 System

- 5. Pull the end of the extraction lever outward to release the fan tray assembly from the centerplane.**
- 6. Slowly remove the fan tray assembly from the enclosure.**

To replace the fan tray assembly:

- 1. Carefully insert the fan tray assembly into the slot on the left side of the Enterprise system.**
Viewed from the rear of the system, the fan tray is on the left side of the enclosure. See Figure E-15.
- 2. Ensure that the extraction lever is in the outward position as you slide the fan tray assembly toward the centerplane.**
The fan tray assembly will not seat fully unless the lever is in this starting position.



Caution – DO NOT FORCE the fan tray assembly into the slot; this can cause damage to the fan tray assembly and system.

The fan tray assembly should insert and seat smoothly. If it binds, remove it, and inspect the slot for any obvious obstructions. Do not damage the springfingers at the bottom of the fan tray assembly.

- 3. Use the extraction lever to seat the fan tray assembly.**
Swing the lever inwards to the locked position. Do not press on the fan tray assembly to seat it; doing so will damage the connector pins.
- 4. Tighten the two captive screws to secure the fan tray in place.**
- 5. Connect the power cord.**
- 6. Power on the Enterprise system.**
See the power on instructions in Chapter 12, “Powering Off and On.”

E.2.2 Key Switch Assembly

To remove the key switch assembly:

- 1. Completely power off the Enterprise system.**
See the power off instructions in Chapter 12, “Powering Off and On.”
- 2. Remove the system key.**
- 3. Grasp the bottom corners of both sides of the top bezel and pull it toward you.**
- 4. Tilt the top bezel upward to a 45° angle and remove the bezel.**
Set the bezel aside. See Figure E-16.

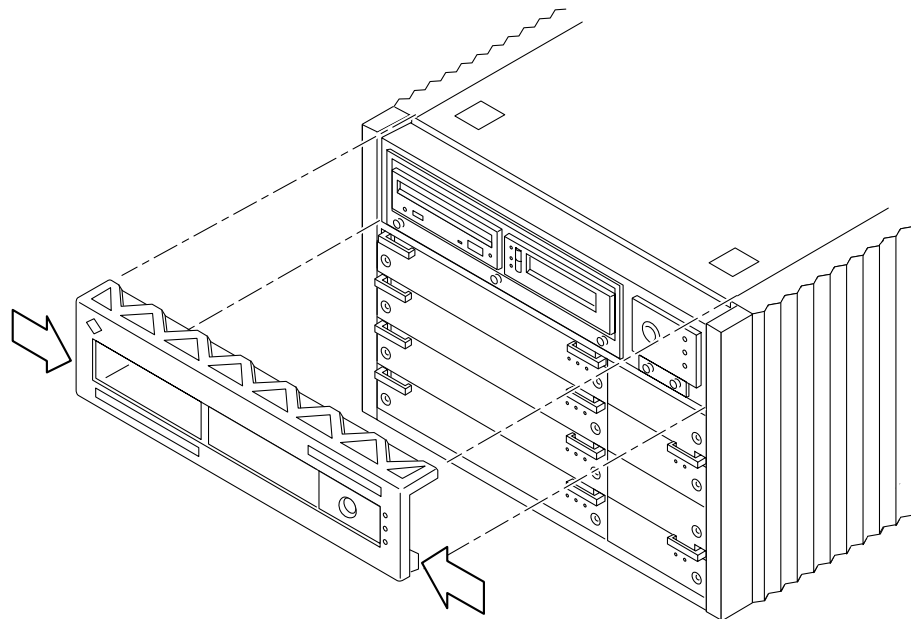


Figure E-16 Removing the Top Bezel

5. Loosen the two captive screws securing the key switch assembly to the enclosure.

Viewed from the front of the system, the key switch assembly is on the right side of the enclosure.

6. Gently pull the key switch assembly from the enclosure.

See Figure E-17.

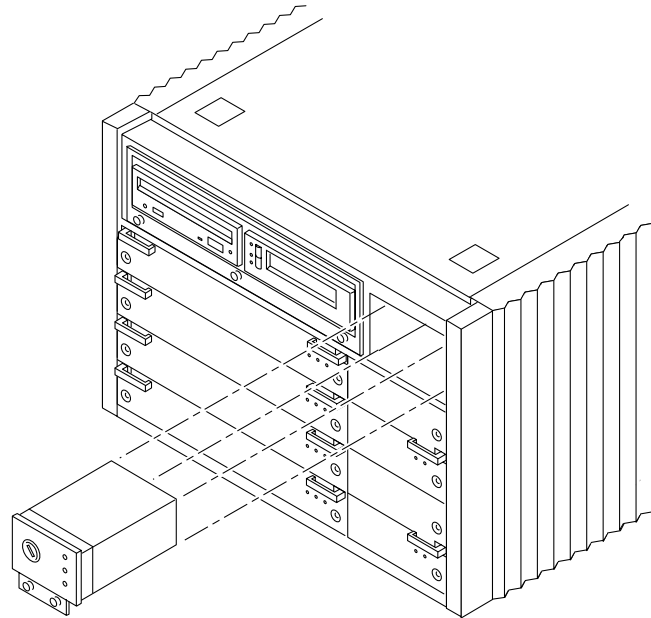


Figure E-17 Replacing the Key Switch/LED Tray Assembly in the Enterprise 4000 System

To replace the key switch assembly:

1. Gently insert the key switch assembly in the enclosure.

Viewed from the front of the system, the key switch assembly is on the right side of the enclosure. See Figure E-17.



Caution – DO NOT FORCE the key switch assembly into the slot; this can cause damage to the key switch assembly and system.

The key switch assembly should insert and seat smoothly. If it binds, remove it, and inspect the slot for any obvious obstructions. Do not damage the springfingers at the bottom of the key switch assembly.

2. Tighten the two captive screws securing the key switch assembly to the enclosure.

- 3. Tilt the top bezel at a 45° angle and insert the lip of the bezel under the top of the enclosure.**

See Figure E-16.

- 4. Lower the top bezel.**

The top bezel should snap into place.

- 5. Replace the system key.**

- 6. Power on the Enterprise system.**

See the power on instructions in Chapter 12, “Powering Off and On.”

E.2.3 Centerplane

To remove the centerplane:

- 1. Completely power off the Enterprise system.**

See the power off instructions in Chapter 12, “Powering Off and On.”

- 2. Remove the top bezel.**

See Chapter 13, “Preparing for Service,” for information on removing this assembly.

- 3. Remove the side vents. Push each side vent backwards until it stops. Then lift the vent off the Enterprise system and set it aside.**

- 4. Remove the top cover.**

- a. Locate the four plugs in each corner of the enclosure.**

- b. Lift each plug by pushing down in the dotted area.**

This action causes the plug to pop up.

- c. Remove each plug.**

- d. Lift up the front of the top cover and slide it backwards approximately 6-10 millimeters. Remove the top cover and set it aside.**

- 5. Remove all the boards and power supplies.**

See Chapters 3-6 for information on removing the boards and Chapter 7, “Power Supplies,” for information on removing power supplies.

6. Loosen the bottom three captive screws securing the SCSI tray to the enclosure.

Insert a screwdriver in the notch at the top center of the SCSI tray to pull out the tray and separate it from the rear slip connectors. See Figure E-18.

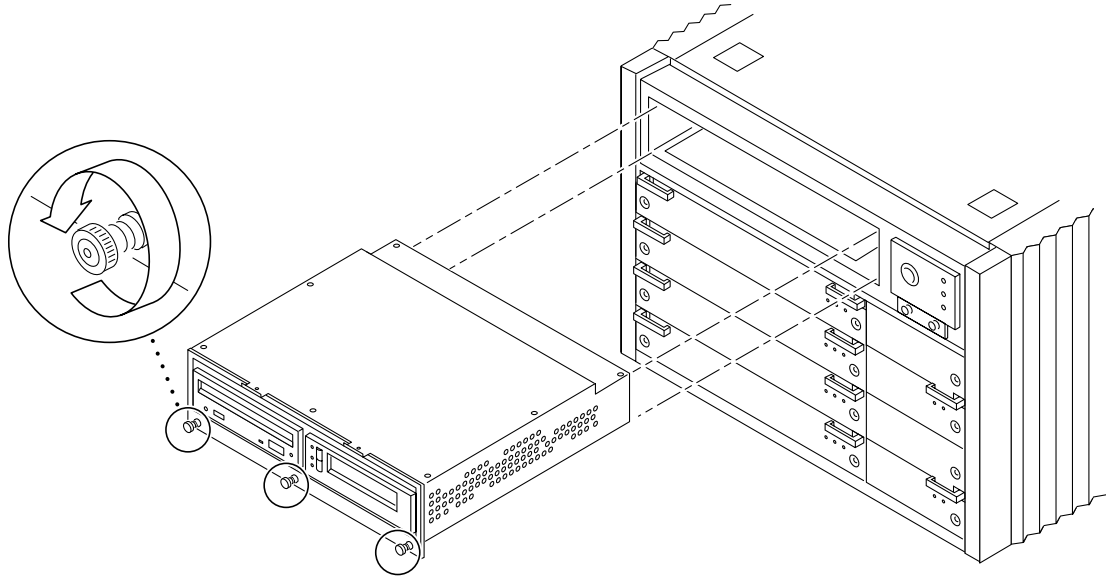


Figure E-18 Removing the SCSI tray

7. Remove the key switch assembly and the 100/240V fan tray assembly.

See Section E.2.2, “Key Switch Assembly and Section E.2.1, “Fan Tray Assembly, 100V/240V” for information on removing these assemblies.

8. Turn over the enclosure and remove the feet on the bottom.

- a. Locate the four feet in each corner of the enclosure.
- b. Unscrew and remove each foot.

9. Turn the enclosure front side down onto a surface.

10. Remove the 26 screws around the center of the main chassis.

11. Lift and remove the rear chassis and set it aside.

12. Remove the 20 screws that hold the centerplane to the front chassis.

Note – Remember the proper orientation of the centerplane when removing it from the front chassis.

