

# Sun™ Ultra™ 450 Workstation Owner's Guide

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THE NETWORK IS THE COMPUTER™

## **Sun Microsystems Computer Company**

A Sun Microsystems, Inc. Business  
2550 Garcia Avenue  
Mountain View, CA 94043 USA  
415 960-1300 fax 415 969-9131

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Your Sun product is marked to indicate its compliance class:

- Federal Communications Commission (FCC) — USA
- Department of Communications (DOC) — Canada
- Voluntary Control Council for Interference (VCCI) — Japan

Please read the appropriate section that corresponds to the marking on your Sun product before attempting to install the product.



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For important safety precautions to follow when installing or servicing this system, please see “Safety Precautions” on page 447.

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## FCC Class A Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

**Note:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

**Shielded Cables:** Connections between the workstation and peripherals must be made using shielded cables in order to maintain compliance with FCC radio frequency emission limits. Networking connections can be made using unshielded twisted-pair (UTP) cables.

**Modifications:** Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

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1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

**Shielded Cables:** Connections between the workstation and peripherals must be made using shielded cables in order to maintain compliance with FCC radio frequency emission limits. Networking connections can be made using unshielded twisted pair (UTP) cables.

**Modifications:** Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

## DOC Class A Notice - Avis DOC, Classe A

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.  
Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## VCCI 基準について


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# Declaration of Conformity

Compliance ID: Q36  
Product Name: Ultra Enterprise 450, Ultra 450 Creator, and Ultra 450 Creator3D families

## EMC

USA – FCC Class B

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This equipment may not cause harmful interference.
2. This equipment must accept any interference that may cause undesired operation.

## European Union

This equipment complies with the following requirements of the EMC Directive 89/336/EEC:

EN55022 / CISPR22 (1985)		Class B	Integrity Design & Test Services, Inc. Report Nos: 61419.E2, 61233.E3
EN50082-1	IEC801-2 (1991)	8 kV (Direct), 15 kV (Air)	
	IEC801-3 (1984)	10 V/m, 80% AM at 1KHz	
	IEC801-4 (1988)	4.0 kV Power Lines, 1 kV Signal Lines	
	IEC801-5	2 kV Power Lines (L-L, L-G) 1 kV Signal Lines (L-G, Shield-G)	
EN61000-3-2/IEC1000-3-2 (1994)		Pass	

## Safety

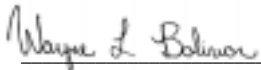
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EC Type Examination Certificates:

EN60950/IEC950 (1993)	TUV Rheinland Certificate # S9771525
EN60950 w/ Nordic Deviations	CB Scheme Certificate # (pending)

## Supplementary Information

This product was tested and complies with all the requirements for the CE Mark.

  
\_\_\_\_\_  
Wayne L. Bolivar                      4/10/97  
Manager, Qualification Engineering                      DATE  
Sun Microsystems Computer Company  
4 Omni Way UCHL04-203  
Chelmsford, MA 01824 USA  
Tel: (508) 442-0599  
Fax: (508) 250-5059

  
\_\_\_\_\_  
John Shades                      4/10/97  
Quality Assurance Manager                      DATE  
Sun Microsystems Limited  
Springfield, Linlithgow  
West Lothian, EH49 7LR  
Scotland, United Kingdom  
Tel: 1506 670000  
Fax: 1506 672323



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**Caution** - Before installing internal options in your system, you must verify that the power requirements of the upgraded system do not exceed the maximum current limit for a 15-amp power outlet (North America only). See "How to Determine System Power Requirements" on page 84 for additional information.

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# Preface

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*Sun Ultra 450 Workstation Owner's Guide* answers your questions about setting up and running the Sun™ Ultra™ 450 workstation. Features and options, installation, troubleshooting, parts replacement, and network administration information for the Sun Ultra 450 workstation are covered in this manual.

This manual presents information in a modular format designed to answer the type of questions that you might ask while installing, configuring, and using the Sun Ultra 450 workstation. Look at the titles of the modules and you'll find the cue words that direct you to the categories of questions and answers, such as:

- How to . . . How do I do something?
- About . . . Is there more information about this topic?
- Locating . . . Where can I find something on the system?
- What If . . . What if I were to do this, or what if this were to happen?
- Reference for . . . Where can I find reference material for something?

You determine how much or how little of the information you need to read.

Using the table of contents or the task list on the first page of each chapter, you can quickly find a specific topic or task. The information modules are brief; however, they are interrelated and refer to other modules that you may want to read. For instance, if you're installing a memory module and you're already familiar with the task, you could go to "How to Install a Memory Module" and follow the four steps. But if you need more background information before performing the task, you should first read "About Memory."

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# Using UNIX Commands

This document may not contain information on basic UNIX<sup>®</sup> commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:

- *Solaris 2.x Handbook for SMCC Peripherals*
- AnswerBook<sup>™</sup> online documentation for the Solaris<sup>™</sup> 2.x software environment
- Other software documentation that you received with your system

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# 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	<i>machine_name%</i>
C shell superuser	<i>machine_name#</i>
Bourne shell and Korn shell	\$
Bourne shell and Korn shell superuser	#



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# Conventions

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

Typeface or Symbol	Meaning	Examples
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. % You have mail.
<b>AaBbCc123</b>	What you type, when contrasted with on-screen computer output.	% <b>su</b> Password:
<i>AaBbCc123</i>	Book titles, new words or terms, words to be emphasized. Command-line variable; replace with a real name or value.	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be <i>root</i> to do this. To delete a file, type <code>rm filename</code> .

The table below provides definitions of the terms “left” and “right” as used in this book.

Term	Meaning
Left	The side to your left as you face the front of the system; the side that contains the system's main logic board.
Right	The side to your right as you face the front of the system; the side that contains the disk backplanes and power supplies.

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## Related Documents

The following documents contain topics that relate to the information in the *Sun Ultra 450 Workstation Owner's Guide*.

Application	Title
Performing diagnostic tests	<i>SunVTS User's Guide</i>
	<i>SunVTS Quick Reference Card</i>
	<i>SunVTS Test Reference Manual</i>
System and network administration	<i>Solaris System Administrator AnswerBook</i>
	<i>SPARC: Installing Solaris Software</i>
Using operating system software	<i>Solaris User's Guide</i>
Miscellaneous	<i>Solaris on Sun Hardware AnswerBook</i>
	<i>Solaris 2.x Handbook for SMCC Peripherals</i>
	<i>SMCC SPARC Hardware Platform Guide</i>

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## Cautions



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**Caution** – This equipment contains lethal voltage. Accidental contact can result in serious injury or death.

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**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.

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**Caution** – Use proper electrostatic discharge (ESD) grounding techniques when handling components. Wear an antistatic wriststrap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

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Individuals servicing this equipment must observe all safety precautions and ensure compliance with skill level requirements, certification, and all applicable local and national laws.

Some procedures in this document must be performed by trained maintenance providers. Only people who have been trained at the Sun Microsystems™ training facilities (or by Sun Microsystems affiliates) and have been certified as required by local and national laws are considered qualified.

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Japan	0120-33-9096	0120-33-9097
Luxembourg	32-2-720-09-09	32-2-725-88-50
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# System Overview

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This chapter introduces you to the Sun Ultra 450 workstation and explains some of its features. Information covered in this chapter includes:

- *About the Sun Ultra 450 Workstation—page 2*
- *Locating Front Panel Features—page 5*
- *Locating Rear Panel Features—page 7*
- *About the Status and Control Panel—page 9*

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# About the Sun Ultra 450 Workstation

The Sun Ultra 450 workstation is a high-performance, symmetric-multiprocessing workstation. It offers multiple processors, a clear CPU upgrade path, PCI-based I/O performance and expandability, high-performance graphics, and a large internal storage capacity.

The system is housed in a roll-around tower enclosure which measures 58.1 cm high, 44.8 cm wide, and 69.6 cm deep (22.9 inches x 17.7 inches x 27.4 inches). The system has a maximum weight of 94 Kg (205 lbs).

Processing power is provided by up to four modular UltraSPARC™ II CPUs, each of which comes with 1 Mbyte or 2 Mbytes of local high-speed external cache memory. The UltraSPARC II CPU supports both 2-D and 3-D graphics as well as image processing, video compression and decompression, and video effects through the sophisticated Visual Instruction Set (VIS). VIS provides high levels of multimedia performance, including real-time H.261 video compression/decompression and two streams of MPEG-2 decompression at full broadcast quality with no additional hardware support. For more information about CPU modules, see “About CPU Modules” on page 53.

System main memory is provided by up to sixteen memory DIMM modules, each of which is capable of storing 16, 32, 64, 128, or 256 Mbytes of data. Total main memory is expandable up to 4 Gigabytes. To enhance memory I/O performance, the system transfers 64 bytes of data into or from memory on each memory transfer. The system also implements up to four-way memory interleaving, which can significantly reduce the system’s average memory access time. For more information about system memory and interleaving, see “About Memory” on page 50.

System I/O is handled by six separate Peripheral Component Interconnect (PCI) buses. These industry standard buses support all main logic board I/O and up to ten PCI interface cards. Three PCI buses operate at 33-MHz clock rates, while the remaining three buses can operate at either 33 MHz or 66 MHz. Individual PCI buses are capable of sustained throughput of 200 Mbytes per second, and together they give the system over 600-Mbytes per second of total I/O throughput. All PCI cards plug into slots provided on the system’s main logic board. For more information about PCI buses, see “About Peripheral Component Interconnect (PCI) Buses” on page 57.

Internal disk storage is provided by up to twenty low profile (1-inch high), 3.5-inch wide, UltraSCSI disk drives. The first four drives are supported by a 40-Mbyte per second UltraSCSI interface provided directly on the system’s main logic board. Additional drives can be supported by installing one or two 8-bay storage expansion options. Each option kit provides an 8-slot disk backplane, a dual-channel UltraSCSI PCI adapter card, and all required interconnecting cables. With two 8-bay storage

expansion options installed, the system operates five separate 40-Mbyte per second UltraSCSI buses, each supporting data transfers to and from four internal disks. For more information about disk storage, see “About Internal Disk Drives” on page 63.

External multi-disk storage subsystems and RAID storage arrays can be supported by installing single-channel or multi-channel PCI host adapter cards along with the appropriate system software. Software drivers supporting SCSI and other types of devices are included in the Solaris™ operating environment.

Two 5.25-inch half-height (1.6-inch) bays are provided at the front of the system, which may be used to house optional narrow SCSI (50-pin) devices, such as a 12x CD-ROM drive, an 8-mm tape drive, a 4-mm DDS-2 or DDS-3 tape drive, or a quarter-inch cassette tape drive. A 1.44-Mbyte, 3.5-inch diskette drive is included as a standard feature on the system.

Up to two external tape devices can be attached to the standard 68-pin Fast/Wide SCSI port provided on the system’s rear panel. Additional external tape devices can be supported with appropriate PCI host adapter cards.

The Sun Ultra 450 workstation can easily be connected to either a 10-Mbps or a 100-Mbps Ethernet by means of an auto-sensing Ethernet interface provided on the system’s main logic board. Additional Ethernet interfaces or connections to other networks, such as FDDI, ATM, or token ring, can be provided by installing the appropriate PCI interface cards. For more information, see “Administration and Networking” on page 341.

The system supports up to two high performance Creator-series graphics cards for 24-bit true color, high-resolution graphics, with acceleration for imaging, multimedia, and 2-D graphics applications. The Creator3D graphics card also includes double-buffering and Z-buffer support for accelerating 3-D solids and animation applications. For additional details, see “About UPA Graphics Cards” on page 60.

The Sun Ultra 450 workstation provides two serial communications ports, one synchronous/asynchronous port and one asynchronous-only port, through a single, shared DB-25 connector located on the rear panel. It also provides one external, 2-Mbyte per second, bidirectional, Centronics-compatible, EPP parallel port for connecting the system to a local printer or other compatible parallel device.

Power is provided by one or two 560-watt power supplies. Up to three of these modular units can be installed, providing both N+1 redundancy and full hot swap capability. For more information about the power supplies, see “About Power Supplies” on page 66.

The Sun Ultra 450 workstation is Energy Star-compliant, with the ability to shut down automatically after a predefined period of inactivity. The checkpoint-and-resume capability of the Solaris operating environment allows users to quickly resume work in progress after the shutdown.

System reliability, availability, and serviceability are enhanced by features that include:

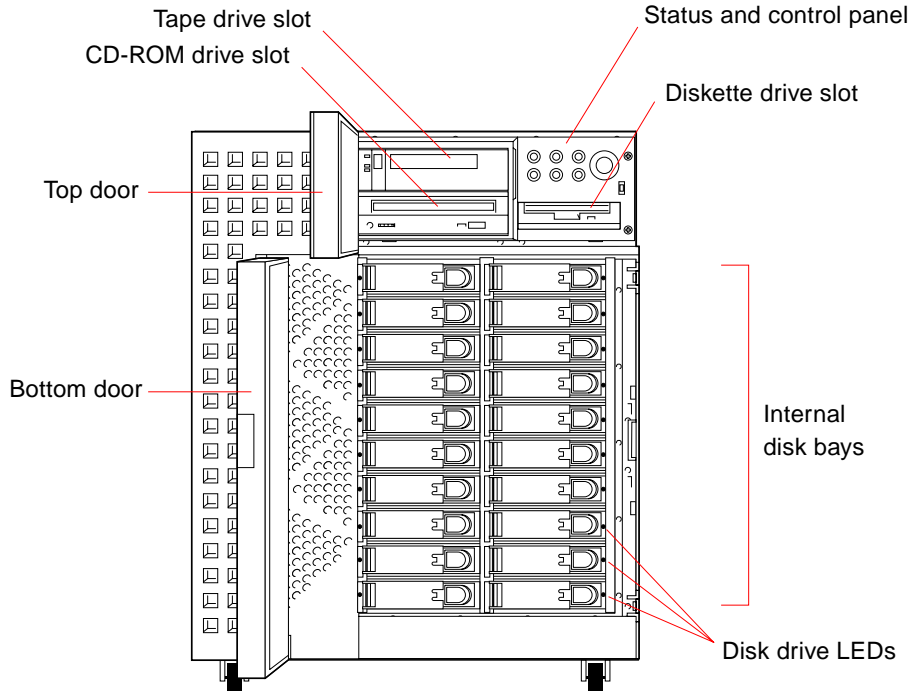
- Error correcting code on memory and all data paths
- Parity checking on all address buses
- Front panel status indicator lights
- Disk drive health indicator lights
- Hot-pluggable disk drives with easy front access
- Support for RAID 0, 1, and 5 implementations
- Thermal sensing and over-temperature protection
- Power system monitoring and fault protection
- N+1 power supply redundancy
- Hot swap power supplies with easy rear access
- Automatic system recovery
- Three levels of system diagnostics
- Easy side access to all internal replaceable components



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# Locating Front Panel Features

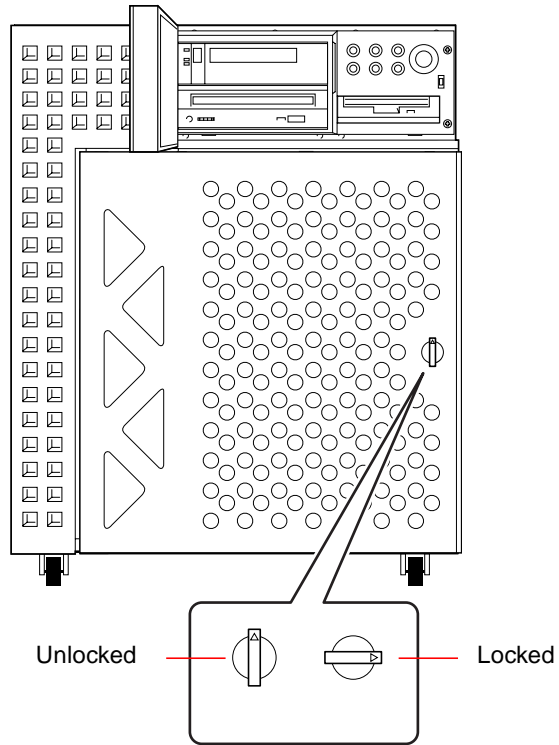
The illustration below shows the system features that are accessible from the front panel with the top and bottom doors open.



For more information about front panel controls and indicators, see “About the Status and Control Panel” on page 9.

Access to the system’s internal storage devices is through two hinged doors at the front of the system. The top door provides access to the removable media devices and the status and control panel. All of the front panel status indicators are visible through windows in this door. The bottom door provides access to the system’s internal disk drives and features a key lock for added security.