13. Lift the centerplane out and set it aside.

To replace the centerplane:

1. Place the centerplane in the front chassis.

Be sure the centerplane has the proper orientation when placed in the front chassis.

2. Replace the 20 screws that hold the centerplane to the front chassis.

3. Place the rear chassis on the front chassis.

4. Replace the 26 screws around the center of the main chassis.

5. Replace the feet on the bottom of the enclosure.

Screw in one foot in each corner.

6. Turn the enclosure over so that the feet are supporting the chassis.

7. Replace all boards and power supplies.

See Chapters 3-6 for information on replacing the boards and Chapter 7, “Power Supplies,” for information on replacing power supplies.

8. Replace the SCSI tray.

Tighten the bottom three captive screws and secure the SCSI tray to the enclosure. See Figure E-18.

9. Replace the key switch assembly and the 100/240V fan tray assembly.

See Section E.2.2, “Key Switch Assembly and Section E.2.1, “Fan Tray Assembly, 100V/240V” for information on replacing these assemblies.

10. Replace the top cover.

a. Slide the top cover over the key slots until it fits securely on the main chassis.

b. Replace each plug.

11. Replace the side vents. Place each vent alongside the main chassis and push the vent forward until it stops.

12. Replace the top bezel.

See Chapter 13, “Preparing for Service,” for information on replacing this assembly.

13. Power on the Enterprise system.

See the power on instructions in Chapter 12, “Powering Off and On.”

Illustrated Parts Breakdown (IPB)



The illustrations and tables in this appendix are intended to supplement the removal and replacement procedures described in previous chapters and appendixes.

Note – Part numbers in this section may differ from those found in your system. Before ordering replacement parts, find the label on the part to be replaced and place your order using that number. Be sure to use the right part number (for the entire assembly instead of the individual components) as shown in Table F-1.

For example, the part number for the fan tray assembly in the data center system cabinet is 540-2709. Although the individual fans in the assembly may have a separate part number, the part number you should use when placing your order is 540-2709 for the entire assembly.

Note – For information about additional capacity drives and other replacement options, contact your sales representative.

Table F-1 List of Replaceable Components (1 of 3)

General Category	Description	Part Number	Page
Enterprise 6000/5000 Systems			
Fan tray	Fan tray assembly, 200/240V	370-1812	
	Fan tray assembly, system cabinet	540-2709	page F-12
Centerplane	Centerplane assembly (Enterprise 6000)	501-3050	page F-13
	Centerplane assembly (Enterprise 5000)	501-2978	page F-24
SCSI devices	Assembly, cable, CD tray data	530-2224	
	Assembly, cable, CD tray power	530-2223	
	Terminator, 68 pin	150-2267	page F-25
	SCSI tape adapter PCS assembly	540-2713	page F-9
	SunCD 4	370-2203	page F-9
	Key switch tray	370-2161	page F-9
	Key switch adapter tray	370-2073	
	Cable, key switch adapter to remote key switch	530-2225	
Power	Power supply, peripheral	300-1301	page F-14
	Power/cooling module (PCM)	300-1260	page F-14
	PCM filler panel	540-2593	
	Cable, system cabinet AC input, domestic	530-2265	page F-11
	Cable, system cabinet AC input, international	530-2266	page F-11
	Cable, universal power cord, internal	530-2197	page F-12
	Assembly, power cable, sequencer to AC input box	530-2213	
	Assembly, AC input/sequencer fan fail cable	530-2235	
	Power sequencer, universal, system cabinet	300-1290	page F-11
Boards	CPU/Memory board assembly	501-2976	page F-15
	6 ns, 512 Kbyte CPU module	501-2941	page F-15
	6 ns, 1 Mbyte CPU module	501-2959	page F-15

Table F-1 List of Replaceable Components (2 of 3)

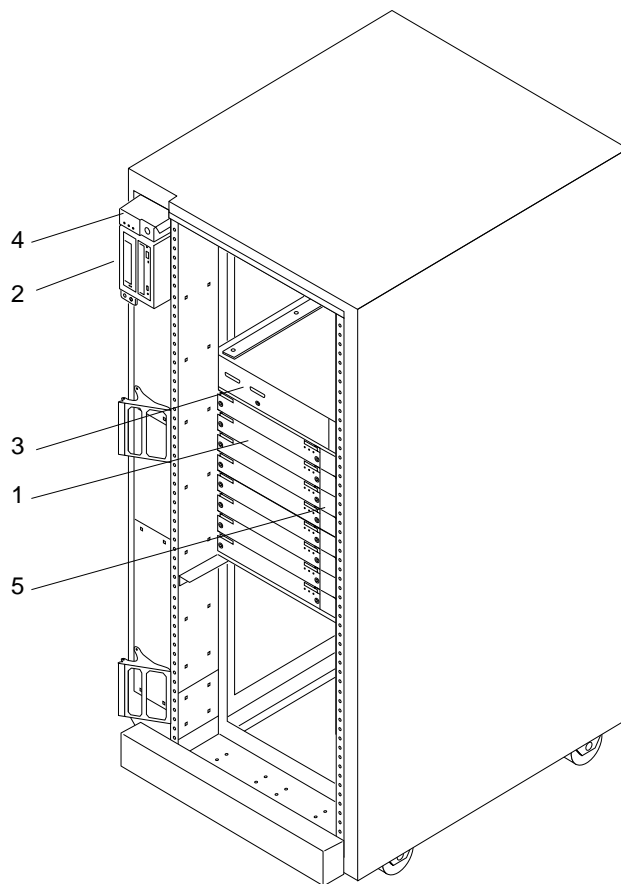
General Category	Description	Part Number	Page
	6 ns, 2 Mbyte CPU module	501-2974	page F-15
	Assembly, DRAM, 1MX72, JEDEC, SIMM, 60 ns	501-2652	page F-15
	Assembly, DRAM, 4MX72, JEDEC, SIMM, 60 ns	501-2653	page F-15
	Assembly, DRAM, 16MX72, JEDEC, SIMM, 60 ns	501-2654	page F-15
	SBus I/O board assembly	501-2977	page F-16
	Graphics I/O board assembly	501-2749	page F-17
	Optical link card	370-1426	
	Clock board assembly	501-2975	page F-18
	Disk board assembly (Enterprise 5000)	501-3113	page F-19
	Load board assembly (Enterprise 6000)	501-3142	page F-19
	Board, filler panel	540-2592	
Enterprise 4000 System			
	Fan tray assembly, 100/240V	370-1811	page F-23
	Centerplane assembly, 8-slot	501-2978	page F-24
	Terminator, 68 pin	150-2267	page F-25
	Assembly, SCSI tray CD/tape drive	540-2587	page F-25
	SunCD 4	370-2203	page F-25
	Key switch tray, standalone, 8-slot	370-1810	page F-23
Power	Power supply, peripheral	300-1301	page F-14
	Power/cooling module (PCM)	300-1260	page F-14
	PCM filler panel	540-2593	
Boards	CPU/Memory board assembly	501-2976	page F-15
	6 ns, 512 Kbyte CPU module	501-2941	page F-15
	6 ns, 1 Mbyte CPU module	501-2959	page F-15
	6 ns, 2 Mbyte CPU module	501-2974	page F-15
	Assembly, DRAM, 1MX72, JEDEC, SIMM, 60 ns	501-2652	page F-15
	Assembly, DRAM, 4MX72, JEDEC, SIMM, 60 ns	501-2653	page F-15

Table F-1 List of Replaceable Components (3 of 3)

General Category	Description	Part Number	Page
	Assembly, DRAM, 16MX72, JEDEC, SIMM, 60 ns	501-2654	page F-15
	SBus I/O board assembly	501-2977	page F-16
	Graphics I/O board assembly	501-2749	page F-17
	Clock board assembly	501-2975	page F-18
	Disk board assembly	501-3113	page F-19
	Board, filler panel	540-2592	