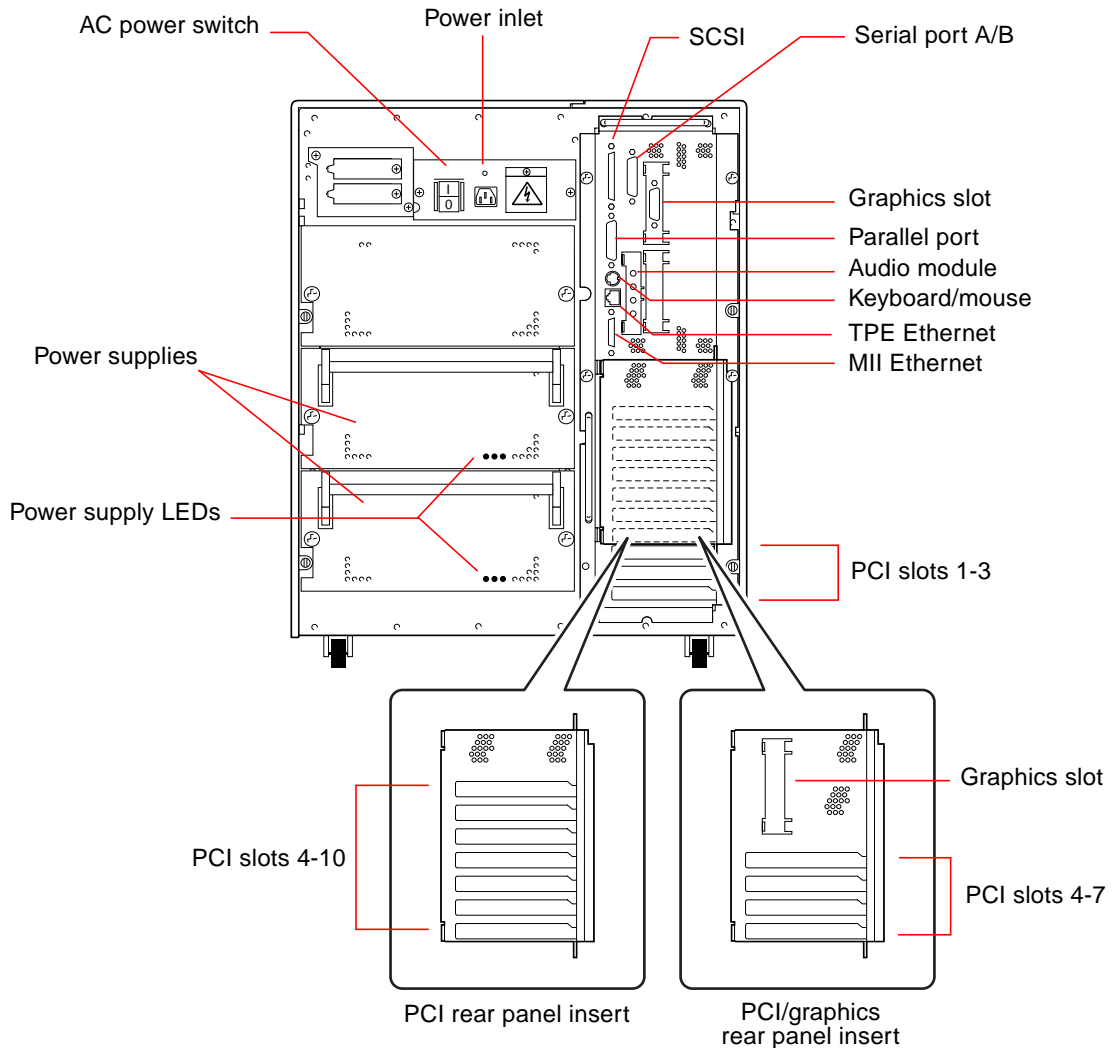
When the key is in the vertical position, the door is unlocked. Make sure that the key is in this position before you close the door. To lock the door, simply turn the key 90 degrees clockwise and remove the key.



---

# Locating Rear Panel Features

The illustration shows system features that are accessible from the rear panel. The system can either have a PCI rear panel insert or a PCI/graphics rear panel insert. The PCI insert is standard with the system and provides seven PCI slots, for a total of ten PCI slots. The PCI/graphics insert provides the slot for a second UPA graphics card and four PCI slots, for a total of seven PCI slots.



Power supplies and the main AC power switch are accessible from the system rear panel. Each power supply has three LED indicators for displaying power status and fault conditions.

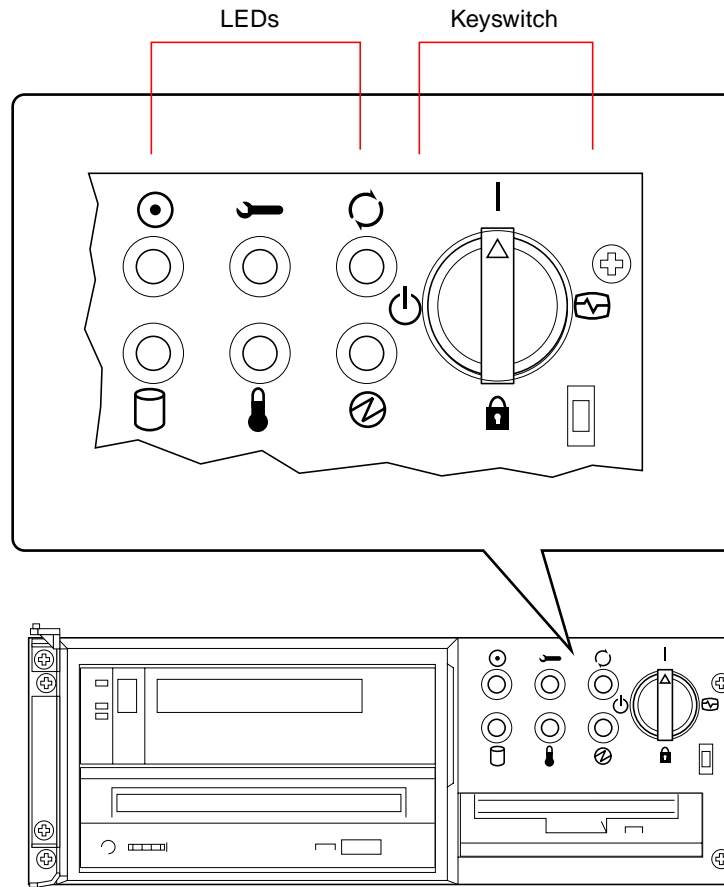
A sturdy rear panel security device prevents unauthorized removal of power supplies, the main logic board, and all main logic board components. For instructions on installing the device, see “How to Install the Rear Panel Security Device” on page 20.

---

# About the Status and Control Panel

The status and control panel includes six LED indicators and a security keyswitch. The panel is located at the top right on the front panel of the system, as shown in “Locating Front Panel Features” on page 5.







The LED indicators can be viewed when the top door is open or closed. The keyswitch is only accessible when the top door is open. The following figure shows the status and control panel with the top door open.







The LEDs consist of two types: system health indicators and fault indicators. The system health indicators light to show you that the system is functioning normally. The fault indicators light when a problem is detected in the system. Because it is

important for you to know that a fault exists in the system, the fault indicators remain lit when the system is reset or switched to standby mode using the keyswitch.

When the system is first powered on, the LEDs are individually toggled on and off to verify that each one is working correctly. After that, the LEDs operate as described in the following table.

Name	Icon	Description
Power-on		This green LED lights steadily when the system power is on and the keyswitch is in the On, Diagnostics, or Locked position.
General fault		This yellow LED blinks slowly while the system runs its power-on self-test (POST) diagnostics and blinks rapidly during OpenBoot diagnostics (OBdiag) tests. It lights steadily when any fault is detected (including a fault also reported by any other LED).
Activity		This green LED lights steadily to indicate that the system is operating normally.
Disk fault		This yellow LED lights steadily to indicate a fault in one of the hard disk drives. When this LED is lit, one or more disk LEDs may also be lit, indicating the source of the fault.
Temperature Fault		This yellow LED lights steadily to indicate an over-temperature condition in the system or a faulty fan assembly.
Power supply fault		This yellow LED lights steadily to indicate a fault in one of the power supplies. When this LED is lit, LEDs on the rear of each power supply will indicate the source of the fault.

Before you turn on the main AC power switch on the rear panel, make sure that the front panel keyswitch is in the Standby position; see “How to Power On the System” on page 28. After that, you can use the keyswitch setting to affect the power-on mode of the system. The following table describes the function of each switch setting.

Name	Icon	Description
Power-On		Turns the system power on if the main AC power switch on the rear panel is also turned on.
Diagnostics		Turns the system power on and runs power-on self-test (POST) and OpenBoot diagnostics (OBDDiag).  Turn the switch to this setting when you want to run POST and OBDDiag at power-up. For more information on POST and OBDDiag, see “About Diagnostic Tools” on page 386.
Locked		Turns the system power on and disables the keyboard <code>Stop-a</code> command and terminal <code>Break</code> key command. This prevents users from suspending system operation and accessing the system <code>ok</code> prompt in order to modify OpenBoot configuration parameters stored in the system’s nonvolatile memory.  This setting also prevents unauthorized programming of the system flash PROM. For additional details, see “About Flash PROM Jumpers” on page 75.
Standby		Places the system in standby mode by turning off power to all internal system components except for the power supplies and AC line filter assembly. When the keyswitch is in this position, the keyboard power switch is disabled.  To power off the system completely, use the AC power switch located on the rear panel. See “How to Power Off the System” on page 26.





## System Setup

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This chapter explains how to attach all cords and cables needed to get the machine up and running. Where software is involved, this chapter explains some of what you need to do, and points you to the appropriate software manuals for the rest.

*Tasks covered in this chapter include:*

- *How to Install the Sun Ultra 450 Workstation—page 15*
- *How to Install the Rear Panel Security Device—page 20*
- *How to Attach an Alphanumeric Terminal—page 24*

*Other information covered in this chapter includes:*

- *About the Parts Shipped to You—page 14*
- *About Setting Up a Console—page 23*

---

## About the Parts Shipped to You

Your system is “configured-to-order,” which means that most internal options that you order are pre-installed at the factory. However, if you ordered options that are not factory-installed (such as a monitor), these will be shipped to you separately.

In addition, you should have received the media and documentation for all appropriate system software (ordered separately). Check that you’ve received everything you ordered.

---

**Note** – Inspect all shipping cartons for evidence of physical damage. If a shipping carton is damaged, request that the carrier's agent be present when the carton is opened. Keep all contents and packing material for the agent's inspection.

---

Unpacking instructions are printed on the outside of the shipping carton.

Save the original shipping containers and packing materials in case you need to store or ship your system. If you cannot store the shipping materials, recycle or dispose of the materials properly. Consult your local recycling authority for information.

---

# How to Install the Sun Ultra 450 Workstation

## Before You Begin

The Sun Ultra 450 workstation is a general-purpose workstation, which you can use for many types of applications. Exactly how you set up your machine depends in some measure upon what you want it to do.

This procedure is intended to be as “generic” as possible, so as to cover the needs of most sites. Even so, you will need to make certain decisions to complete the procedure:

- **On which network or networks do you intend your machine to operate?**

For background information about network support, see “About Network Interface Options” on page 342.

- **How do you want to use/configure your machine’s internal disk array?**

For background information about internal disk array use, see “About Disk Array Configurations and Concepts” on page 359.

- **What software do you intend to load?**

Software included in the software media kit or other software products may impose certain disk space or disk partitioning requirements. Refer to the documentation accompanying this software to determine those requirements.

Once you’ve answered these questions, you’re ready to begin.

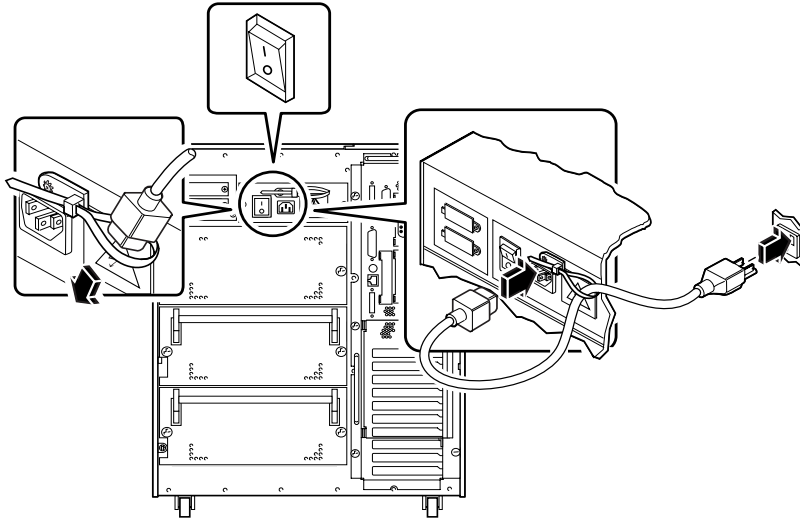
## What to Do

- 1. Verify that you’ve received all the parts of your system.**  
See “About the Parts Shipped to You” on page 14.
- 2. Ensure that the system’s rear panel AC power switch is in the Off (O) position.**

**3. Connect the AC power cord to an appropriate AC power outlet and to the system's rear panel power inlet.**

The outlet must connect the system to a 15A circuit for North America and Japan, and a 10A circuit for Europe. See your local electrical codes.

Insert the female end of the power cord through the tie-wrap loop above the system's power inlet. Tighten the tie-wrap to secure the connection.



**4. Install any optional components shipped with your system.**

Many of the options ordered with your system may have been pre-installed at the factory. However, if you ordered options that were not factory-installed, see the following sections for installation instructions:

- *How to Install a Memory Module—page 125*
- *How to Install a UPA Graphics Card—page 136*
- *How to Install a CPU Module—page 141*
- *How to Install a DC/DC Converter—page 145*
- *How to Install a PCI Card—page 149*
- *How to Install a Disk Drive—page 199*
- *How to Install a CD-ROM Drive or Tape Drive—page 205*
- *How to Install a Power Supply—page 239*
- *How to Install a Rear Panel Insert—page 260*
- *How to Install the 8-Bay Storage Expansion Option—page 103*



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**Caution** – If you are installing an internal option in your system, you must ensure that it does not cause your configuration to exceed the system power supply limits; see “How to Determine System Power Requirements” on page 84 for more information.

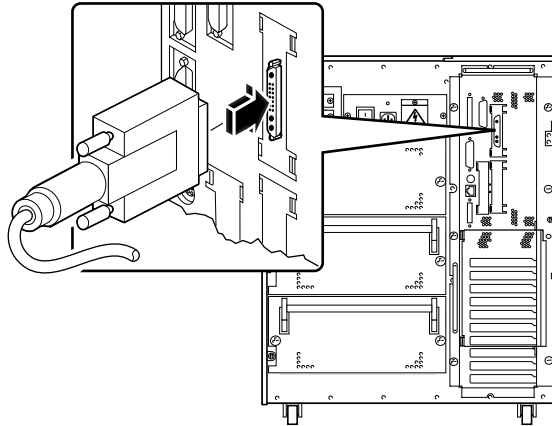
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**5. Configure the serial port jumpers (if necessary).**

Two serial port jumpers located on the main logic board are used to configure the system’s serial ports A and B for either EIA-423 or EIA-232D signal levels. The jumpers are factory-set for EIA-423 levels, which is the default standard for North American users. EIA-232D levels are required for digital telecommunication in nations of the European Community. If you require EIA-232D signal levels, see the following sections for configuration instructions:

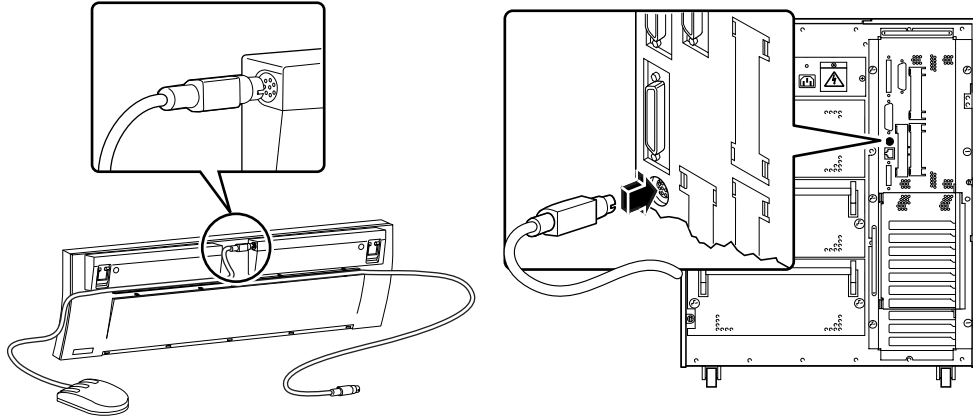
- *How to Remove the Left Side Panel—page 36*
- *How to Avoid Electrostatic Discharge—page 40*
- *About the Main Logic Board Jumpers—page 71*
- *About Serial Port Jumpers—page 73*
- *How to Install the Left Side Panel—page 38*

**6. Attach a monitor to the system’s video port.**



**7. Connect the monitor to a grounded AC power outlet.**

**8. Connect the keyboard to the system's keyboard/mouse port.**



**9. Connect the mouse to the appropriate receptacle on the keyboard.**

**10. Configure the network interface.**

The system's standard network interface is a switchable 10BASE-T/100BASE-TX Ethernet interface conforming to the IEEE 802.3u Ethernet standard. The interface configures itself automatically for either 10-Mbps or 100-Mbps operation, depending on network characteristics.