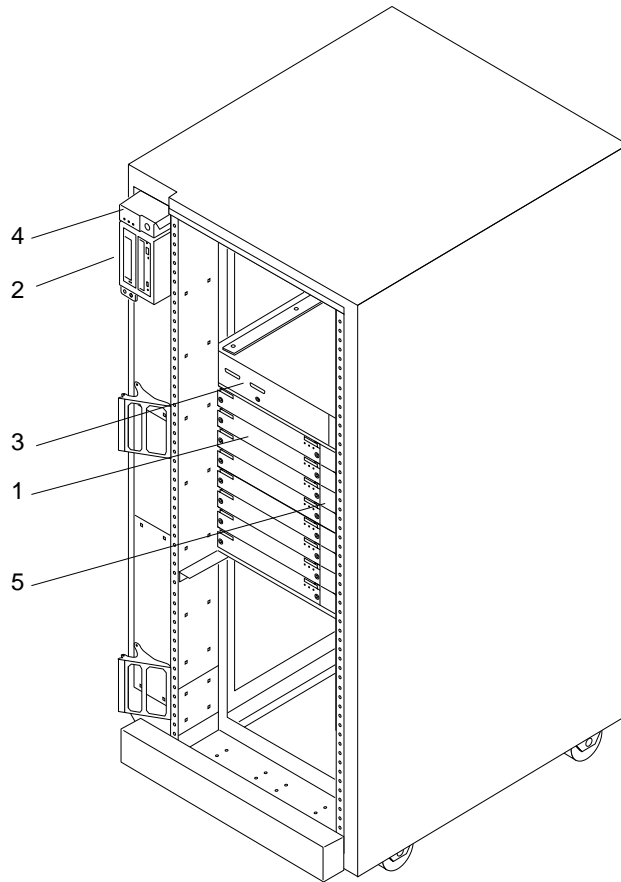
F.1 Enterprise 6000/5000 Systems

Table F-2 Enterprise 6000 System, Front View



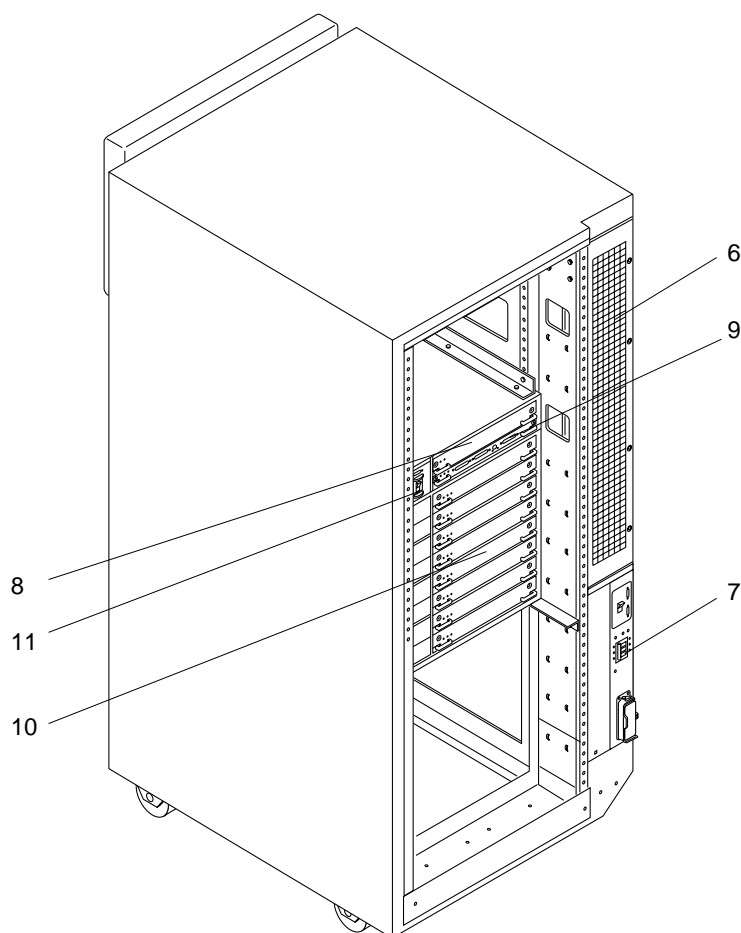
Key	Description	Part Number
1	CPU/Memory board	501-2976
2	SunCD 4	370-2203

Table F-2 Enterprise 6000 System, Front View

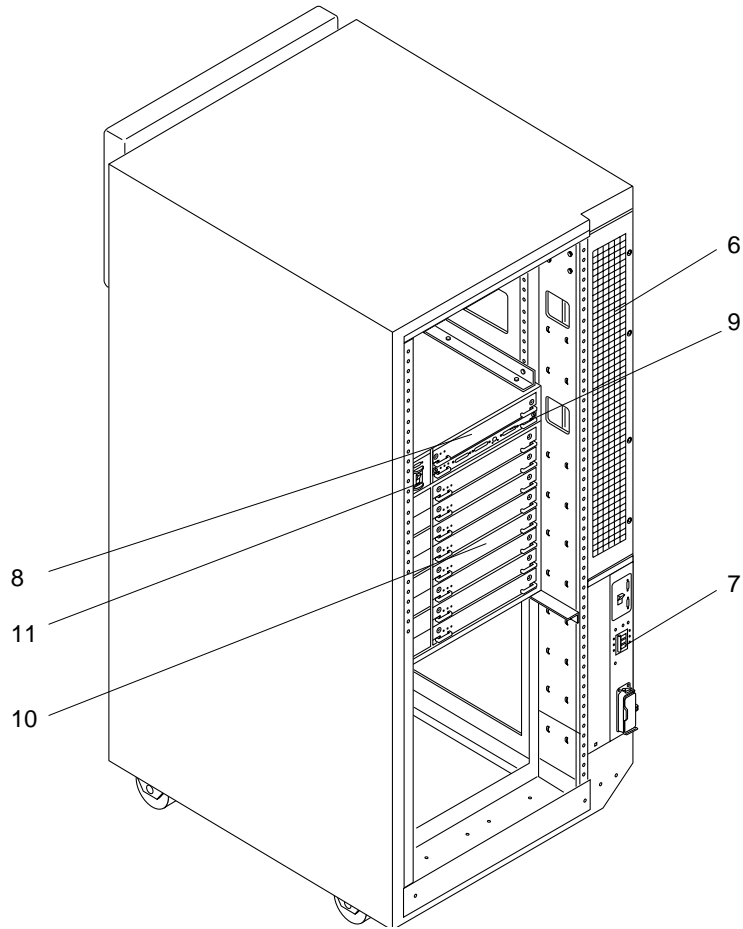


Key	Description	Part Number
3	SCSI tape adapter PCS assembly	540-2713
4	Key switch tray, cabinet, 8-slot/16-slot	370-2161
5	PCM	300-1260

Table F-3 Enterprise 6000 System, Rear View

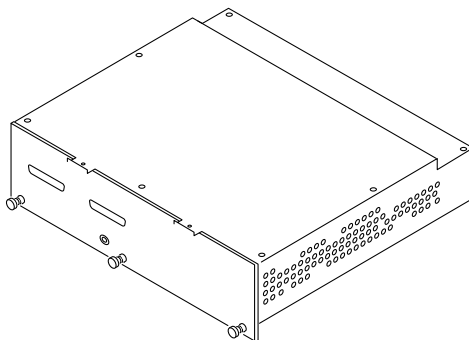


Key	Description	Part Number
6	Fan tray assembly, system cabinet	540-2709
7	Power sequencer, universal, system cabinet	300-1290
8	Power supply, peripheral	300-1301



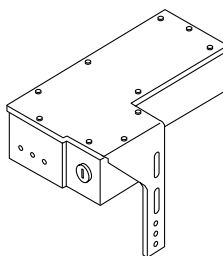
Key	Description	Part Number
9	Clock board assembly	501-2975
10	SBus I/O board assembly	501-2977
11	Fan tray assembly, 200/240V	370-1812

Table F-4 SCSI Tape Adapter PCS Assembly



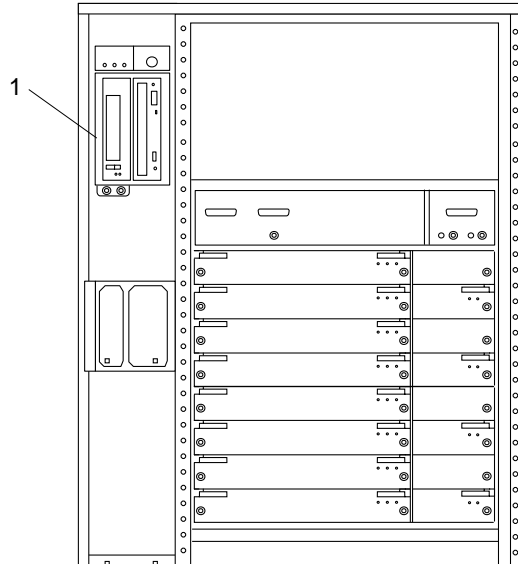
Key	Description	Part Number
	SCSI tape adapter PCS assembly	540-2713

Table F-5 Key Switch Tray



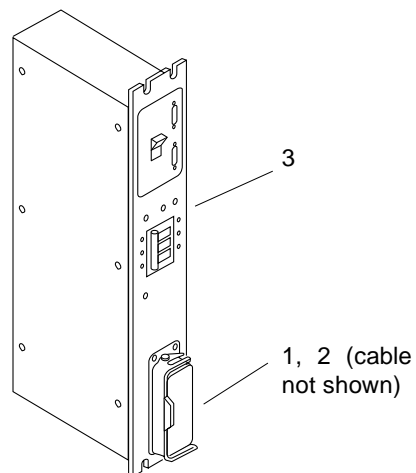
Key	Description	Part Number
	Key switch tray, cabinet, 16-slot or 8-slot	370-2161

Table F-6 SunCD 4



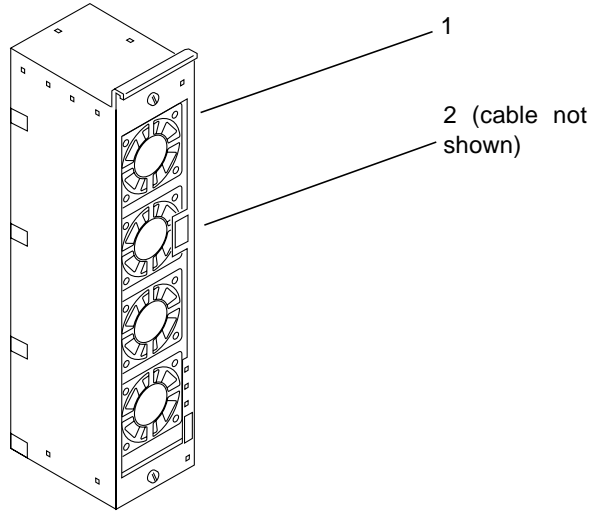
Key	Description	Part Number
1	SunCD 4	370-2203

Table F-7 Power Sequencer



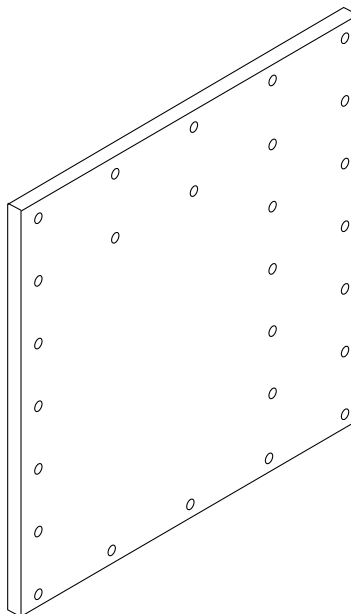
Key	Description	Part Number
1	Cable, system cabinet AC input, domestic	530-2265
2	Cable, system cabinet AC input, international	530-2266
3	Power sequencer, universal, system cabinet	300-1290

Table F-8 Fan Tray Assembly



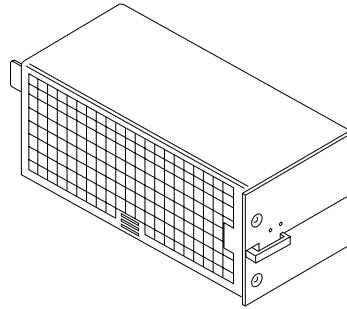
Key	Description	Part Number
1	Fan tray assembly, system cabinet	540-2709
2	Assembly, cable, universal power cord, internal	530-2197