Supported PCI cards allow connection to additional Ethernet networks, or to token ring, FDDI, or other network types.

- If you're using the standard Ethernet interface, see "How to Configure the Standard Ethernet Interface" on page 343.
- If you're using a PCI network interface, see the documentation accompanying the PCI network card.

**11. Install the rear-panel security device, if required.**

See "How to Install the Rear Panel Security Device" on page 20.

**12. Turn on power to your system.**

See "How to Power On the System" on page 28. For information about the LED status indicators that appear during power up, see "About the Status and Control Panel" on page 9.

**13. Install and boot the operating system software.**

See the installation manual accompanying your Solaris software. Also read the *SMCC SPARC Hardware Platform Guide*, which contains platform-specific information about software installation. The operating system software is ordered separately from your system hardware.

**14. Load additional software from the desktop media kit.**

The Solaris desktop media kit includes additional CD-ROM discs containing software to help you operate, configure, and administer your system. This software may include:

- Solaris 2.x software
- Updates for Solaris Operating Environment 2.x from Sun Microsystems Computer Company
- Solaris Desktop 1.x

See the appropriate documents provided in the desktop media kit for a complete listing of included software and detailed installation instructions.

**15. Load the Sun Ultra 450 workstation AnswerBook™ online documentation and ShowMe™ How™ multimedia documentation.**

See the installation booklets that accompany these CD-ROM discs in the Sun Ultra 450 workstation documentation set.

**16. Decide on your internal disk array configuration.**

For information about possible configurations, see “About Disk Array Configurations and Concepts” on page 359.

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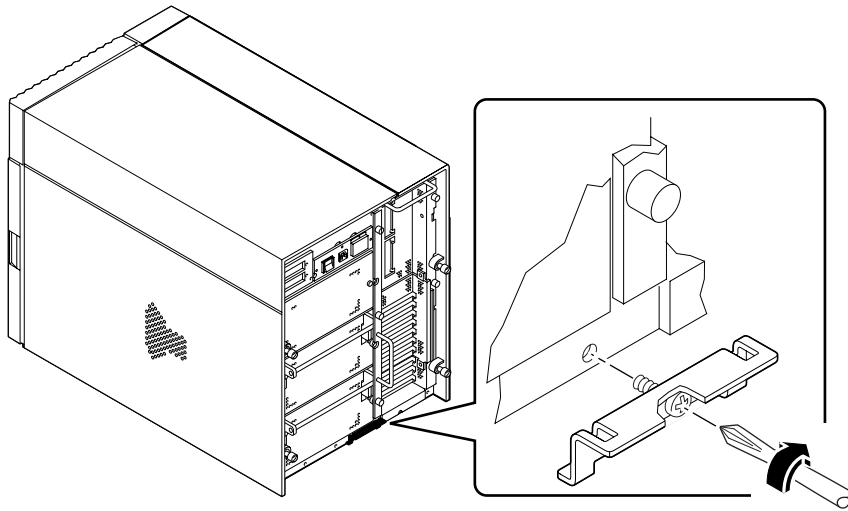
# How to Install the Rear Panel Security Device

The rear panel security device supplied with the system is designed to prevent unauthorized removal of the system power supplies, main logic board, and left side panel.

## What to Do

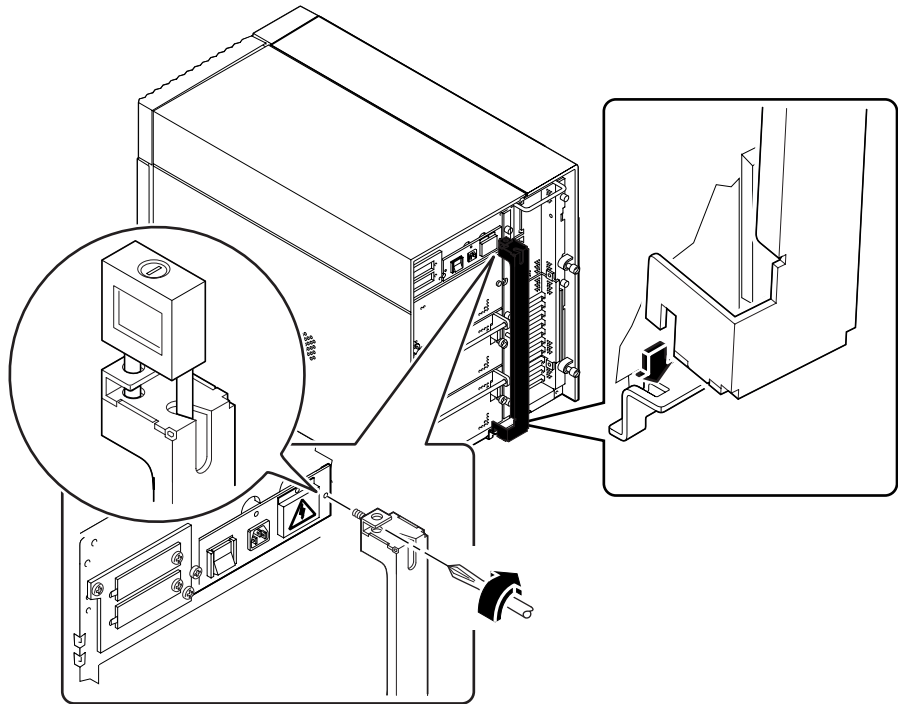
1. **Attach the small security bracket to the rear of the system chassis as shown below.**

The bracket comes with a captive Phillips screw. Remove the existing screw from the system chassis first.





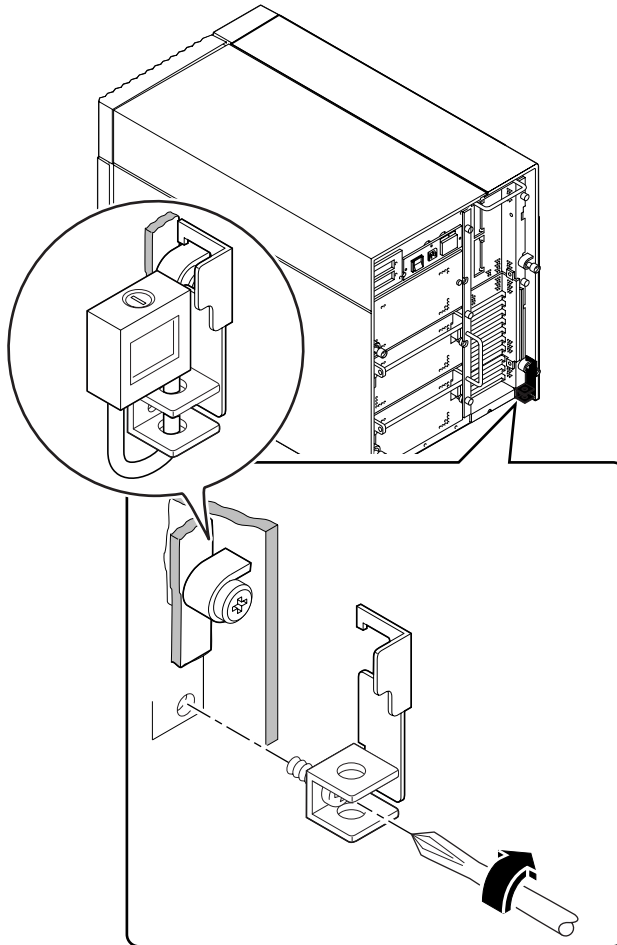
2. Remove the Phillips screw that secures the right side of the AC line filter assembly to the rear panel.
3. Locate the two tabs at the base of the large security bracket and insert them into the corresponding slots in the small bracket that you just installed.
4. Attach the top portion of the large security bracket to the AC line filter assembly as shown below.  
Use the captive Phillips screw at the top of the bracket.
5. Install a padlock or combination lock through the bracket to prevent unauthorized removal of the system power supplies and main logic board.



6. **Attach the remaining security bracket to the bottom corner of the rear panel as shown below.**

The bracket comes with a captive Phillips screw. Remove the existing screw from the system chassis first.

7. **Install a padlock or combination lock through the bracket to prevent unauthorized removal of the left side panel.**



---

# About Setting Up a Console

To view power-on self-test (POST) status and error messages, you must set up a console on your system. There are two ways to set up a console.

1. Attach an ACSII character terminal to the serial port.

You can attach a simple terminal to the serial port. The terminal can be capable of displaying and entering alphanumeric but not graphical data. For instructions, see “How to Attach an Alphanumeric Terminal” on page 24.

2. Establish a `tip` connection from another Sun system.

For information about establishing a `tip` connection, see the *OpenBoot 3.x Command Reference Manual*, an on-line version of which is included with the *Solaris System Administrator AnswerBook* that ships with Solaris software.

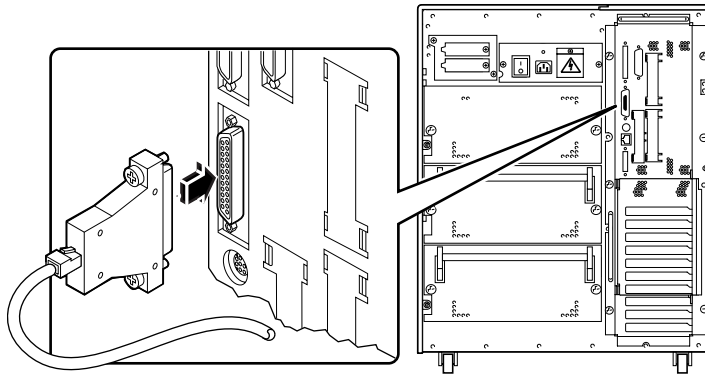
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# How to Attach an Alphanumeric Terminal

## What to Do

1. **Connect the terminal's data cable to the serial port connector or to serial port A on the splitter cable.**

The serial port connector is located on the back panel, as shown.



2. **Connect the terminal's power cable to an AC outlet.**

3. **Set the terminal to receive:**

- At 9600 baud
- An 8-bit signal with no parity and 1 stop bit

See the documentation accompanying your terminal for more information.

## Preparing to Install or Replace Parts

---

This chapter tells you what you need to know, and need to do, before opening the system to install, remove, or replace parts.

*Tasks covered in this chapter include:*

- *How to Power Off the System—page 26*
- *How to Power On the System—page 28*
- *How to Initiate a Reconfiguration Boot—page 30*
- *How to Remove the Right Side Panel—page 32*
- *How to Install the Right Side Panel—page 34*
- *How to Remove the Left Side Panel—page 36*
- *How to Install the Left Side Panel—page 38*
- *How to Avoid Electrostatic Discharge—page 40*

*Other information covered in this chapter includes:*

- *Reference for Installation and Service: Tools Required—page 42*

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# How to Power Off the System



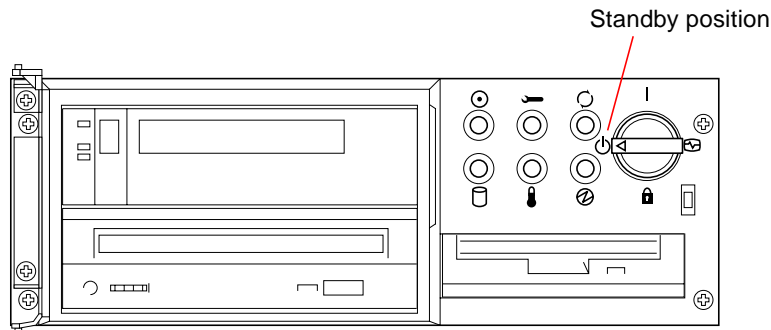
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**Caution** – Before turning off system power, halt the operating system as described below. Failure to halt the operating system properly can result in loss of disk drive data.

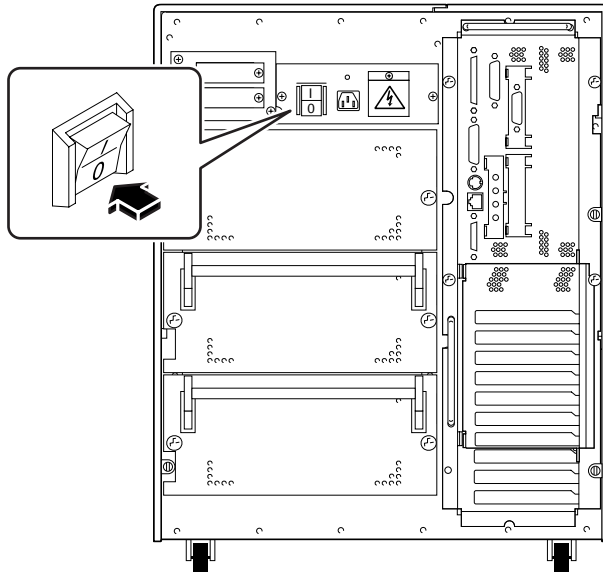
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## What to Do

1. **Notify users that the system will be powered down.**
2. **Back up the system files and data, if necessary.**
3. **Halt the operating system using the appropriate commands.**  
Refer to the *Solaris Handbook for SMCC Peripherals* that corresponds to your operating system.
4. **Wait for the system halt messages and the `ok` prompt.**
5. **Turn the keyswitch on the front panel of the system to the Standby position (⏻), which is fully counterclockwise.**



**6. Press the AC power switch on the system rear panel to turn off power.**



---

# How to Power On the System

## Before You Begin

---

**Note** – Do not use this power-on procedure if you have just installed an internal or external storage device, or any new part that plugs into the main logic board. To power on the system after adding any of these options, see “How to Initiate a Reconfiguration Boot” on page 30.

---

## What to Do



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**Caution** – Never move the system when system power is on. Movement can cause catastrophic disk drive failure. Always power off the system before moving it.

---

---

**Note** – Removing either of the system side panels activates the system power interlock switches. This safety mechanism prevents DC voltages from reaching any internal component when either side panel is removed and the AC power switch is left on.

---

- 1. Turn on power to any peripherals and external storage devices.**

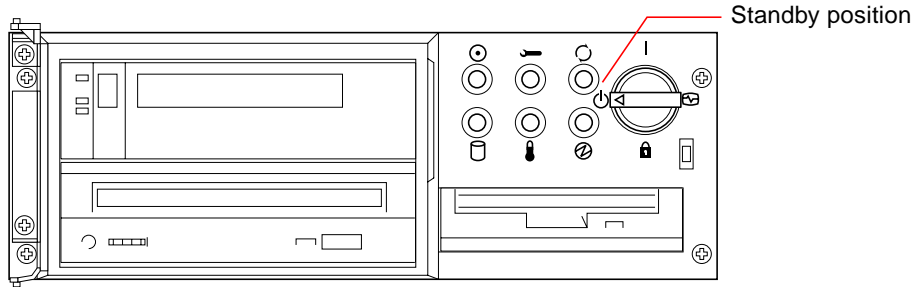
Read the documentation supplied with the device for specific instructions.

- 2. Turn on power to the monitor.**

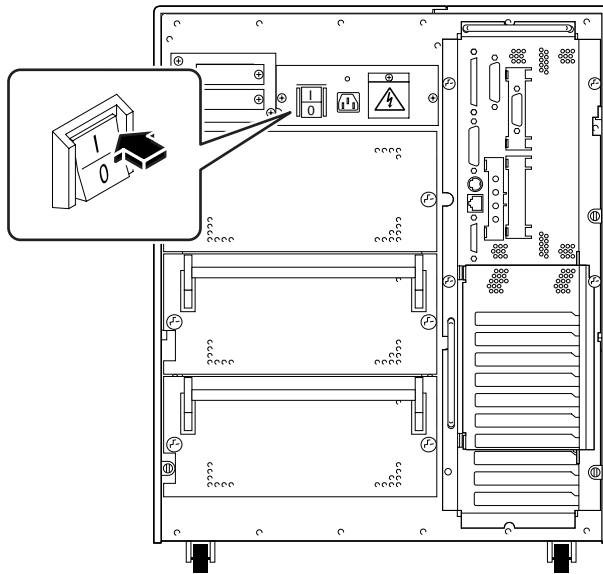
- 3. Open the top door on the front of the system.**



4. Turn the keyswitch to the Standby position (⏻).



5. Press the rear panel AC power switch to the On (I) position.



6. Turn the keyswitch to the appropriate setting.

See “About the Status and Control Panel” on page 9 for information about keyswitch settings.

---

**Note** – The system may take anywhere from 30 seconds to two minutes before video is displayed on the system monitor or the ok prompt appears on an attached terminal. This time depends on the level of power-on self-test diagnostics being performed.

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# How to Initiate a Reconfiguration Boot

## Before You Begin

After installing any new part that plugs into the main logic board or any internal or external storage device, you must perform a reconfiguration boot so that your system is able to recognize the newly installed option(s).