Table F-9 Centerplane Assembly



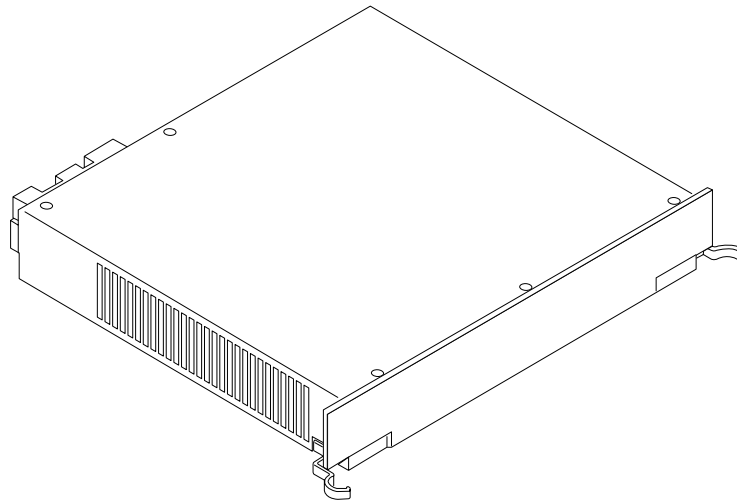
Key	Description	Part Number
1	Centerplane assembly, 16-slot	501-3050

Table F-10 Power/Cooling Module (PCM)



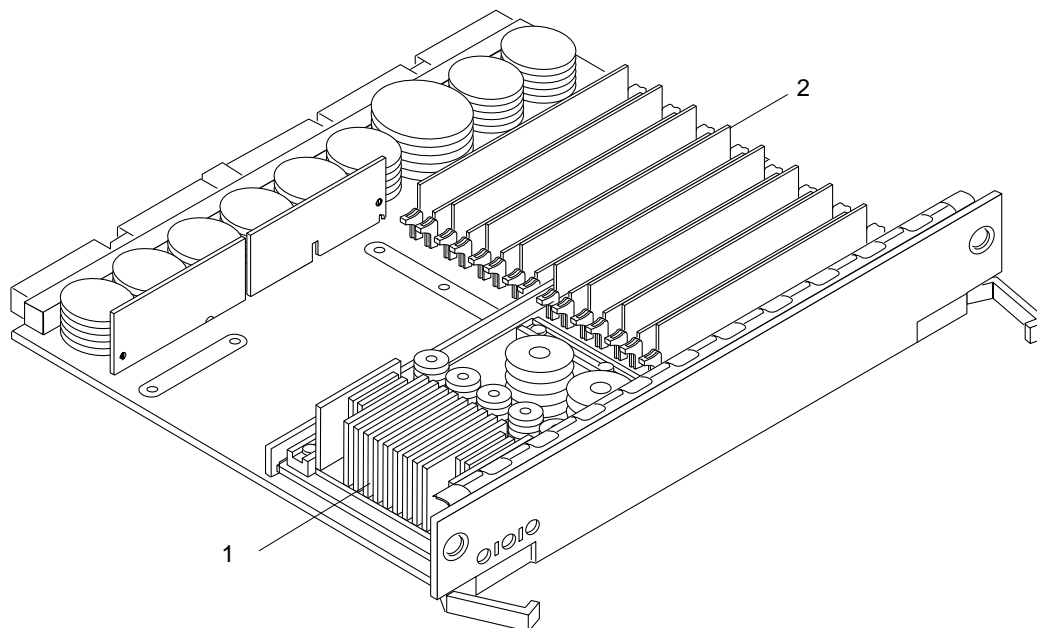
Key	Description	Part Number
	PCM	300-1260

Table F-11 Peripheral Power Supply



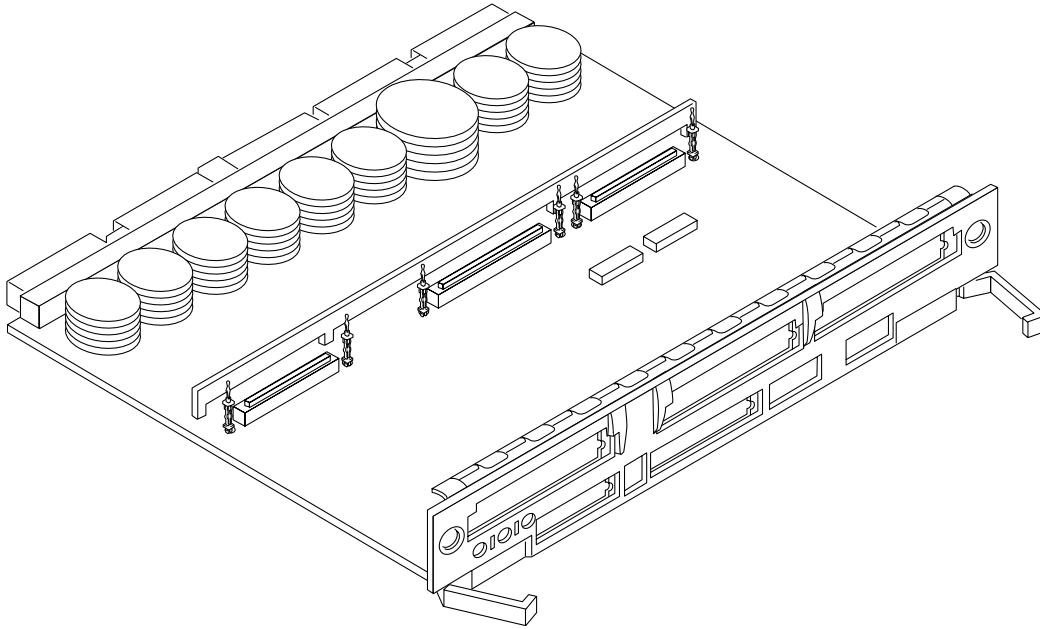
Key	Description	Part Number
	Power supply, peripheral	300-1301

Table F-12 CPU/Memory Board



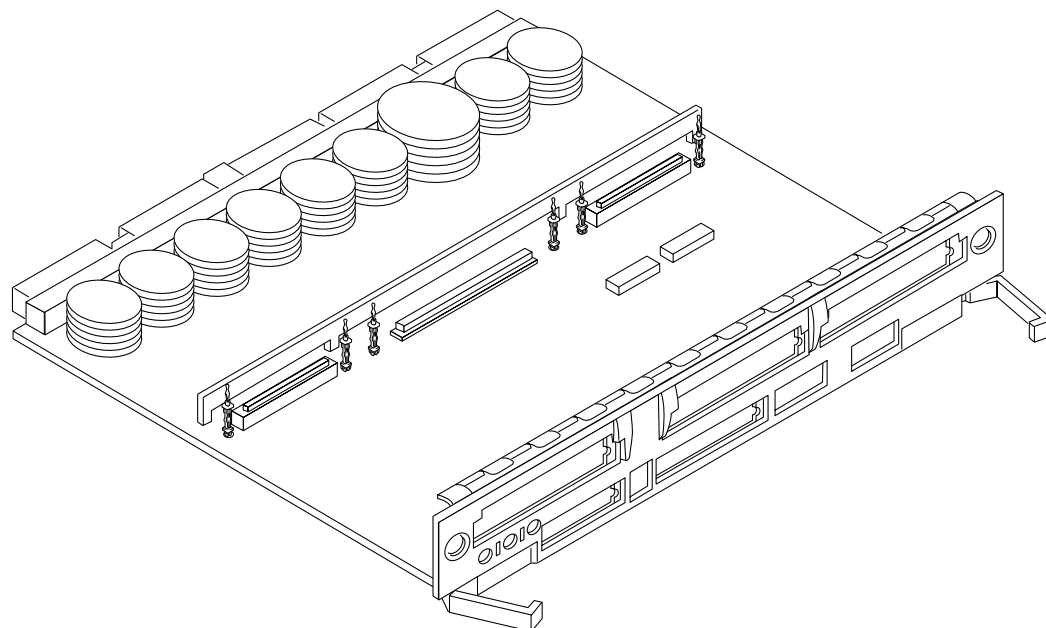
Key	Description	Part Number
	CPU/Memory board assembly	501-2976
1	6 ns, 512 Kbyte CPU module	501-2941
	6 ns, 1Mbyte CPU module	501-2959
	6 ns, 2 Mbyte CPU module	501-2974
2	Assembly, DRAM, 1MX72, JEDEC, SIMM, 60 ns	501-2652
	Assembly, DRAM, 4MX72, JEDEC, SIMM, 60 ns	501-2653
	Assembly, DRAM, 16MX72, JEDEC, SIMM, 60 ns	501-2654

Table F-13 SBus I/O Board Assembly



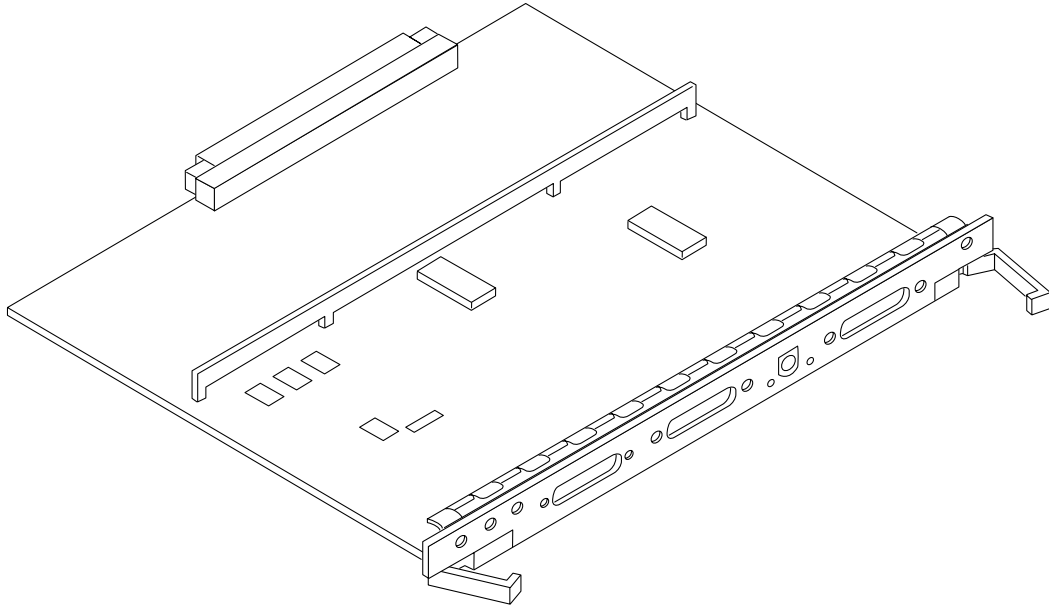
Key	Description	Part Number
	SBus I/O board assembly	501-2977