## What to Do

- 1. Turn on power to any peripherals and external storage devices.**  
Read the documentation supplied with the device for specific instructions.
- 2. Turn on power to the monitor.**
- 3. Open the top door on the front of the system.**
- 4. Turn the keyswitch to the Standby position (⏻).**
- 5. Press the rear panel AC power switch to the On (|) position.**
- 6. Turn the keyswitch to the Power-on position (|).**
- 7. When the system banner is displayed on the monitor, immediately enter the Stop-a sequence on the Sun keyboard.**  
Hold down the `Stop` key and press the `a` key. If you are using an alphanumeric terminal instead of a monitor, press the `Break` key on the terminal's keyboard.
- 8. When the `ok` prompt is displayed, enter the following command:**

```
ok boot -r
```

This command rebuilds the device trees for the system, incorporating any newly installed options. After a device has been added to a device tree, it can be recognized by the system. After the reconfiguration reboot has successfully completed, the system prompt should be displayed.

---

**Note** – The system may take anywhere from 30 seconds to two minutes before video is displayed on the system monitor or the `ok` prompt appears on an attached terminal. This time depends on the level of power-on self-test diagnostics being performed.

---



---

**Caution** – Never move the system when system power is on. Movement can cause catastrophic disk drive failure. Always power off the system before moving it.

---

## What Next

The system's front panel LED indicators provide power-on status information. For more information about the system LEDs, see:

- “About the Status and Control Panel” on page 9.

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# How to Remove the Right Side Panel

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**Note** – Removing either of the side panels activates the system power interlock switches. This safety mechanism prevents DC voltages from reaching any internal component when a side panel is removed and the AC power switch is left on. Do not remove a side panel while the system is operating or the system will power off abruptly.

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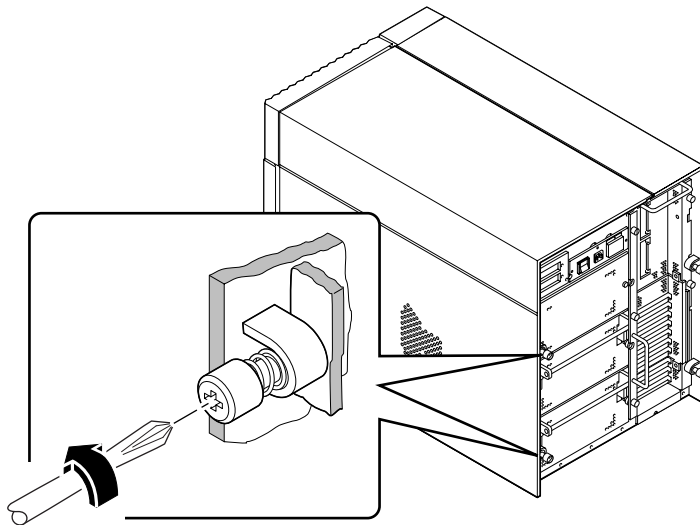
## Before You Begin

Complete this task:

- “How to Power Off the System” on page 26

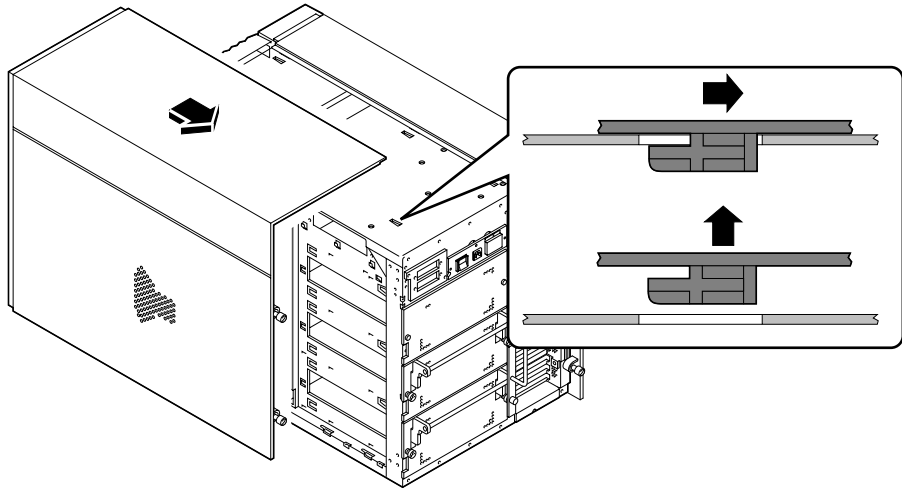
## What to Do

1. Loosen the two large captive screws that secure the right side panel to the rear of the system chassis.



**2. Slide the panel toward the rear of the system approximately 1 inch (2.5 cm).**

The hooks beneath the top surface of the panel should disengage from the slots on top of the system chassis.



**3. Lift the panel up and free from the system chassis.**

Put the panel in a safe location until you're ready to reassemble the system.

## What Next

You are now ready to install, remove, or replace components inside the right half of the system chassis.

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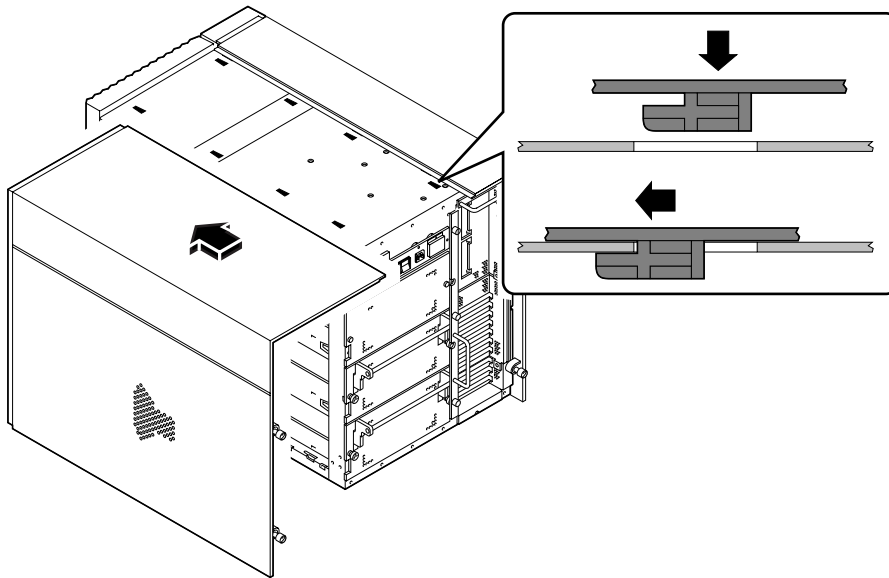
# How to Install the Right Side Panel

## Before You Begin

Remember to detach the antistatic wrist or foot strap from the system chassis sheet metal.

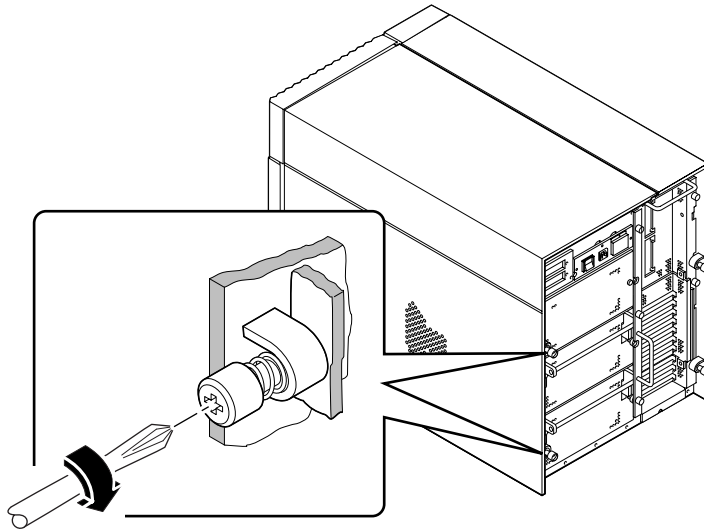
## What to Do

1. **Insert the eight hooks beneath the top surface of the panel into the corresponding slots on top of the system chassis.**



2. **Press the lower edge flush against the chassis and slide the panel toward the front of the unit as far as it will go.**

3. Tighten the two large captive screws that secure the panel to the rear of the system chassis.



## What Next

When you're ready to restart the system, see:

- “How to Power On the System” on page 28; or
- “How to Initiate a Reconfiguration Boot” on page 30

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# How to Remove the Left Side Panel

---

**Note** – Removing either of the side panels activates the system power interlock switches. This safety mechanism prevents DC voltages from reaching any internal component when a side panel is removed and the AC power switch is left on. Do not remove a side panel while the system is operating or the system will power off abruptly.

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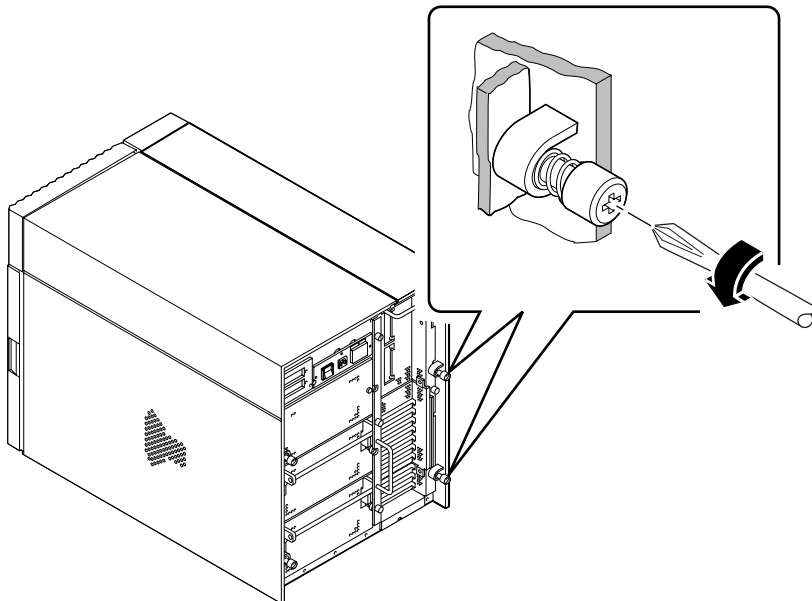
## Before You Begin

Complete this task:

- “How to Power Off the System” on page 26

## What to Do

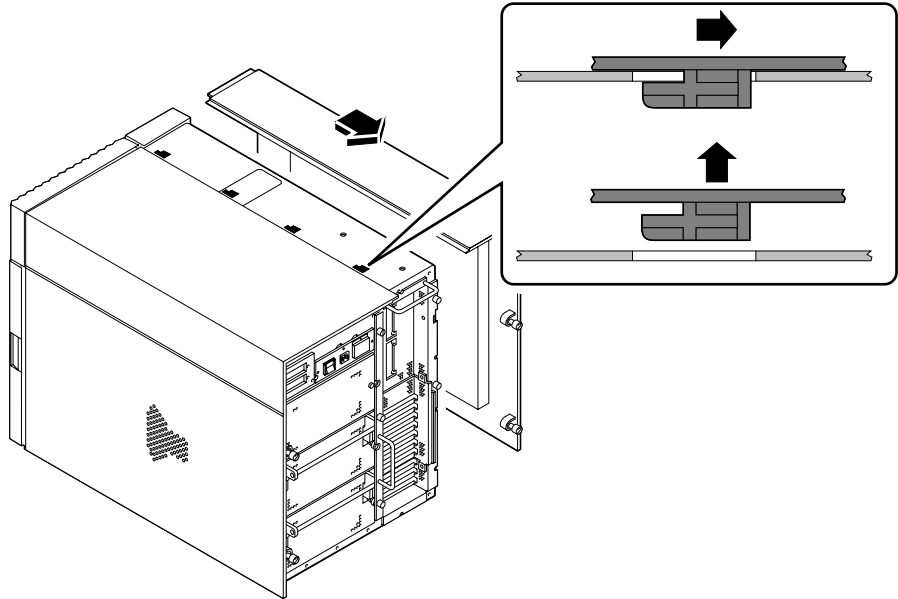
1. Loosen the two large captive screws that secure the left side panel to the rear of the system chassis.





- 2. Slide the panel toward the rear of the system approximately 1 inch (2.5 cm).**

The hooks beneath the top surface of the panel should disengage from the slots on top of the system chassis.



- 3. Lift the panel up and free from the system chassis.**

Put the panel in a safe location until you're ready to reassemble the system.

## What Next

You are now ready to install, remove, or replace components inside the left half of the system chassis.

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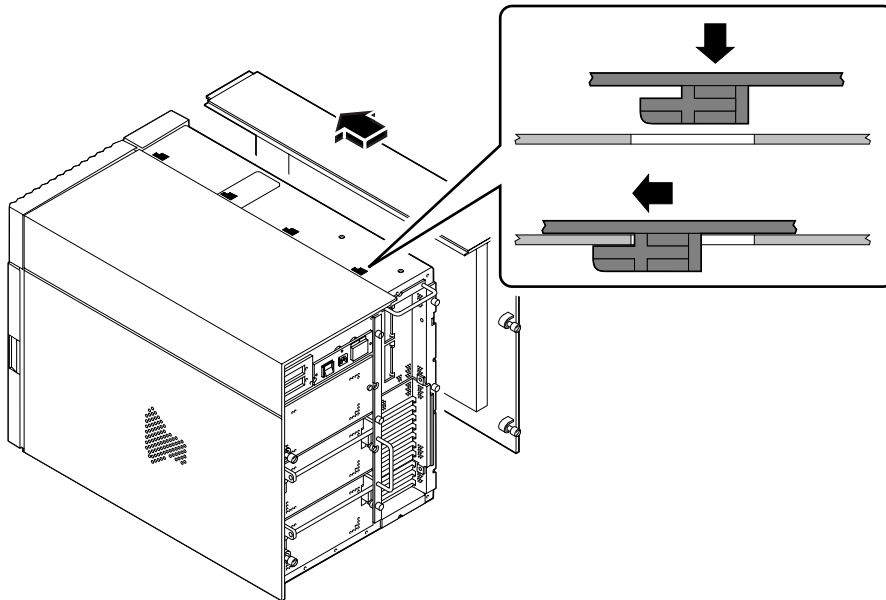
# How to Install the Left Side Panel

## Before You Begin

Remember to detach the antistatic wrist or foot strap from the system chassis sheet metal.

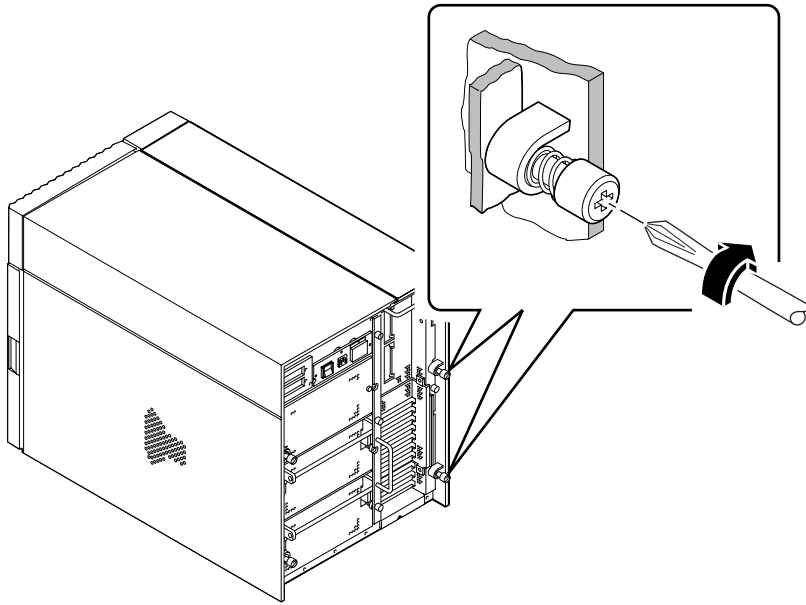
## What to Do

1. **Insert the four hooks beneath the top surface of the panel into the corresponding slots on top of the system chassis.**



2. **Press the lower edge flush against the chassis and slide the panel toward the front of the unit as far as it will go.**

3. Tighten the two large captive screws that secure the panel to the rear of the system chassis.



## What Next

When you're ready to restart the system, see:

- “How to Power On the System” on page 28
- “How to Initiate a Reconfiguration Boot” on page 30

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# How to Avoid Electrostatic Discharge

Use the following procedure to prevent static damage whenever you are accessing any of the internal components of the system.

## Before You Begin

Complete this task:

- “How to Power Off the System” on page 26

You must have the following items:

- Antistatic wrist or foot strap
- Antistatic mat (or the equivalent)

## What to Do



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**Caution** – Printed circuit boards and hard disk drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static from your clothes or the work environment can destroy components. Do not touch the components themselves or any metal parts without taking proper antistatic precautions.

---

1. **Disconnect the AC power cord from the wall power outlet** *only if you will be handling the AC line filter assembly or power distribution board.*

The AC power cord provides a discharge path for static electricity, so you generally want to leave it plugged in during installation and repair procedures. The only time you should unplug the cord is when you service the AC line filter assembly or power distribution board.

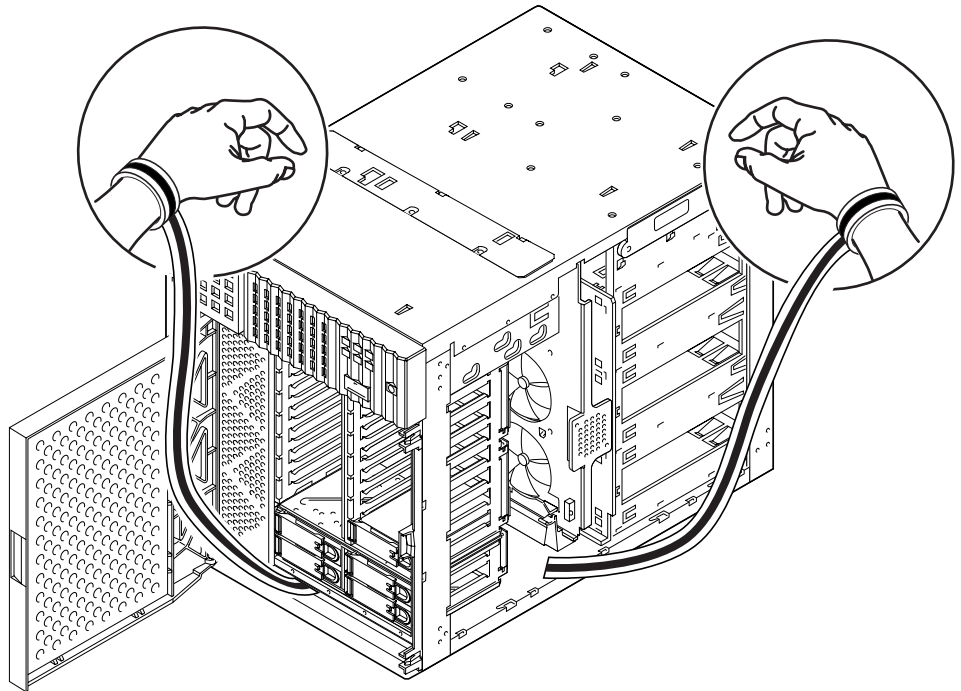
**2. Use an antistatic mat or similar surface.**

When performing any option installation or service procedure, place static-sensitive parts, such as boards, cards, and disk drives, on an antistatic surface. The following items can be used as an antistatic surface:

- The bag used to wrap a Sun™ replacement part
- The shipping container used to package a Sun replacement part
- Sun electrostatic discharge (ESD) mat, PN 250-1088 (available through your Sun sales representatives)
- Disposable ESD mat, shipped with replacement parts or options

**3. Use an antistatic wrist strap.**

Attach the appropriate end to the system chassis sheet metal, and attach the other end of the strap to your wrist. Refer to the instructions that come with the strap.



**4. Detach both ends of the strap after you have completed the installation or service procedure.**

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## Reference for Installation and Service: Tools Required

The following tools are required to install and service the system:

- Screwdriver, Phillips #1
- Screwdriver, Phillips #2
- Screwdriver, flat-blade#1
- Screwdriver, flat-blade#2
- ESD mat, Sun PN 250-1088, or equivalent
- Grounding wrist or foot strap

The latter two items help protect the server against damage due to electrostatic discharge. For more information, see “How to Avoid Electrostatic Discharge” on page 40.

# Hardware Configuration

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This chapter describes hardware configurations for the system. Topics covered in this chapter include:

- *About Reliability, Availability, and Serviceability Features—page 44*
- *About Memory—page 50*
- *About CPU Modules—page 53*
- *About DC/DC Converters—page 55*
- *About Peripheral Component Interconnect (PCI) Buses—page 57*
- *About UPA Graphics Cards—page 60*
- *About Internal Disk Drives—page 63*
- *About Power Supplies—page 66*
- *About the Standard Ethernet Port—page 68*
- *About the Serial Ports—page 69*
- *About the Parallel Port—page 70*
- *About the Main Logic Board Jumpers—page 71*
- *About Serial Port Jumpers—page 73*
- *About the Clock Mode Select Jumper—page 74*
- *About Flash PROM Jumpers—page 75*
- *About the SCSI Removable Media Bays and the External SCSI Port—page 77*
- *About Power Budget Constraints—page 81*
- *How to Determine System Power Requirements—page 84*

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# About Reliability, Availability, and Serviceability Features

Reliability, availability, and serviceability are aspects of a system's design that affect its ability to operate continuously and minimize the time necessary to service the system. Reliability refers to a system's ability to operate continuously without failures and to maintain data integrity. System availability refers to the percentage of time that a system remains accessible and usable. Serviceability relates to the time it takes to restore a system to service following a system failure. Together, reliability, availability, and serviceability provide for near continuous system operation.

To deliver high levels of reliability, availability and serviceability, the system offers the following features:

- Error correction and parity checking for improved data integrity
- Easily accessible status indicators
- Hot-pluggable disk drives
- Support for RAID 0, 1, and 5 storage configurations
- Environmental monitoring and fault protection
- N+1 power supply redundancy
- Hot-swappable power supplies
- Automatic system recovery (ASR)
- Three different levels of system diagnostics

## Error Correction and Parity Checking

Error Correcting Code (ECC) is used on all internal system data paths to ensure high levels of data integrity. All data that moves between processors, I/O, and memory has end-to-end ECC protection.

The system reports and logs correctable ECC errors. A correctable ECC error is any single bit error in a 64-bit field. Such errors are corrected as soon as they are detected. The ECC implementation can also detect double bit errors in the same 64-bit field and multiple bit errors in the same nibble (4 bits).

In addition to providing ECC protection for data, the system offers parity protection on all system address buses. Parity protection is also used on the PCI and SCSI buses, and in the UltraSPARC CPU's internal and external cache.



## Status LEDs

The system provides easily accessible light emitting diode (LED) indicators on the system front panel, internal disk bays, and power supplies to provide a visual indication of system and component status. Status LEDs eliminate guesswork and simplify problem diagnosis for enhanced serviceability.

Status and control panel LEDs are described in “About the Status and Control Panel” on page 9. Disk drive and power supply LEDs are described in “Error Indications” on page 408.

## Hot-Pluggable Disk Drives

The “hot-plug” feature of the system’s internal disk drives permits the removal and installation of drives while the system is operational. All drives are easily accessed from the front of the system. Hot-plug technology significantly increases the system’s serviceability and availability, by providing the ability to:

- Increase storage capacity dynamically to handle larger workloads and improve system performance.
- Replace disk drives without service disruption.

For more information about hot-pluggable disk drives, see “About Internal Disk Drives” on page 63 and “About Disk Array Configurations and Concepts” on page 359.

## Support for RAID 0, RAID 1, and RAID 5 Disk Configurations

The Solstice™ DiskSuite™ software designed for use with the system provides the ability to configure system disk storage in a variety of different RAID levels. You choose the appropriate RAID configuration based on the price, performance, and reliability/availability goals for your system.

RAID 0 (striping), RAID 1 (mirroring), RAID 0+1 (striping plus mirroring) and RAID 5 configurations (striping with interleaved parity) can all be implemented using Solstice DiskSuite. You can also configure one or more drives to serve as “hot spares” to automatically fill in for a defective drive in the event of a disk failure.

For more information about RAID configurations, see “About Disk Array Configurations and Concepts” on page 359.

# Environmental Monitoring and Control

The system features an environmental monitoring subsystem designed to protect against:

- Extreme temperatures
- Lack of air flow through the system
- Power supply problems

Monitoring and control capabilities reside at the operating system level as well as in the system's flash PROM firmware. This ensures that monitoring capabilities are operational even if the system has halted or is unable to boot.

The environmental monitoring subsystem uses an industry standard I<sup>2</sup>C bus implemented on the main logic board. The I<sup>2</sup>C bus is a simple two-wire serial bus, used throughout the system to allow the monitoring and control of temperature sensors, fans, power supplies, and status LEDs.

Temperature sensors (thermistors) are located throughout the system to monitor each CPU module and power supply, as well as the ambient temperature of the system. The monitoring subsystem frequently polls each thermistor in the system and uses the sampled temperatures to:

- Regulate fan speeds for maintaining an optimum balance between proper cooling and noise levels.
- Report and respond to any over temperature conditions.

To indicate an over temperature condition, the monitoring subsystem generates a warning or error message, and depending on the nature of the condition, may even shut down the system. If a CPU module reaches 80 degrees C or the ambient temperature reaches 50 degrees C, the system generates a warning message, illuminates the temperature fault LED on the status and control panel, and automatically shuts itself down. In the case of a power supply, a warning is generated when the power supply temperature reaches 95 degrees C and the system is shut down if the temperature reaches 100 degrees C.

All error and warning messages are displayed on the system console (if one is attached) and are logged in the `/var/adm/messages` file. Front panel fault LEDs remain lit after an automatic system shut down to aid in problem diagnosis.

The monitoring subsystem is designed to protect the system from overheating even if the operating system is hung. The system uses a timer that is continually reset by the operating system. If the operating system fails to reset the timer within three minutes, the system automatically accelerates all fans to full speed. The fans spinning at full speed also provide an audible warning that the system is not functioning properly.

The monitoring subsystem is also designed to detect and respond to fan failures. The system includes seven fans, arranged into three groups as follows:

- CPU fan tray assembly (three fans)
- Disk fan tray assembly (three fans)
- Upper blower assembly (one fan)

A fan failure in the CPU or disk fan tray assemblies causes the monitoring subsystem to generate an error message, light the temperature LED on the status and control panel, and shut down the system. If the upper blower assembly fails, a error message is generated but the system continues to operate.

The power subsystem is monitored in a similar fashion. The monitoring subsystem periodically polls the power supply status registers for the following conditions in the power supplies:

- Power supply OK status, indicating the status of each supply's +3.3V, +5V and +12V DC outputs
- Current limit error condition, indicating that the system configuration exceeds the AC current limit of the power supply subsystem
- Current share error condition, indicating that the power supplies in a multiple power supply configuration are not sharing the load equally

If a problem in any of these areas is detected, an error message is displayed on the console (if one is attached) and logged in the `/var/adm/messages` file. The power supply LED on the status and control panel is also lit. The LEDs located on the power supply itself will indicate the type of fault, and if two or more power supplies are installed, will indicate which supply is the source of the fault. If the problem reaches a safety limit, the system is automatically powered off.

For more information about error messages generated by the environmental monitoring subsystem, see “Environmental Failures” on page 426. For additional details about the status and control panel LEDs, see “About the Status and Control Panel” on page 9.

## N+1 Power Supply Redundancy

The system can accommodate a maximum of three power supplies. Most system configurations can operate with only one power supply installed. In this case, a second supply can be used to provide N+1 redundancy, allowing the system to continue operating should one of the power supplies fail.

Two supplies will provide enough power for a heavily configured system. In this case, a third supply can be added for redundancy. With three power supplies installed in the system, even a heavily configured machine can continue full operation during removal or replacement of one of the supplies.

For more information about power supplies, redundancy, and configuration rules, see “About Power Supplies” on page 66.

## Hot-Swappable Power Supplies

Power supplies in a redundant configuration feature a “hot swap” capability. You can remove and replace a faulty power supply without turning off the system power or even shutting down the operating system. The power supplies are easily accessed from the rear of the system, without the need to remove system covers.

## Automatic System Recovery (ASR)

The system provides for automatic system recovery from the following types of hardware component failures:

- CPU modules
- Memory modules
- Audio module
- PCI buses
- System I/O interfaces

The automatic system recovery (ASR) feature allows the system to resume operation after experiencing certain hardware faults or failures. Automatic self-test features enable the system to detect failed hardware components and an auto-configuring capability designed into the system’s boot firmware allows the system to deconfigure failed components and restore system operation. As long as the system is capable of operating without the failed component, the ASR features will enable the system to reboot automatically, without operator intervention.

During the power-on sequence, if a faulty component is detected, the component is effectively disabled and if the system remains capable of functioning, the boot sequence continues. In a running system, some types of failures (such as a processor failure) will usually bring the system down. If this happens, the ASR functionality enables the system to reboot immediately if it is possible for the system to function without the failed component. This prevents a faulty hardware component from keeping the entire system down or causing the system to crash again.

Control over the system’s ASR functionality is provided by a number of OpenBoot PROM commands. These are described in the document *Platform Notes: Sun Ultra 450 Workstation and Ultra Enterprise 450 Server*, available on the *Solaris on Sun Hardware AnswerBook*. This AnswerBook documentation is provided on the SMCC Updates CD for the Solaris release you are running.

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**Note** – In some cases, *Platform Notes: Sun Ultra 450 Workstation and Ultra Enterprise 450 Server* may be included with your system documentation instead of on the *Solaris on Sun Hardware AnswerBook*.

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## Three Levels of Diagnostics

For enhanced serviceability and availability, the system provides three different levels of diagnostic testing: Power-On Self-Test (POST), OpenBoot diagnostics (OBDDiag), and SunVTS.

POST and OBDDiag are firmware-resident diagnostics that can run even if the system is unable to boot the operating system. SunVTS is an application-level diagnostic program that offers additional troubleshooting capabilities once the operating system is running.

POST diagnostics provide a quick but thorough check of the most basic hardware functions of the system. For more information about POST, see “About Power-On Self-Test (POST) Diagnostics” on page 388 and “How to Use POST Diagnostics” on page 389.

OBDDiag provides a more comprehensive test of the system, including external interfaces. OBDDiag is described in “About OpenBoot Diagnostics (OBDDiag)” on page 391 and “How to Use OpenBoot Diagnostics (OBDDiag)” on page 399.

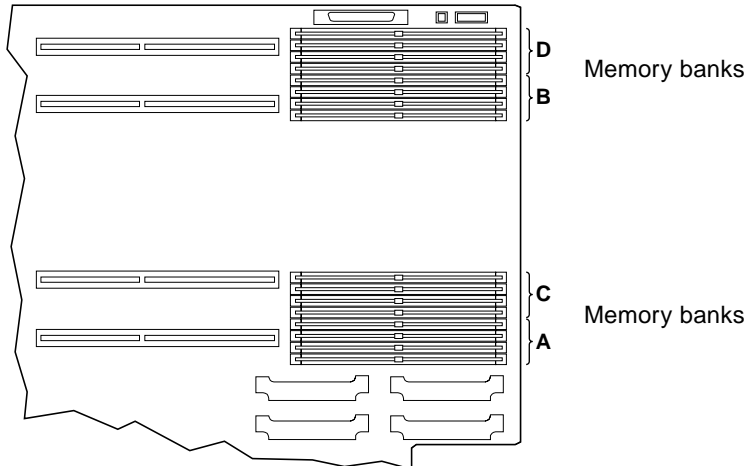
At the application level, you have access to SunVTS diagnostics. Like OBDDiag, SunVTS provides a comprehensive test of the system, including its external interfaces. SunVTS also allows you to run tests remotely over a network connection. You can only use SunVTS if the operating system is running. For more information about SunVTS, see “About SunVTS Software” on page 403, “How to Use SunVTS Software” on page 406, and “How to Check Whether SunVTS Software Is Installed” on page 405.

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# About Memory

The system's main logic board provides sixteen slots for high-capacity dual inline memory modules (DIMMs). The system supports Sun standard 144-pin, 5-volt, 60-nanosecond memory modules. Modules of 16-, 32-, 64-, 128-, and 256-Mbyte capacities can be installed in the system. Total system memory capacity ranges from 64 Mbytes to 4 Gbytes.

Memory slots are organized into four banks, with each bank comprising four slots. The system reads from, or writes to, all four DIMMs in a bank at the same time. DIMMs, therefore, must be added four at a time in the same bank. The following figure shows the memory banks on the main logic board.



Whenever banks A and B are populated with identical capacity DIMMs, memory reads and writes are automatically interleaved between the two banks. This is called *two-way interleaving*. Two-way interleaving significantly reduces the average memory latency, thus improving overall system performance. Two-way interleaving also occurs automatically when banks C and D are populated with identical capacity DIMMs. When all four banks contain identical capacity DIMMs, the system interleaves across all four banks (called *four-way interleaving*), to further reduce average memory latency.

By default, memory interleaving only occurs when identical capacity DIMMs are installed. However, it is possible to configure the system to perform memory interleaving even when DIMMs of different sizes are used. In this case, however, some of the memory capacity will remain unused. For more information, please refer

to *Platform Notes: Sun Ultra 450 Workstation and Ultra Enterprise 450 Server*, available on the *Solaris on Sun Hardware AnswerBook*. This AnswerBook documentation is provided on the SMCC Updates CD for the Solaris release you are running.

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**Note** – In some cases, *Platform Notes: Sun Ultra 450 Workstation and Ultra Enterprise 450 Server* may be included with your system documentation instead of on the *Solaris on Sun Hardware AnswerBook*.

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## Configuration Rules

Memory DIMMs must be added four at a time within the same bank, and each bank used should have four identical capacity DIMMs installed (for example, four 32-Mbyte DIMMs, or four 64-Mbyte DIMMs).

The main logic board *must* have at least one bank filled or the system will not boot.

You must fill the banks in the following order: A, B, C, D.