Table F-14 Graphics I/O Board Assembly



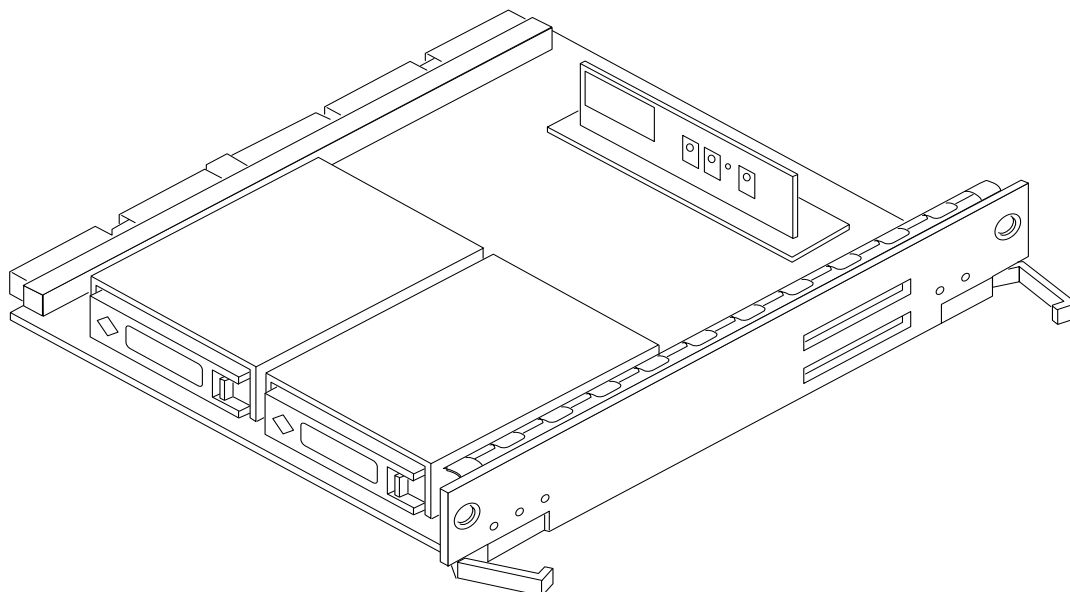
Key	Description	Part Number
	Graphics I/O board assembly	501-2749

Table F-15 Clock Board Assembly



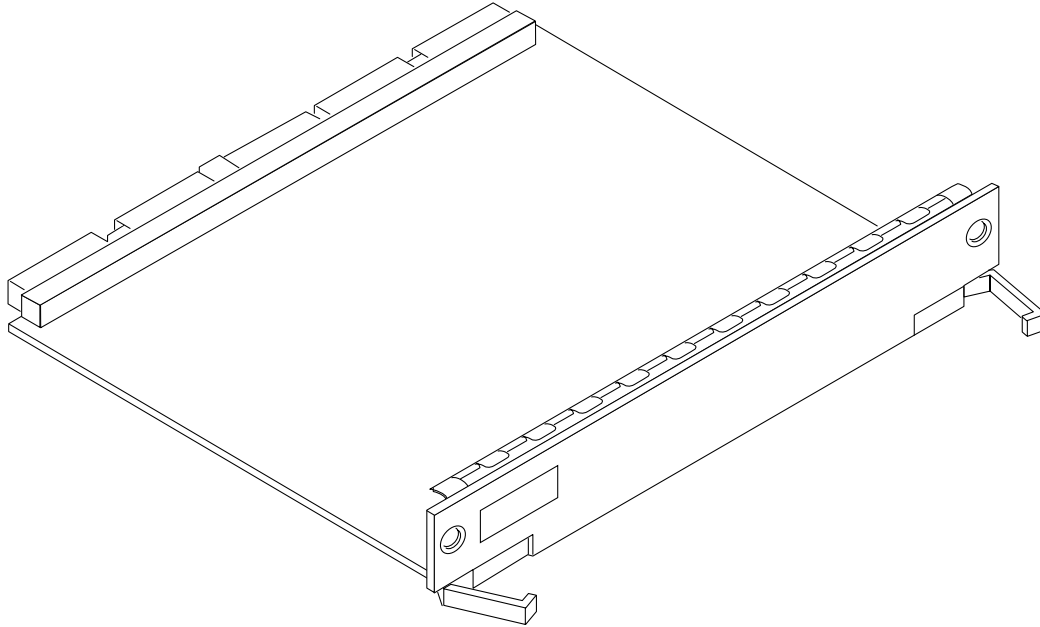
Key	Description	Part Number
	Clock board assembly	501-2975

Table F-16 Disk Board Assembly



Key	Description	Part Number
	Disk board assembly	501-3113

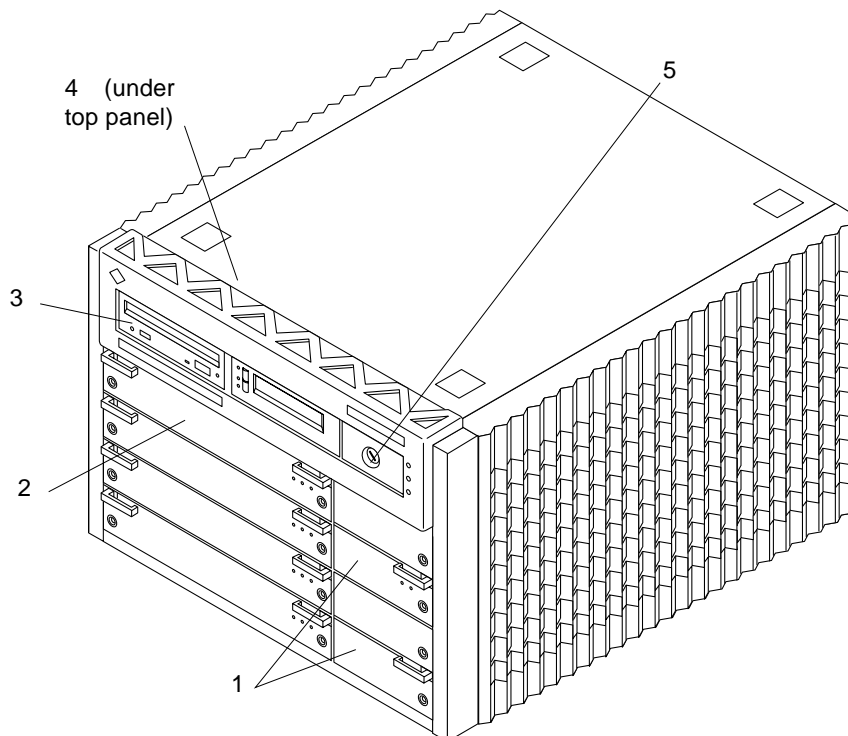
Table F-17 Load Board Assembly



Key	Description	Part Number
	Load board assembly	501-3142

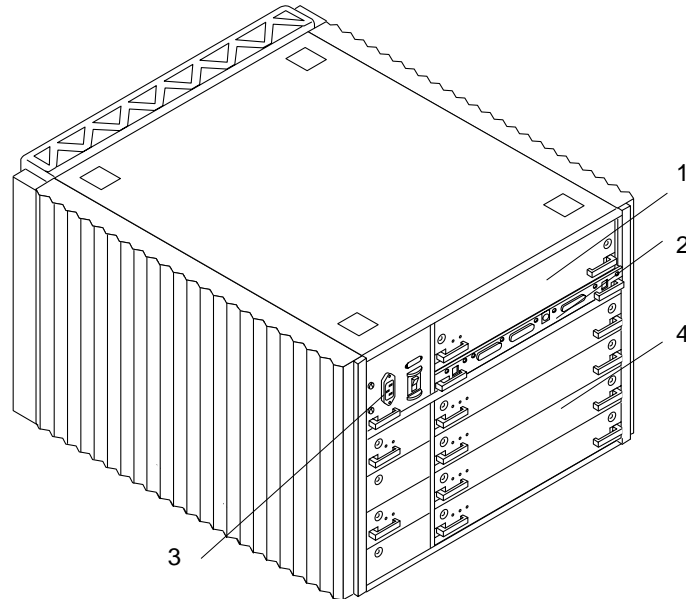
F.2 Enterprise 4000 System

Table F-18 Enterprise 4000 System, Front View



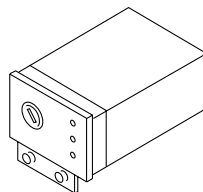
Key	Description	Part Number
1	PCM	300-1260
2	CPU/Memory board	501-2976
3	SunCD 4	370-2203
4	Assembly, SCSI tray, CD/tape drive	540-2587
5	Key switch tray, 8-slot standalone	370-1810

Table F-19 Enterprise 4000 System, Rear View



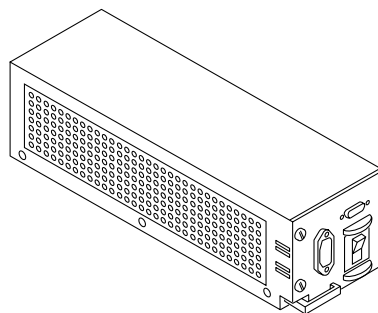
Key	Description	Part Number
1	Power supply, peripheral	300-1301
2	Clock board assembly	501-2975
3	Fan tray assembly, 100/240V	370-1811
4	Graphics I/O board assembly	501-2749