Bank	Sockets
A (Required)	U1901 through U1904
B	U1801 through U1804
C	U1701 through U1704
D	U1601 through U1604

Two-way interleaving occurs automatically whenever identical capacity DIMMs are installed in banks A and B or in banks C and D. Four-way interleaving occurs automatically whenever all four banks are filled with identical capacity DIMMs. Interleaving is disabled when only one or three banks are occupied. Therefore, it is recommended that when adding additional memory to the system you increase from one bank to two, or from two banks to four. While the system will operate with three banks filled, the performance gains from adding memory in the third bank will be partially offset by the loss of memory interleaving.

The system will operate with memory DIMMs of different capacities in different banks (for example four 32-Mbyte DIMMs in bank A and four 64-Mbyte DIMMs in bank B), but for improved performance, populate banks A and B with DIMMs of identical capacity, and populate banks C and D with DIMMs of identical capacity.

Installing additional memory will almost always improve system performance, however adding DIMMs of equal capacities to those already installed will provide the best performance gains.

For maximum performance, install identical capacity DIMMs in all four memory banks. The following table shows how to best populate the memory banks when configuring your system for 512 Mbytes of memory.

---

Memory Performance Level	Memory Slot Population
Good	Bank A has four, 128-MB DIMMs (no interleaving)
Better	Banks A and B each have four 64-MB DIMMs (two-way interleaving)
Best	Banks A, B, C, and D all have four 32-MB DIMMs (four-way interleaving)

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Memory modules are delicate. Be sure to take appropriate precautions to avoid damaging them through electrostatic discharge. For more information, see “How to Avoid Electrostatic Discharge” on page 40.



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**Caution** – Dual Inline Memory Modules (DIMMs) are made of electronic components that are extremely sensitive to static electricity. Static from your clothes or work environment can destroy the modules.

Do not remove any DIMM from its antistatic packaging until you are ready to install it on the system board. Handle the modules only by their edges. Do not touch the components or any metal parts. Always wear a grounding strap when you handle the modules.

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# About CPU Modules

The UltraSPARC II CPU module is a high-performance, highly-integrated superscalar processor implementing the SPARC-V9 64-bit RISC architecture. The UltraSPARC II processor supports both 2D and 3D graphics, as well as image processing, video compression and decompression, and video effects through the sophisticated visual instruction set (VIS). VIS provides high levels of multimedia performance, including real-time video compression/decompression and two streams of MPEG-2 decompression at full broadcast quality with no additional hardware support.

The system's main logic board provides slots for four UltraSPARC II CPU modules. Each processor module includes one CPU chip with integrated cache memory for data and instructions, as well as 1 Mbyte or more of external SRAM cache memory. Each processor slot is supported by a DC/DC converter module, located on the system's main logic board, which provides the proper core voltage for the CPU chip.

Processor modules communicate with the system's main memory and I/O subsystem via the system's high-speed Ultra Port Architecture (UPA) data bus. The UPA's clock rate is automatically synchronized with the clock speed of the CPU modules, and the UPA clock operates at either one third or one fourth the clock rate of the CPUs. For example, if the CPUs operate at 250 MHz, the UPA will operate at a clock rate of 83.3 MHz.

For information on installing CPU modules, see "How to Install a CPU Module" on page 141. For information on installing a DC/DC converter, see "How to Install a DC/DC Converter" on page 145.

## Configuration Rules

One, two, three, or four CPU modules can be installed. Only UltraSPARC II processors are supported.

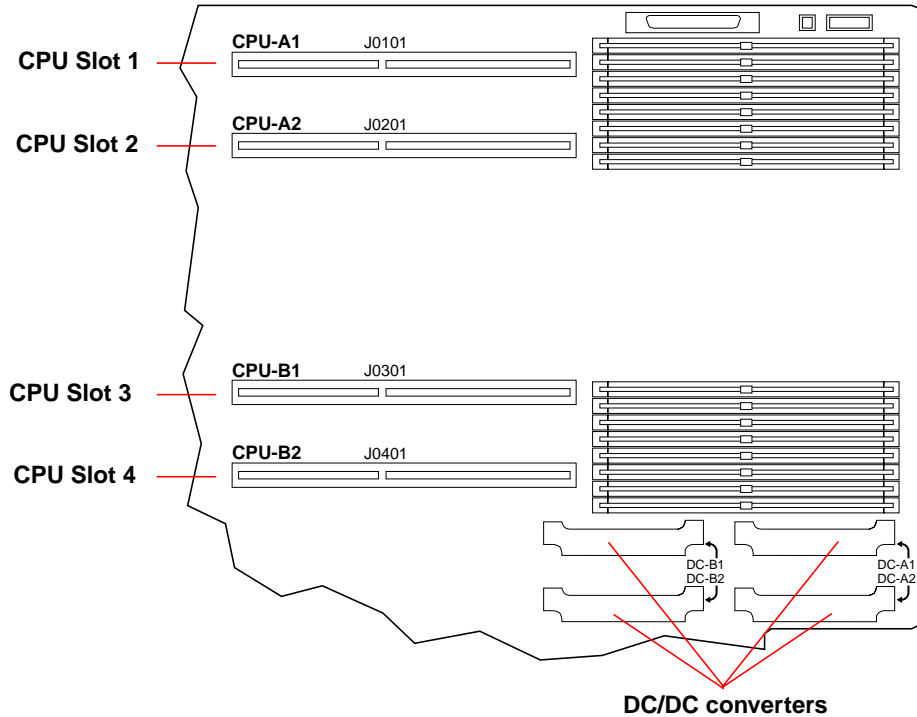
All CPUs installed in a system must operate at identical clock speeds.

Fill the CPU slots in the following order:

Order of Installation	Slot Number	Slot Name	Connector Number
First	4	CPU-B2	J0401
Second	2	CPU-A2	J0201
Third	3	CPU-B1	J0301
Last	1	CPU-A1	J0101

For each CPU module installed in the system, you must install an associated DC/DC converter. If the DC/DC converter is not installed or is installed in the wrong location, the system will not operate. For information on DC/DC converter, see “About DC/DC Converters” on page 55 and “How to Install a DC/DC Converter” on page 145.

The following figure shows the CPU slot and DC/DC converter socket locations on the main logic board.



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## About DC/DC Converters

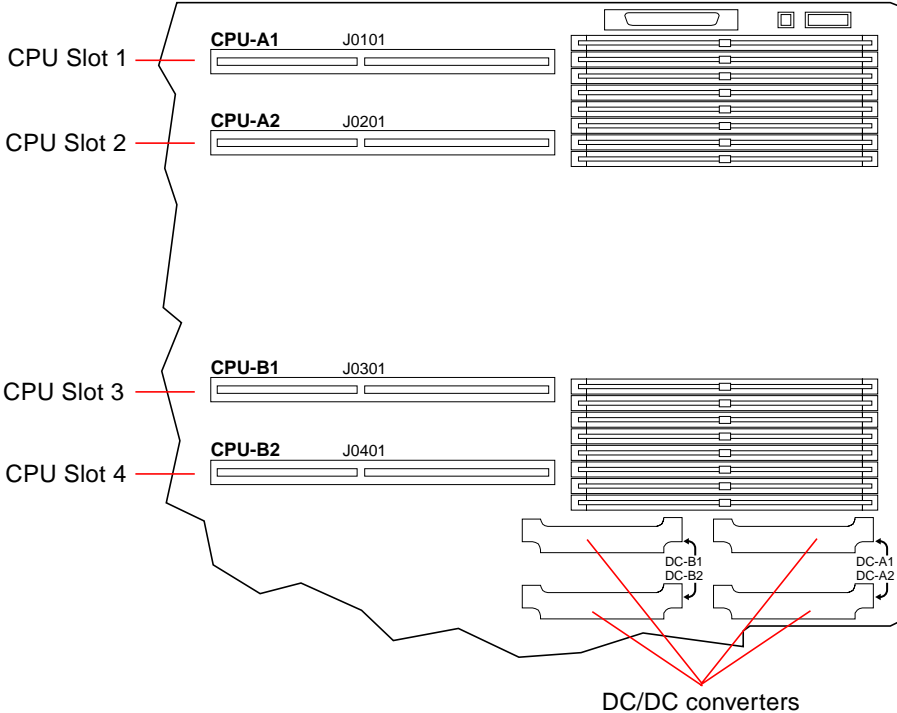
Each CPU module slot is supported by a DC-to-DC converter module, located on the system's main logic board, which provides the proper core voltage for the CPU chip. For each CPU module installed in the system, you must install the correct DC/DC converter type in the correct socket. If the DC/DC converter is not installed or is installed in the wrong location, the system will not operate.

The following table identifies the DC/DC converter socket associated with each CPU module slot:

<b>If the CPU module is installed in</b>	<b>The DC-DC converter must be installed in</b>
CPU-B2 (Slot 4)	DC-B2 socket
CPU-A2 (Slot 2)	DC-A2 socket
CPU-B1 (Slot 3)	DC-B1 socket
CPU-A1 (Slot 1)	DC-A1 socket

For information about installing a DC/DC converter, see “How to Install a DC/DC Converter” on page 145. For more information about CPU modules, see “About CPU Modules” on page 53 and “How to Install a CPU Module” on page 141.

The following figure shows the CPU slot and DC/DC converter socket locations on the main logic board.



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# About Peripheral Component Interconnect (PCI) Buses

All system communications with storage peripherals and network interface devices is mediated by three UPA-to-PCI bridges, located on the system's main logic board. Each of these bridge chips manages communication between the UPA bus and two PCI buses, giving the system a total of six separate PCI buses. Together, these six PCI buses support slots for up to ten PCI interface cards. One PCI bus (bus B) also handles communications between the system and devices connected to the main logic board's SCSI, FastEthernet, serial, parallel, and keyboard/mouse ports.

PCI cards come in a variety of configurations. Not all cards will fit or operate in all PCI slots, so it is important to know the specifications of your PCI cards and the types of cards supported by each PCI slot in the system.

Some PCI cards are as short as 6.875 inches in length (called "short" cards), while the maximum length of PCI cards is 12.28 inches (called "long" cards). Each slot in the system can accommodate either a long or a short card.

Older PCI cards communicate over 32-bit PCI buses, while many newer cards communicate over wider 64-bit buses. The system will accept up to ten 32-bit cards or up to nine 64-bit wide cards. Two of the nine slots available for 64-bit cards are 32-bit slots, so cards inserted in these slots will operate as 32-bit cards.

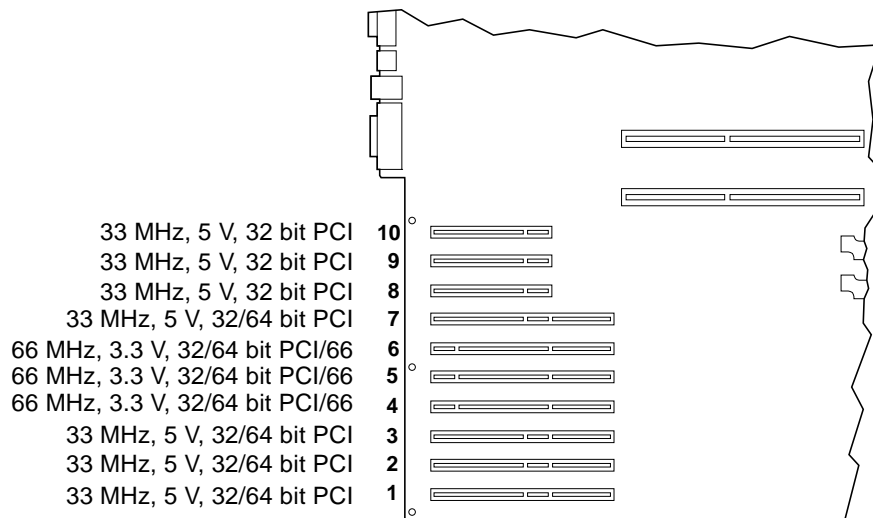
Older PCI cards operate at 5 VDC, while newer cards are designed to operate on 3.3 VDC. Cards that require 5 volts will not operate in 3.3-volt slots, and 3.3-volt cards will not operate in 5-volt slots. "Universal" PCI cards are designed to operate on either 3.3 volts or 5 volts, so these cards can be inserted into either type of slot. The system will accept three cards that operate at 3.3 volts or seven cards that operate at 5 volts. The system will accept up to ten universal cards.

Most PCI cards operate at clock speeds of 33 MHz, while some newer cards operate at 66 MHz. The system will accept up to three cards that operate at 66 MHz and up to ten cards that operate at 33 MHz.

The table below shows the mapping of the PCI slots to the three PCI-UPA bridges and six PCI buses, and the type of PCI cards supported in each slot.

PCI Slot	PCI-UPA Bridge	PCI Bus	Slot Width (bits)/ Card Type (bits)	Clock Rates (MHz)	DC Voltage/ Card Type
10	1	B	32 / 32 only	33	5 V & Univ
9	3	F	32 / 32 or 64	33	5 V & Univ
8	3	F	32 / 32 or 64	33	5 V & Univ
7	3	F	64 / 32 or 64	33	5 V & Univ
6	3	E	64 / 32 or 64	33 and 66	3.3 V & Univ
5	1	A	64 / 32 or 64	33 and 66	3.3 V & Univ
4	2	C	64 / 32 or 64	33 and 66	3.3 V & Univ
3	2	D	64 / 32 or 64	33	5 V & Univ
2	2	D	64 / 32 or 64	33	5 V & Univ
1	2	D	64 / 32 or 64	33	5 V & Univ

The following figure shows the PCI slots on the main logic board.



# Configuration Rules

All slots can be used for PCI universal cards.

All slots can support PCI long or short cards.

Each slot can supply up to 15 W of power.

The SCSI host adapter card included in the 8-bay storage expansion option consumes one 32-bit or 64-bit PCI slot. If two storage expansion options are installed, two 32-bit or 64-bit PCI slots will be unavailable for other cards.

PCI cards may be freely installed in any compatible PCI slots. Slots need not be filled in any particular order. In most cases, the system's I/O performance will be unaffected by placement of PCI cards in the slots. Heavily loaded systems, however, will deliver better overall performance if attention is given to the bus placement of high-throughput interface cards.

For best performance, the highest throughput interface cards should be installed in slots supported by different buses and different PCI-UPA bridges. Examples of high-throughput interfaces are dual-channel UltraSCSI host adapters and ATM-622 interfaces.

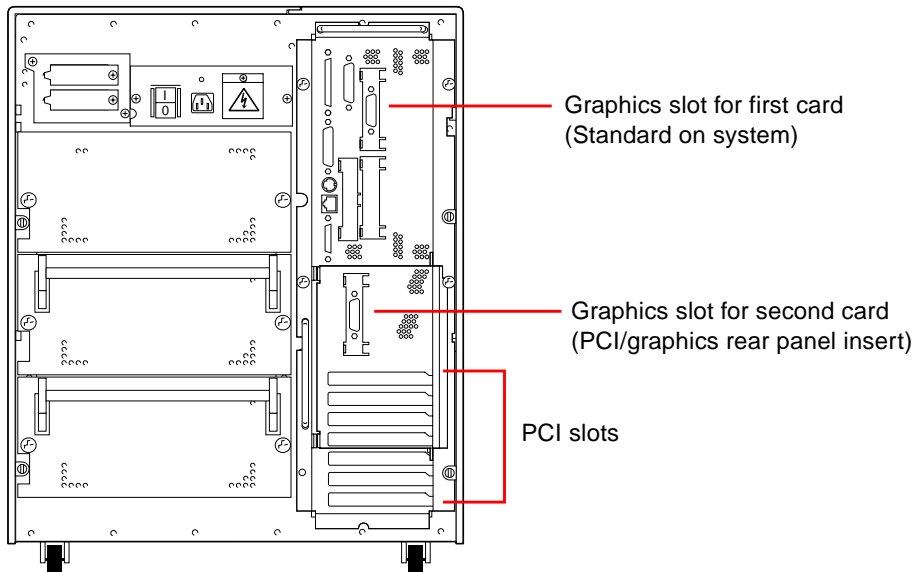
Overall system availability may also be improved by installing redundant storage or network interfaces in slots on different PCI buses and PCI-UPA bridges.

For maximum system performance, heavily-used, high-throughput interfaces, such as dual channel UltraSCSI host adapters, should be installed in PCI slot 10 only as a last resort. PCI bus B, which supports slot 10, already supports both the onboard UltraSCSI controller for four internal disk drives plus the onboard FastEthernet. Additional high-throughput interfaces may perform better when installed on another bus.

If a second UPA graphics card is installed in the system, only the bottom seven PCI slots are available for use. In order to accommodate a second UPA graphics card, you must replace the seven-slot PCI rear panel insert with the PCI/graphics rear panel insert, which leaves only the first seven PCI slots available. For more information about graphics cards, see "About UPA Graphics Cards" on page 60.

# About UPA Graphics Cards

The main logic board supports a maximum of two Ultra Port Architecture (UPA) graphics cards. The basic system provides the slot for one UPA graphics card. For a second UPA graphics card, you must replace the PCI rear panel insert with a PCI/graphics rear panel insert. The following figure shows the rear of a system with a PCI/graphics rear panel insert and two single-width UPA graphics cards installed in the system.



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**Note** – When the PCI/graphics rear panel insert is installed, only the bottom seven PCI slots are available for use.

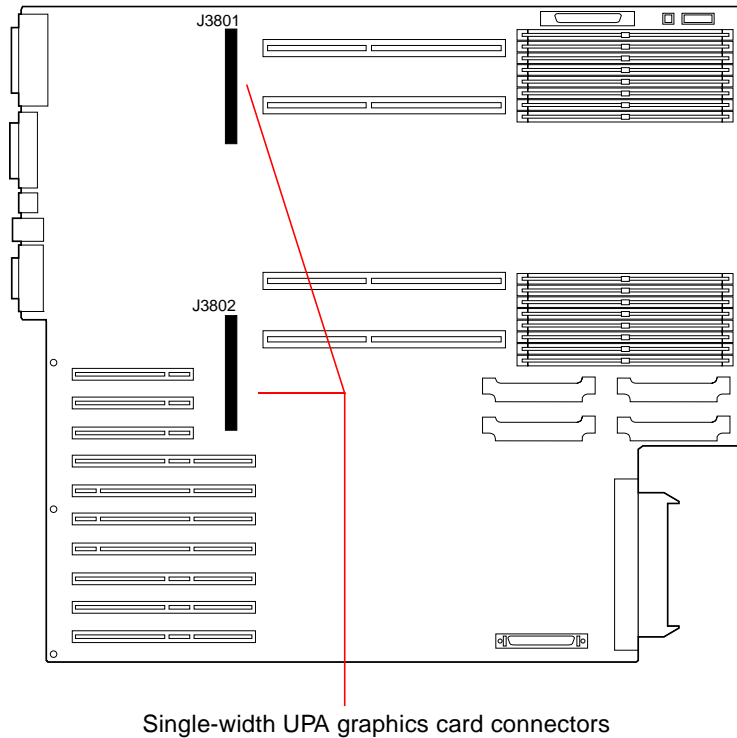
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The main logic board provides the following connectors for single-width UPA graphics cards:

- Connector J3801 for the first card
- Connector J3802 for the second card



These connectors are shown in the following figure.



When two UPA graphics cards are installed in the system, the upper-most card (connector J3801) serves as the main graphics console.

When used with a Sun monitor, a UPA graphics card automatically configures itself to the proper screen resolution and refresh rate for the attached monitor. However, if a non-Sun monitor is used, the monitor may not display the proper screen resolution.

To change the screen resolution, see the `ffbconfig` man page, or consult the *Platform Notes: SMCC Frame Buffers* document on the *Solaris on Sun Hardware AnswerBook*. This AnswerBook documentation is provided on the SMCC Updates CD for the Solaris release you are running.

# Configuration Rules

To install a second UPA graphics card in the system, you must install a PCI/graphics rear panel insert.

When you have two UPA graphics cards installed in the system, only seven PCI slots are available for use.

---

# About Internal Disk Drives

The Sun Ultra 450 workstation supports up to 4, 12, or 20 internal, hot-pluggable UltraSCSI disk drives. Drives are 3.5-inches wide by 1-inch high.

Four drives are supported by the 40-Mbyte per second UltraSCSI interface on the system's main logic board. Eight additional drives can be supported by installing an 8-bay storage expansion option. Two 8-bay storage expansion options are required to support the maximum of 20 internal disk drives.

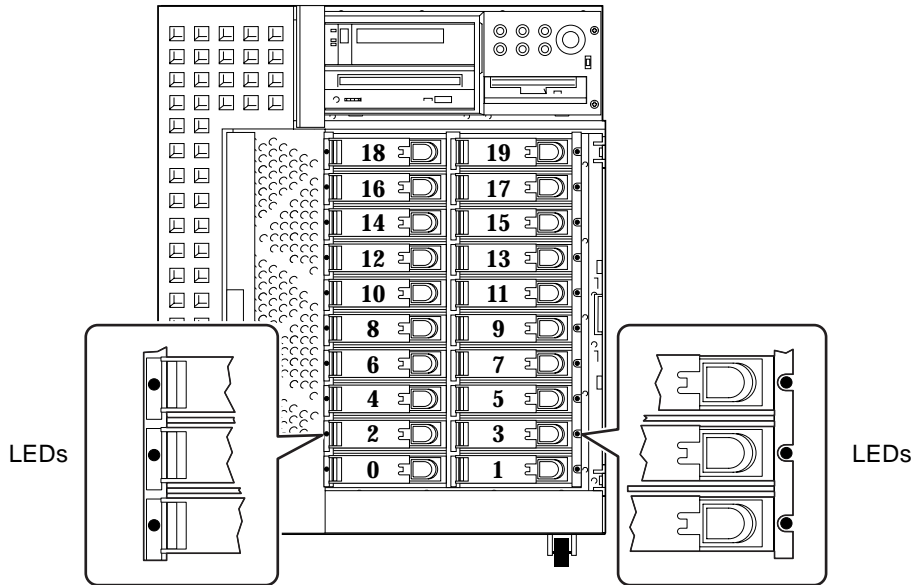
The 8-bay storage expansion option provides an eight disk backplane, which mounts to the rear of the system's disk cage; a 32-bit, dual-channel, UltraSCSI, PCI host adapter card; plus all power and data cables necessary to support eight internal disk drives, four drives on each UltraSCSI channel.

With two 8-bay storage expansion options installed, the system will support up to twenty internal drives, with four drives assigned to each of five separate UltraSCSI channels. This configuration gives the system an internal storage I/O bandwidth of up to 200 Mbytes per second.

The Solstice™ DiskSuite™ software (purchased separately) allows internal disk drives to be used in a variety of RAID configurations. RAID 0 (striping), RAID 1 (mirroring), RAID 0+1 (striping plus mirroring), and RAID 5 (striping with interleaved parity) storage configurations can all be implemented. Drives can also be configured as “hot spares.” For more information on RAID configurations, see “About Disk Array Configurations and Concepts” on page 359.

The system's disk cage features twenty green/yellow LED lights, each one located adjacent to a disk bay. These LEDs indicate the operating status and any fault conditions associated with each disk drive. This diagnostic feature helps the administrator quickly identify drives requiring service. For additional information about disk drive LEDs, see “Disk LEDs” on page 412.

The following figure shows the system's 20 internal disk slots and LEDs. Disk slots are numbered from 0 to 19. When adding a new disk drive to the system, you should install the drive in the lowest available slot number.



The “hot-plug” feature of the system’s internal disk drives allows the removal and installation of drives while the system is operational. This capability significantly reduces system down-time associated with disk drive replacement.

The hot-plug procedure involves software commands for preparing the system prior to removing a disk drive and for reconfiguring the operating environment after installing the replacement drive. The exact hot-plug procedure depends on which version of the Solaris operating environment you are using. For the complete procedure, please refer to *Platform Notes: Sun Ultra 450 Workstation and Ultra Enterprise 450 Server*, available on the *Solaris on Sun Hardware AnswerBook*. This AnswerBook documentation is provided on the SMCC Updates CD for the Solaris release you are running.

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**Note** – In some cases, *Platform Notes: Sun Ultra 450 Workstation and Ultra Enterprise 450 Server* may be included with your system documentation instead of on the *Solaris on Sun Hardware AnswerBook*.

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In order to perform a disk hot-plug procedure, you must know the slot number of the faulty disk (0 through 19) and its logical device name (for example, `c2t3d0`). If you know the disk slot number, it is possible to determine the logical device name, and vice versa. It is also possible to determine both the disk slot number and the logical device name if you know the physical device name (such as `/devices/pci@6,4000/scsi@4,1/sd@3,0`). Physical device names are typically provided in SCSI error messages generated by software.

For instructions on how to translate from one form of disk identifier to another, see *Platform Notes: Sun Ultra 450 Workstation and Ultra Enterprise 450 Server*.

## Configuration Rules

Disk drives must be Sun standard 3.5-inches wide by 1-inch high, UltraSCSI-compatible drives.

Each disk should be installed in the lowest-numbered drive slot available. Fill drive bays from the bottom of the disk cage to the top.

The SCSI IDs for the disks are hardwired on the disk backplanes. There is no need to set any SCSI ID jumpers on the disk drives themselves. The SCSI target address (SCSI ID) of each disk drive is determined by the slot location where the drive is connected to its UltraSCSI backplane. The backplane also provides the SCSI termination for each drive. Jumpers should not be used on the disk drive itself to select a specific SCSI ID.

The disk backplane for the first 8-bay storage expansion option should be installed directly above the system's standard four-disk backplane. The backplane for the second 8-bay storage expansion option mounts above the first option backplane, at the top rear of the disk cage.

The dual-channel UltraSCSI PCI host adapter card supplied with the 8-bay storage expansion option may be installed in any available PCI slot. For maximum performance, the system should be configured, if possible, with no more than one dual-channel UltraSCSI host adapter on each PCI bus. For additional information on configuring PCI adapters, see "About Peripheral Component Interconnect (PCI) Buses" on page 57.

The dual-channel UltraSCSI PCI host adapter card supplied with the 8-bay storage expansion option has two internal SCSI connectors and two external SCSI connectors. When installed as part of the 8-bay storage expansion option, only the internal connectors are used. Do not connect external SCSI devices to a SCSI channel that is used to support internal disk drives. Additional single-ended and differential UltraSCSI host adapters are available for controlling external SCSI storage devices.

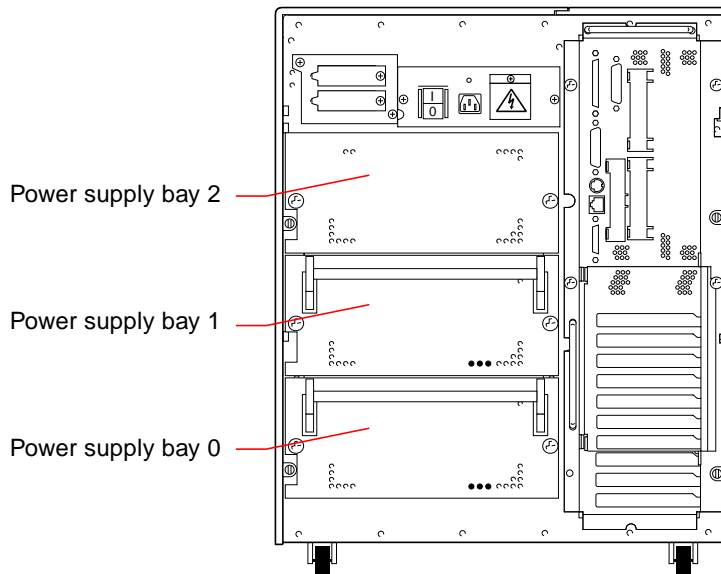
For information about implementing RAID configurations, see "About Disk Array Configurations and Concepts" on page 359.

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# About Power Supplies

A central power distribution board delivers DC power for all internal system components. The system's power supplies plug into connectors on this board, and all of the supplies installed share equally in satisfying the power demands of the system.

Power supplies are modular units, designed for fast, easy installation or removal, even while the system is fully operational. Supplies are installed in bays at the rear of the system, as shown in the following figure.



The system can accommodate a maximum of three power supplies. Each supply provides up to 560 watts of DC power. Most system configurations can operate with only one power supply installed. In this case, a second supply can be used to provide N+1 redundancy, allowing the system to continue operating should one of the power supplies fail.

Two supplies will provide enough power for a heavily configured system. In this case, a third supply can be added for N+1 redundancy. With three power supplies installed in the system, even a heavily configured machine can continue full operation during removal or replacement of one of the supplies.

In a system with three power supplies, the third power supply is always redundant; it cannot be used to increase output capacity.

Power supplies in a redundant configuration feature a “hot swap” capability. You can remove and replace a faulty power supply without turning off the system power or even shutting down the operating system.

In order to determine how many power supplies are required to provide redundancy for your configuration, you must calculate the power requirements for your system. For guidelines on calculating your power requirements, see “How to Determine System Power Requirements” on page 84.

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**Note** – When removing a hot-swappable power supply, do not disengage and reengage the supply in rapid succession. Always remove a supply completely before reinserting the same supply or a replacement supply. Rapid seating and unseating of power supplies will result in false error conditions.

---

## Configuration Rules

You can install power supplies in any of the bays — and in any order. For information about installing power supplies, see “How to Install a Power Supply” on page 239.

If you have only one power supply installed in the system, the system will operate only as long as the power demands of the configuration do not exceed the output capacity of that single supply. In order to determine how many power supplies are required for your configuration (one or two), you must calculate the system’s total power requirements. For guidelines on calculating your power requirements, see “How to Determine System Power Requirements” on page 84.

Once the system’s total power requirements are met (either with one or two power supplies), installation of an additional power supply will enable the system to remain fully operational even if one power supply is removed or becomes inoperative. For information about removing and installing power supplies, see “How to Install a Power Supply” on page 239 and “How to Remove a Power Supply” on page 237.



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**Caution** – Each time you install additional options in the system, you must recalculate the system’s power requirements in order to determine the number of power supplies required to support the new configuration. This is especially important if you expect the system to operate on one power supply or to have power redundancy with only two supplies installed.

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# About the Standard Ethernet Port

The system's main logic board provides an auto-sensing, switchable 10BASE-T/100BASE-TX Ethernet interface conforming to the IEEE 802.3u Ethernet standard. The interface configures itself automatically for either 10 Mbps or 100 Mbps operation, depending on network characteristics.

Two rear panel connectors provide access to the Ethernet interface:

- One RJ-45 connector for connecting a category-5 twisted-pair Ethernet (TPE) cable
- One Media Independent Interface (MII) connector for connecting an external MII transceiver

---

**Note** – You can use only one of the main logic board Ethernet connectors; you cannot connect to the TPE and MII connectors at the same time.

---

The Media Independent Interface lets you connect the system to a variety of external 100BASE-TX (Fast) Ethernet transceivers, providing compatibility with different Ethernet wiring types. When an external transceiver is connected to the MII, the system automatically activates the MII port and disables the TPE port.

Sun Microsystems offers an MII-to-AUI transceiver as a separately orderable option (order number X467A). A number of third-party MII transceivers are also available for connecting to TX, T4, FX, and AUI-type Ethernet networks.

For instructions on configuring the main logic board Ethernet interface, see “How to Configure the Standard Ethernet Interface” on page 343.

For connector diagrams and pin assignments, see “Reference for the Twisted-Pair Ethernet (TPE) Connector” on page 436 and “Reference for the Media Independent Interface (MII) Ethernet Connector” on page 437.

For information about operating characteristics and configuration parameters for the hme Fast Ethernet device driver, please see *Platform Notes: The hme Fast Ethernet Device Driver*. This document is available on *Solaris on Sun Hardware AnswerBook*, which is provided on the SMCC Updates CD for the Solaris release you are running.



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## About the Serial Ports

The system provides two serial communications ports through a single, shared DB-25 connector located on the rear panel. The primary port is capable of both synchronous and asynchronous communication, while the secondary port is asynchronous only. In synchronous mode, the primary port operates at any rate from 50 Kbaud to 256 Kbaud when the clock is generated internally. When the clock is generated from an external source, the synchronous port operates at rates up to 384 Kbaud. In asynchronous mode, either port supports baud rates of 50, 75, 110, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 153600, 230400, 307200 and 460800 baud.

The primary port is accessible by connecting a standard serial cable to the rear panel serial port connector. In order to access the secondary port, a serial port splitter cable (Sun part number X985A) must be attached to the rear panel serial port connector. The connector labeled “A” on the splitter cable provides the primary port; the connector labeled “B” provides the secondary port.

Both the primary and secondary ports can be configured to provide EIA-423 or EIA-232D signal levels. Both ports are configured to one level or the other by jumpers located on the system’s main logic board. The default setting is EIA-423. For more information about configuring the serial port jumpers, see “About Serial Port Jumpers” on page 73.

See “Reference for the Serial Port A and B Connectors” on page 430 for the connector diagram, rear panel icon, and pin assignments.

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## About the Parallel Port

The system provides one IEEE 1284-compatible, bidirectional parallel port for connecting the system to a local printer or other compatible parallel device. Connectivity is provided by a standard 25-pin DB-25 connector on the rear panel of the system. The parallel port operates at a 2-megabytes per second data transfer rate and supports the EPP protocol modes as well as standard Centronics, Nibble, and Byte modes.

See “Reference for the Parallel Connector” on page 432 for the connector diagram, rear panel icon, and pin assignments.