Table F-20 Key Switch Tray

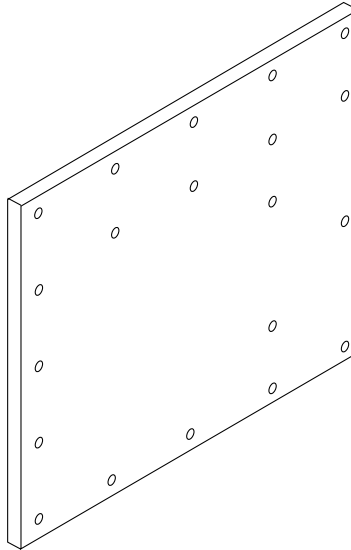


Key	Description	Part Number
1	Key switch tray, 8-slot standalone	370-1810

Table F-21 Fan Tray Assembly

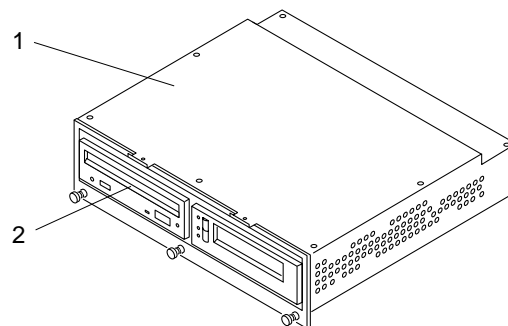


Key	Description	Part Number
1	Fan tray assembly, 100/240V	370-1811

Table F-22 Centerplane Assembly

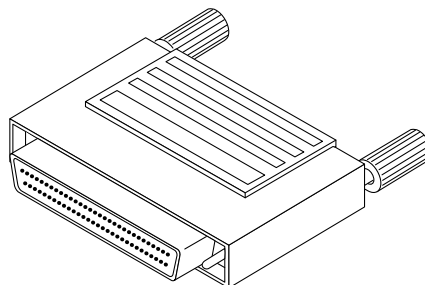
Key	Description	Part Number
1	Centerplane, 8-slot	501-2978

Table F-23 CD-ROM and Tape Devices



Key	Description	Part Number
1	Assembly, SCSI tray, CD/tape drive	540-2587
2	SunCD 4	370-2203

Table F-24 68 Pin Terminator



Key	Description	Part Number
	68 pin terminator	150-2267

Connectors



<i>CPU/Memory Board</i>	<i>page F-2</i>
<i>Centerplane Connector</i>	<i>page F-2</i>
<i>CPU Module Connectors</i>	<i>page F-3</i>
<i>I/O Board</i>	<i>page F-5</i>
<i>Centerplane Connector</i>	<i>page F-7</i>
<i>SBus Connectors</i>	<i>page F-7</i>
<i>UPA Connector Location</i>	<i>page F-8</i>
<i>Ethernet Connector (TPE)</i>	<i>page F-9</i>
<i>MII Connector</i>	<i>page F-9</i>
<i>Fiber Interface Connectors</i>	<i>page F-10</i>
<i>SCSI Connector</i>	<i>page F-11</i>
<i>Disk Board</i>	<i>page F-11</i>
<i>Centerplane Connector</i>	<i>page F-12</i>
<i>SCSI In Connector</i>	<i>page F-12</i>
<i>SCSI Out Connector</i>	<i>page F-13</i>
<i>Clock Board</i>	<i>page F-13</i>
<i>Centerplane Connector</i>	<i>page F-14</i>
<i>Serial Port Connectors</i>	<i>page F-14</i>
<i>Keyboard and Mouse Connector</i>	<i>page F-15</i>

F.1 CPU/Memory Board

Figure F-1 shows the locations of the centerplane and CPU module connectors for the CPU/Memory board.

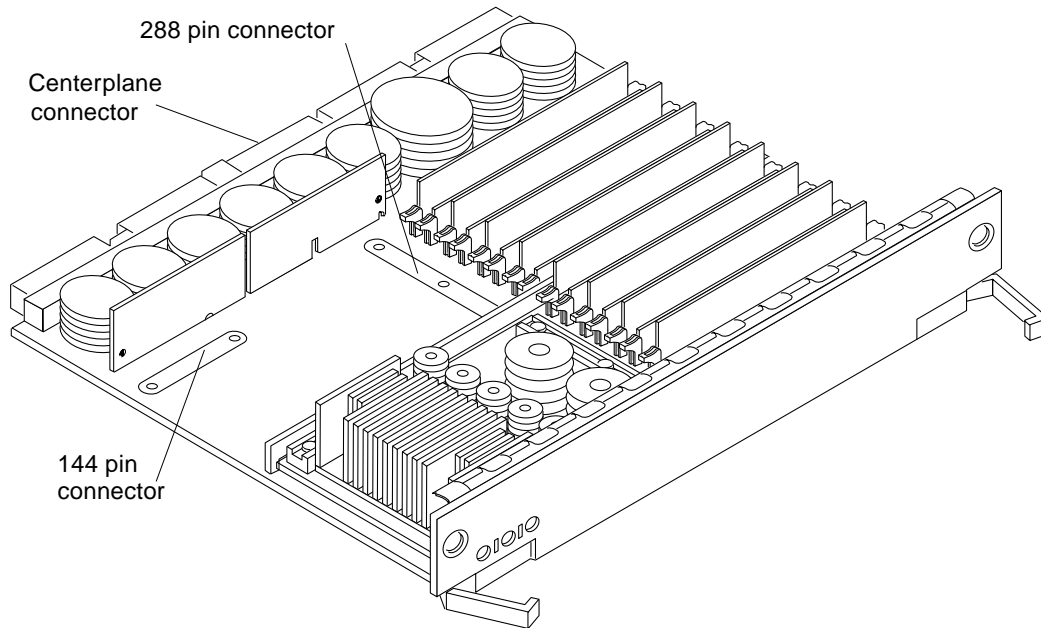


Figure F-1 CPU/Memory Board Connector Locations

F.1.1 Centerplane Connector

Note – Information for the CPU/Memory board centerplane connector also applies to the I/O and disk board centerplane connectors.

The CPU/Memory board centerplane connector is mounted on the rear of the board, opposite the side of the board with the LED display and extraction levers. See Figure F-2. The connector is comprised of modular sections, each with its own set of receptacle pins. See Figure F-3.

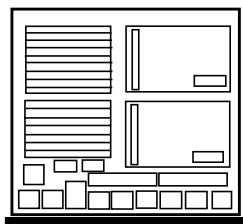


Figure F-2 CPU/Memory Board Centerplane Connector Location

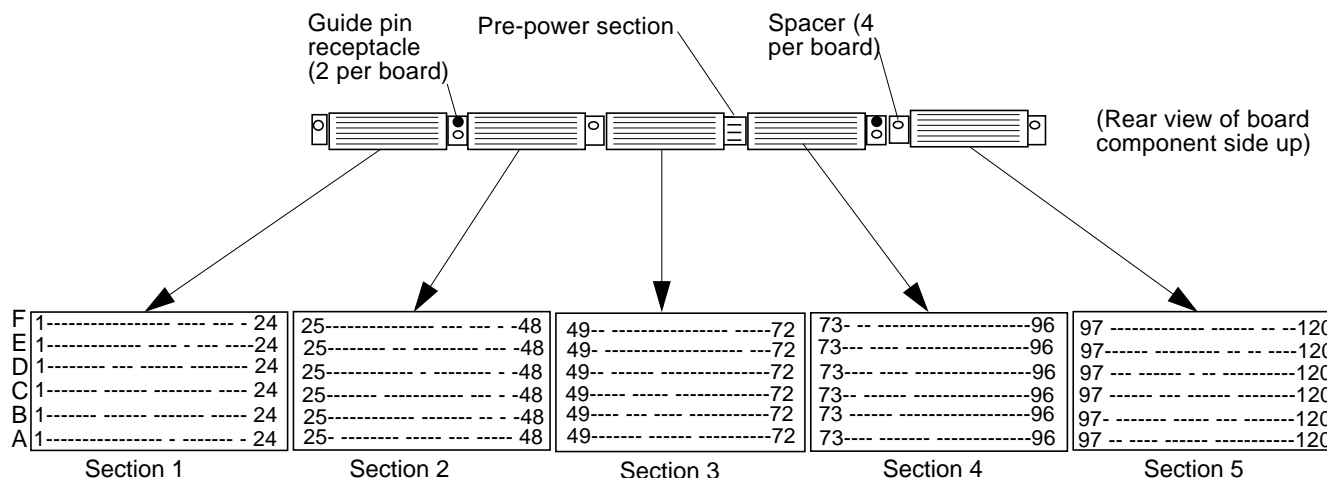


Figure F-3 Centerplane Connector Detail

A three-bladed power section results in 12 pins on the board. There are six, 120 pin rows, labeled A through F, spread across the remaining five sections; each section has 24 pins of each 120 pin row.

F.1.2 CPU Module Connectors

There are two connectors for each CPU module, one with 144 pins and the other with 288 pins. See Figure F-4 through Figure F-6.

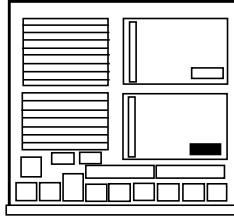


Figure F-4 CPU Module 0 Connector (144 Pin) Location

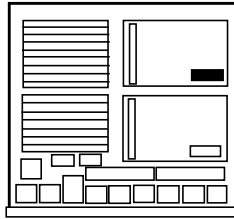


Figure F-5 CPU Module 1 Connector (144 Pin) Location

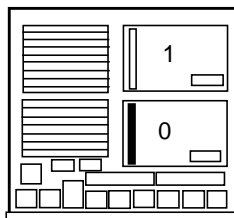


Figure F-6 CPU Module 0 Connector (288 Pin) Location

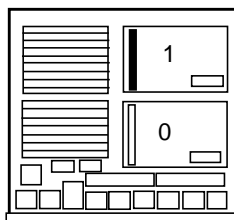


Figure F-7 CPU Module 1 Connector (288 Pin) Location

F.2 I/O Board

Figure F-8 and Figure F-9 show the locations of the connectors on the SBus I/O and Graphics I/O boards.

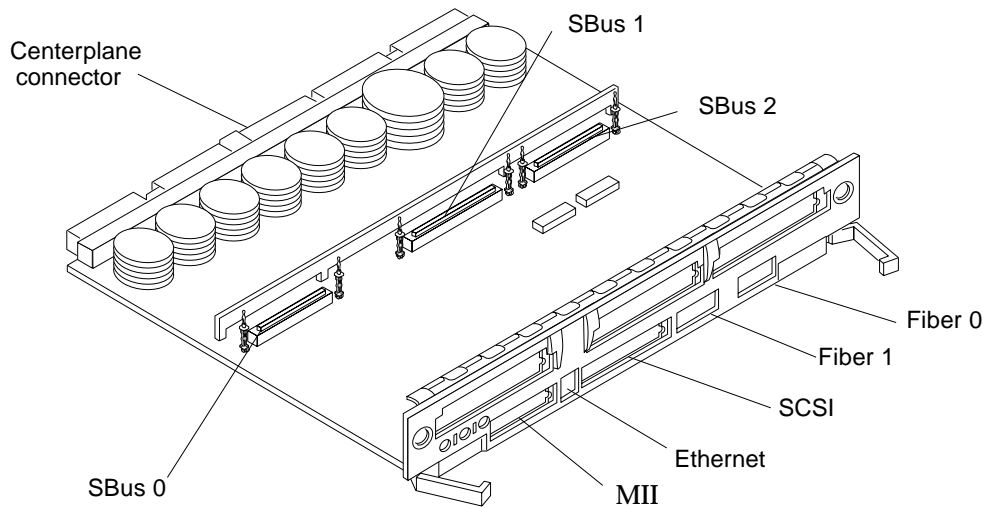


Figure F-8 SBus I/O Board Connector Locations

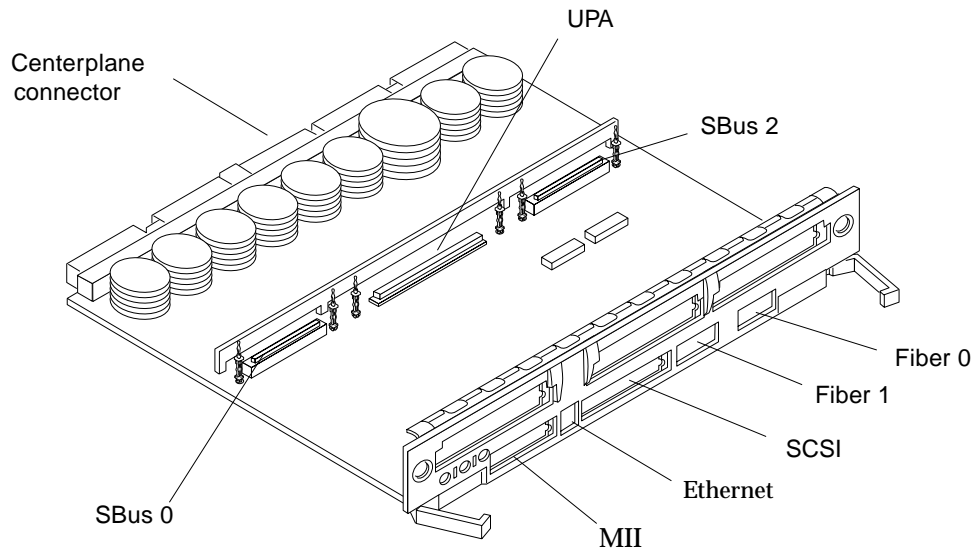


Figure F-9 Graphics I/O Board Connector Location

F.2.1 Centerplane Connector

See Section F.1.1, “Centerplane Connector,” on page F-2. Information for the CPU/Memory board centerplane and the I/O boards centerplane is the same.

F.2.2 SBus Connectors

The SBus I/O board has three SBus connectors (SBus 0, 1, and 2). The Graphics I/O board has two (SBus 0 and 2). See Figure F-10, Figure F-11, and Figure F-12.

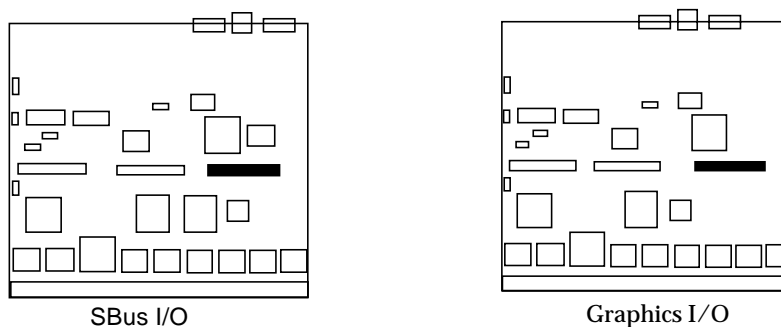


Figure F-10 I/O Board SBus 0 Connector Locations

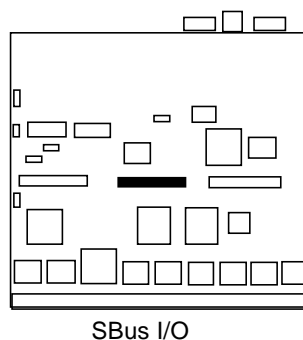


Figure F-11 I/O Board SBus 1 Connector Location

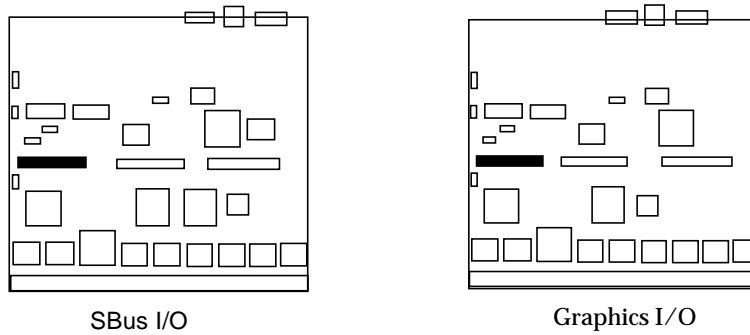


Figure F-12 I/O Board SBus 2 Connector Locations

F.2.3 UPA Connector Location

The Graphics I/O board has one UPA connector.

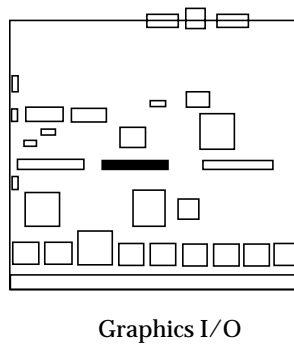


Figure F-13 Graphics I/O Board UPA Connector Location

F.2.4 Ethernet Connector (TPE)

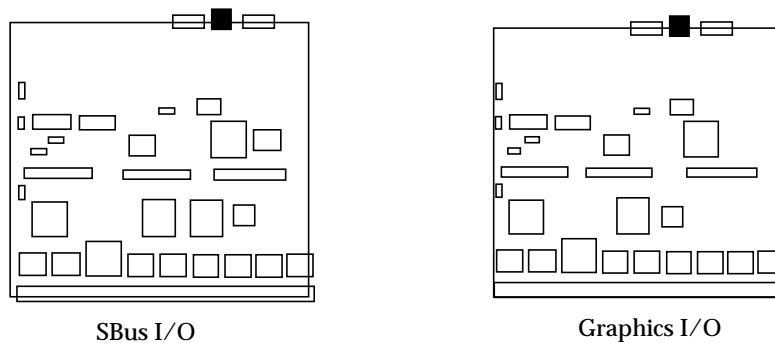


Figure F-14 I/O Board Ethernet Connector Locations

F.2.5 MII Connector

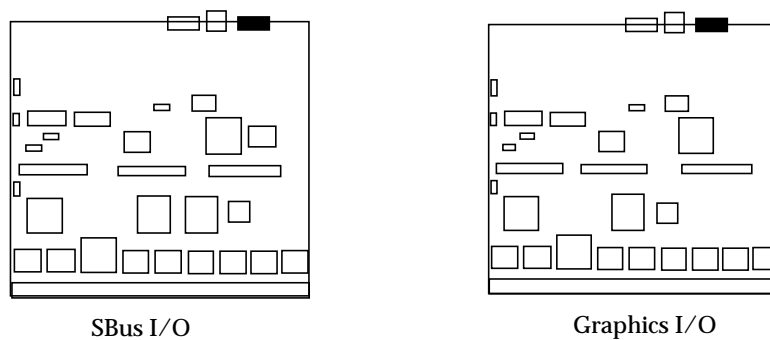
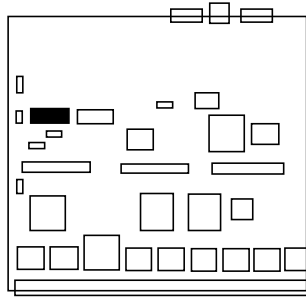
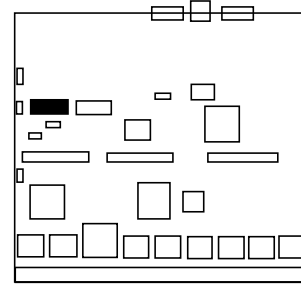


Figure F-15 I/O Board MII Connector Locations

F.2.6 Fiber Interface Connectors

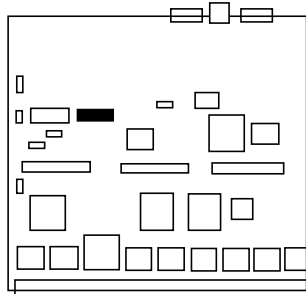


SBus I/O

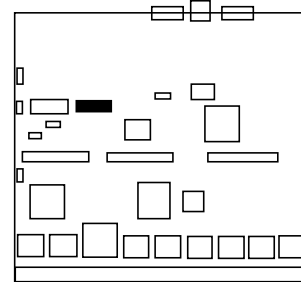


Graphics I/O

Figure F-16 I/O Board Fiber 0 Interface Connector Locations



SBus I/O



Graphics I/O

Figure F-17 I/O Board Fiber 1 Interface Connector Locations

F.2.7 SCSI Connector

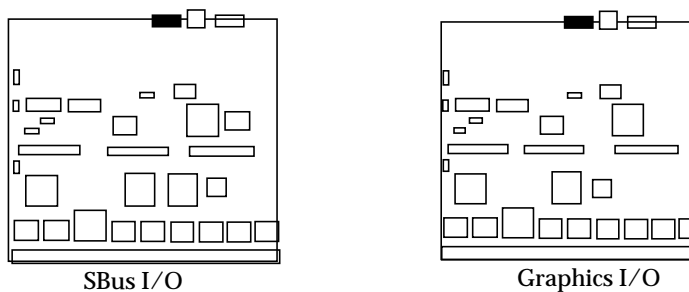


Figure F-18 I/O Board SCSI Connector Locations

F.3 Disk Board

Figure F-19 shows the locations of the connectors on the Disk board.

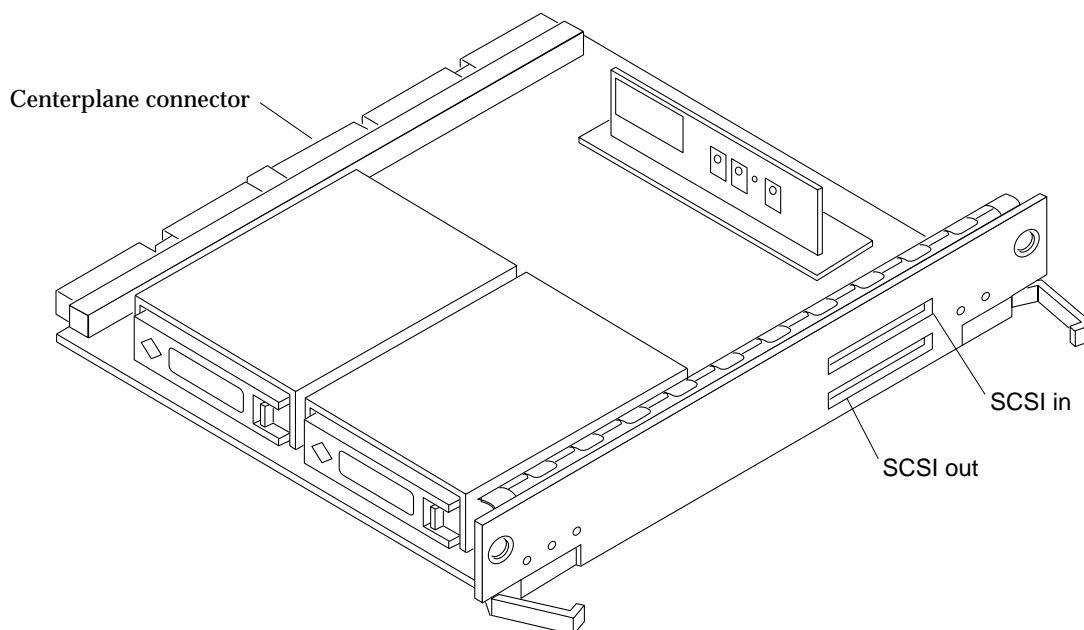


Figure F-19 Disk Board Connector Locations

F.3.1 Centerplane Connector

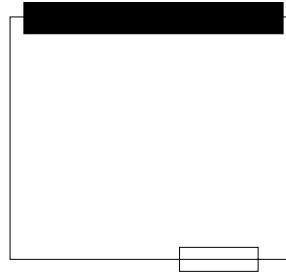


Figure F-20 Disk Board Centerplane Connector Location

F.3.2 SCSI In Connector

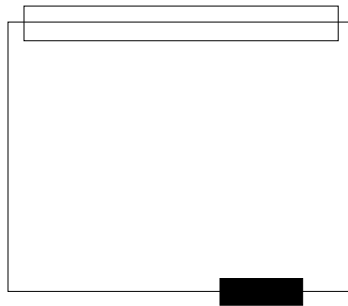


Figure F-21 Disk Board SCSI In Connector Location (Upper)

F.3.3 SCSI Out Connector

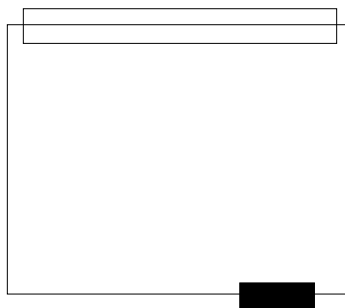


Figure F-22 Disk Board SCSI Out Connector Location (Lower)

F.4 Clock Board

Figure F-23 shows the clock board connector locations.

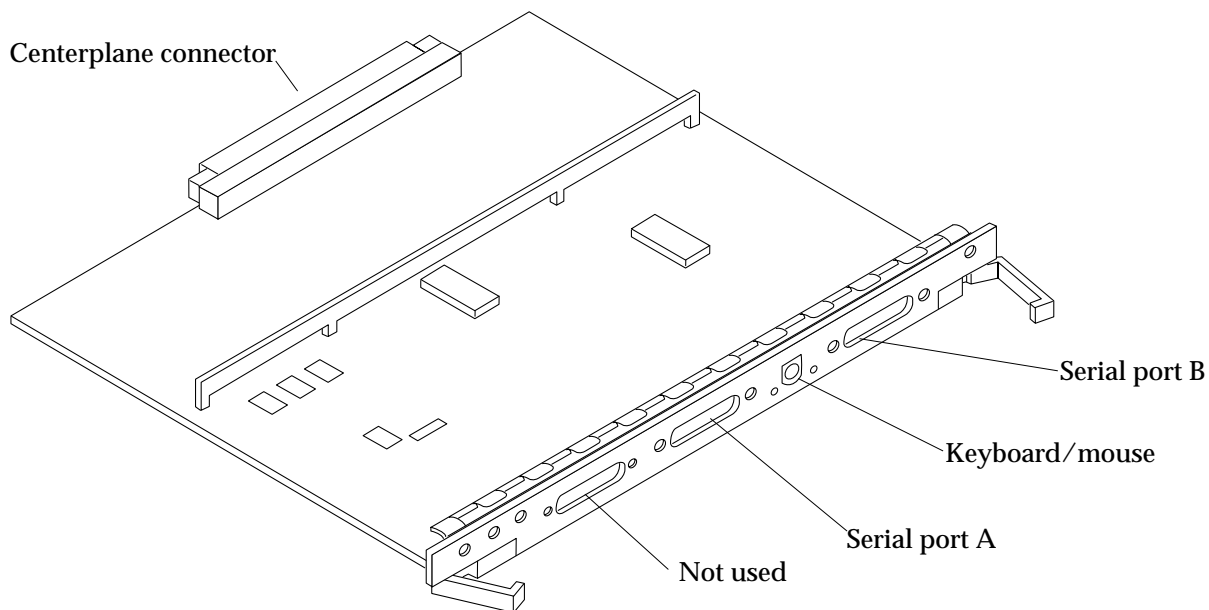


Figure F-23 Clock Board Connector Locations

F.4.1 Centerplane Connector

The clock board centerplane connector interfaces the board to the system. The connector is divided into six rows of pins labeled A through F; each row has 72 pins.



Figure F-24 Clock Board Centerplane Connector Location

F.4.2 Serial Port Connectors

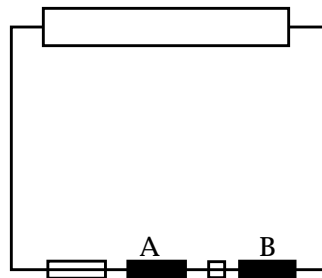


Figure F-25 Clock Board Serial Port Connectors Locations

		1			1
	14	2	TXDA		14
DBA	15	3	RXDA	DBB	15
	16	4	RTSA		16
DDA	17	5	CTSA	DDB	17
	18	6	DSRA		18
	19	7	GND		19
DTRA	20	8	DCDA	DTRB	20
	21	9			21
	22	10			22
	23	11			23
DAA	24	12		DAB	24
	25	13			25

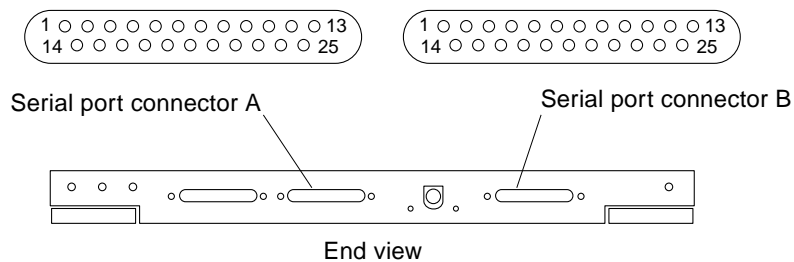


Figure F-26 Serial Port A and B Connector Pinouts

F.4.3 Keyboard and Mouse Connector

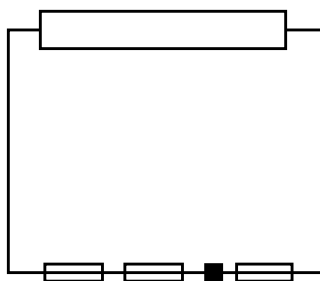


Figure F-27 Clock Board Keyboard/Mouse Connector Location

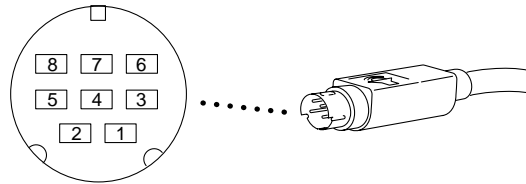


Figure F-28 Keyboard and Mouse Connector Pinouts

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