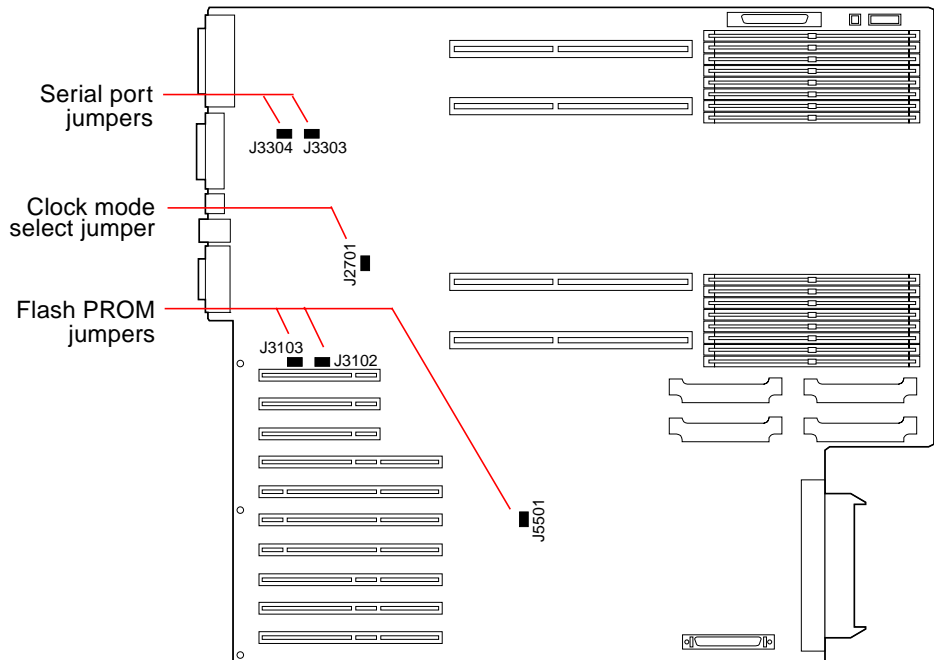
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# About the Main Logic Board Jumpers

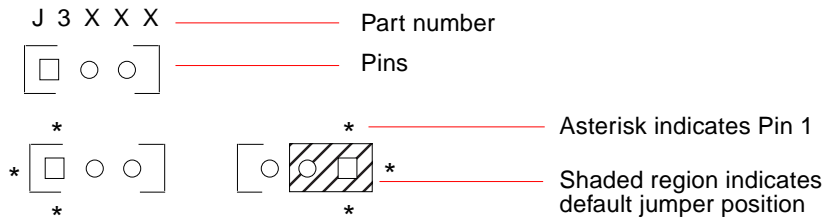
The jumpers on the main logic board have the following functions:

- J3303 and J3304 are used to configure the serial ports provided for either EIA-423 or EIA-232D operation. For information about the EIA-423/232D jumper settings, see “About Serial Port Jumpers” on page 73.
- J3102, J3103, and J5501 are used to affect the operation of the flash PROM located on the main logic board. For information about the flash PROM jumper settings, see “About Flash PROM Jumpers” on page 75.
- J2701 is used to select the proper clock mode for the system. For information on the clock mode select jumper settings, see “About the Clock Mode Select Jumper” on page 74.

The illustration below shows the jumper locations on the main logic board.



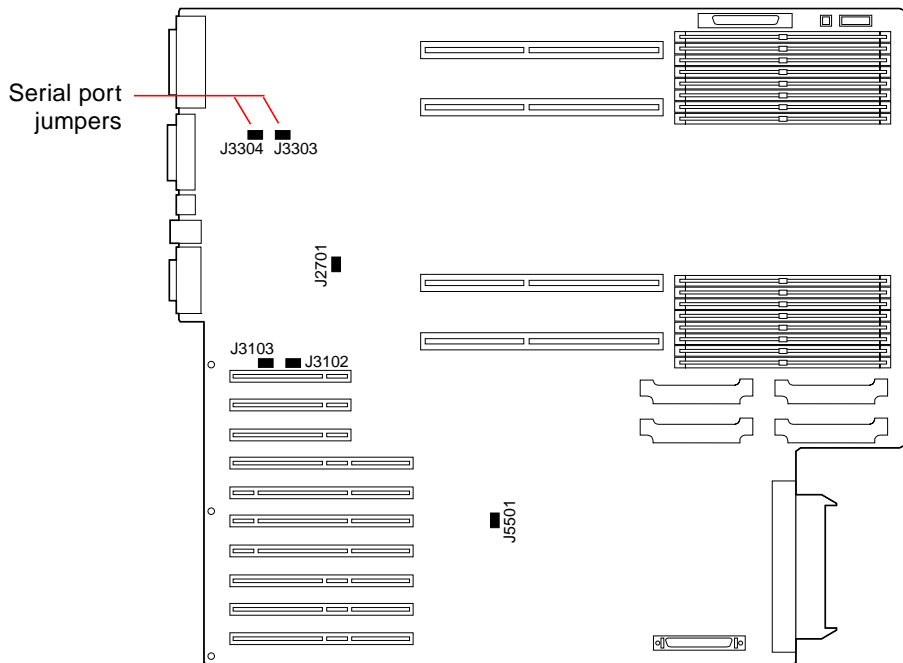
Jumpers are marked on the main logic board with identification numbers. For example, the serial port jumpers are marked J3303 and J3304. Jumper pins are located immediately adjacent to the identification number. The default jumper positions are indicated with shaded regions. Pin 1 is marked with an asterisk (\*) in any of the positions shown below.



# About Serial Port Jumpers

The serial port jumpers on the main logic board (J3303 and J3304) permit the configuration of the system's two serial ports for either EIA-423 or EIA-232D signal levels. EIA-423 levels are the default standard for North American users. EIA-232D levels are required for digital telecommunication in nations of the European Community.

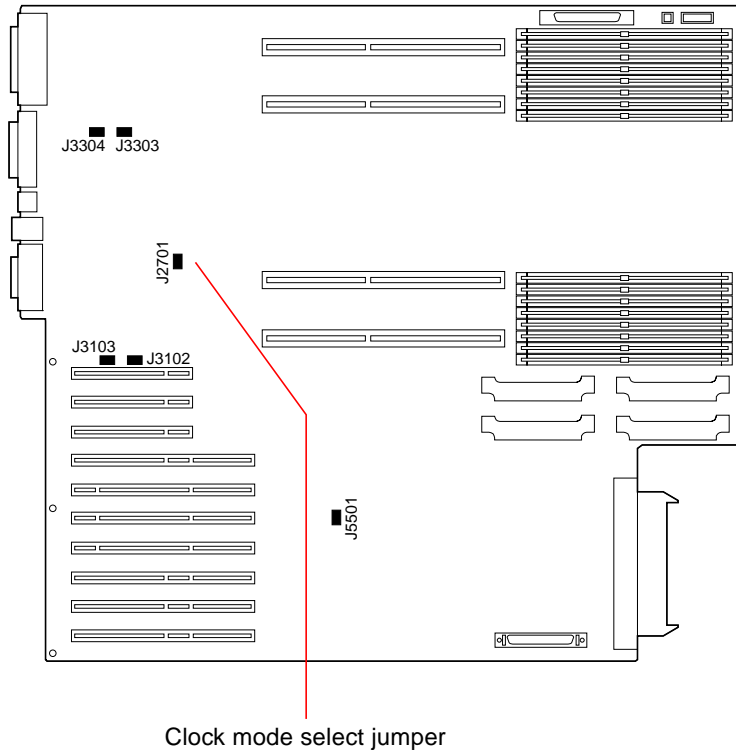
The figure below shows the jumper locations and the table describes their function.



Jumper	Shunt on Pins 1 + 2 Selects	Shunt on Pins 2 + 3 Selects	Default Shunt on Pins	Signal Controlled
J3303	EIA-232D	EIA-423	2 + 3	RS232/RS423 SEL
J3304	EIA-232D	EIA-423	2 + 3	RS232/RS423 SEL

# About the Clock Mode Select Jumper

The clock mode select jumper (J2701) is used to select the appropriate clock mode for the system. This jumper is preset at the factory and should not be changed. The figure below shows the jumper location and the table defines its standard setting.

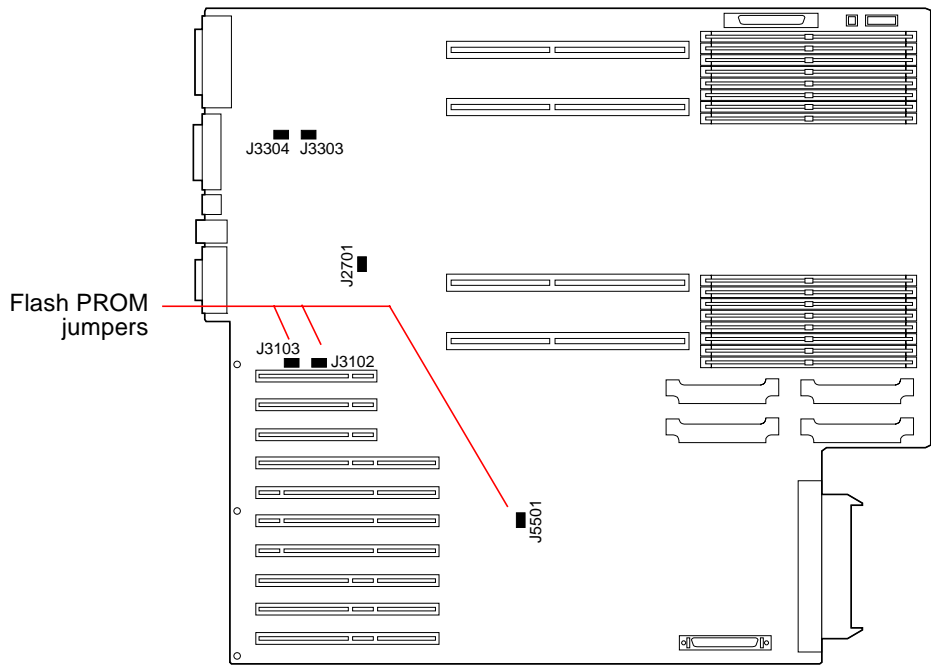


Jumper	Shunt on Pins 1 + 2 Select	Shunt on Pins 2 + 3 Select	Default Shunt on Pins	Signal Controlled
J2701	Correct clock mode for any UltraSPARC II CPU modules	Not used	1 + 2	UPA_RATIO2

# About Flash PROM Jumpers




The system uses flash PROMs to permit the reprogramming of specific code blocks that are held in non-volatile system memory, and to permit remote reprogramming of that code by an authorized system administrator over a local area network.

Three jumpers on the main logic board affect flash PROM operation. The figure below shows the jumper locations, and the table describes their function.



Jumper	Shunt on Pins 1 + 2 Selects	Shunt on Pins 2 + 3 Selects	Default Shunt on Pins	Signal Controlled
J3102	Flash PROM	Not To Be Used	1 + 2	FLASH PROM SEL
J3103	Write Enable	Write Protect	1 + 2	FLASH PROM PROG ENABLE
J5501	High Half Booting	Normal Booting	2 + 3	XOR LOGIC SET

---

**Note** – Jumper J3103 is factory-set so that the flash PROM is write-enabled. You use the keyswitch located on the front panel to write protect the flash PROM. When the switch is set to the Locked position (  ), the flash PROM is write-protected. When the switch is set to the Power-on position (  ) or to the Diagnostics position (  ), the flash PROM is write-enabled.

---

For more information about flash PROM programming, see the documentation supplied with the flash PROM update CD-ROM.



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# About the SCSI Removable Media Bays and the External SCSI Port

The removable media assembly located at the top front of the system provides mounting bays for two SCSI devices. Each bay is a 5.25-inch half-height (1.6-inch) bay, and may be used for a narrow SCSI (50-pin) tape drive, such as a 12x CD-ROM drive, a 8-mm tape drive, a 4-mm DDS-2 or DDS-3 tape drive, or a quarter-inch cassette tape drive. Both removable media bays provide access to the same SCSI bus.

The SCSI bus that supports the removable media devices also extends to a 68-pin SCSI connector, which is located on the system's rear panel. This bus is Fast/Wide-capable (20 Mbytes per second) and can support additional external, single-ended, wide or narrow SCSI devices. See "Reference for the SCSI Connector" on page 433 for a diagram and pinout of the connector.

With an internal tape drive installed, this bus will support up to two external SCSI tape devices. A system without an internal tape drive will support up to four external SCSI tape devices. Additional external tape devices can be supported by installing appropriate PCI host adapter cards.

## Target Devices

Up to 15 devices can operate on the bus at 20 Mbytes/sec. Target addresses for the SCSI bus (also known as SCSI IDs) are available in a range of 0 through F. Target address 7 is reserved for the SCSI host adapter located on the main logic board.









The following target addresses are reserved for internal devices:

Address	Device	Comment
5	Tape drive	If no tape drive is installed in the system, then this address can be used for an external device. If you later install an internal tape drive, then you must use 5 as its address and assign a different address to the external drive.
6	CD_ROM	If no CD-ROM drive is installed in the system, then this address can be used for an external device. If you later install an internal CD-ROM drive, then you must use 6 as its address and assign a different address to the external device.
7	Host adapter	This address is reserved exclusively for the host adapter on the main logic board. It cannot be used for any other device.

The addresses for the CD-ROM and tape drives are determined by jumpers located on the drives. If the CD-ROM and tape drives have been factory-installed, they are configured with the correct addresses for the system.

When installing a drive as an option, you should verify the address settings on these devices. The settings usually involve three sets of pins that determine the address in binary. Attaching a jumper across a set of pins creates a binary 1 in that position.

---

	$000_2 =$ SCSI ID 0		$001_2 =$ SCSI ID 1		$010_2 =$ SCSI ID 2
	$011_2 =$ SCSI ID 3		$100_2 =$ SCSI ID 4		$101_2 =$ SCSI ID 5
	$110_2 =$ SCSI ID 6		$111_2 =$ SCSI ID 7		

---

See the documentation accompanying the drive for device-specific information about checking and setting jumpers.

## Bus Length

The maximum SCSI bus length for daisy-chained SCSI devices is 6 meters (19.7 feet), including the internal bus length (1.0 meter/3.37 feet). You must include the internal bus length (1 meter/3.37 feet) in your bus length calculations.

## Cabling and Termination

The internal bus is terminated on both ends. When an external device is attached to the connector provided on the rear panel of the system, the on-board terminators near that connector are disabled to extend the bus. In this case, the last external device in the chain must provide the termination.

---

**Note** – If you connect a narrow device to the external SCSI port, the on-board terminators only disable the termination for the lower byte of data; the upper byte is still terminated on the main logic board.

---

Use the following cabling guidelines to ensure proper device termination:

- The SCSI bus must be correctly terminated. Most Sun devices use autotermination. See the documentation supplied with the device.
- If all external mass storage devices use 68-pin connectors, connect all non-Sun devices to the system first and Sun devices last in the chain, since Sun 68-pin devices use autotermination.
- If external mass storage devices consist of 68-pin devices and 50-pin devices, connect the Sun 68-pin devices to the system first and terminate the chain with a 50-pin device and its terminator. The 68-pin device connected to the 68-50 pin adapter cable must be auto-terminating in order to terminate the high-order bits.

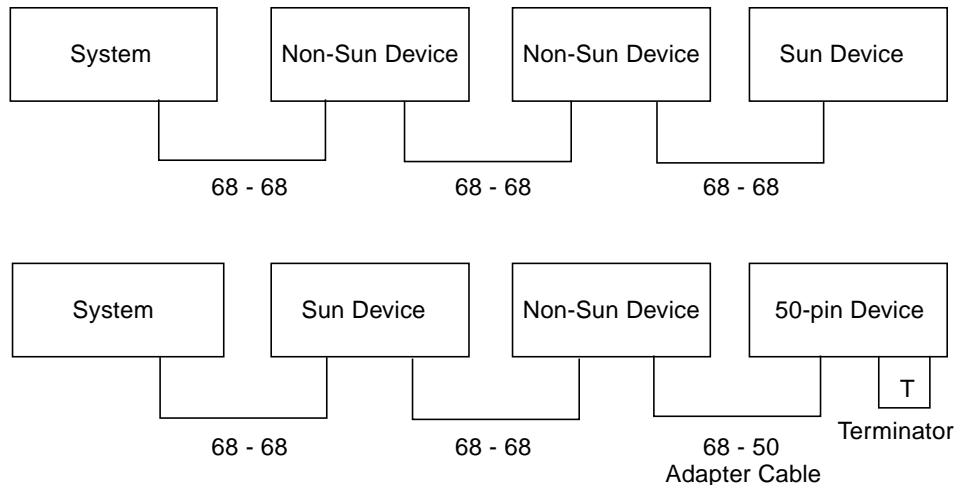


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**Caution** – Do not connect 68-pin devices after 50-pin devices; SCSI bus errors will occur.

---

The following figures provide a summary of the cabling guidelines.



## Multi-initiator Support

The SCSI implementation of the system includes multi-initiator support: any external host adapter on the bus can drive Termpower. This means that if the system should lose, the devices on the SCSI bus (except those powered by the system) can continue to operate.

# Configuration Rules

You can connect up to 15 devices to the Fast/Wide SCSI bus.

The maximum SCSI bus length is 6 meters (19.7 feet), including the internal bus length (1.0 meter/3.37 feet). You must include the internal bus length (1 meter/3.37 feet) in your bus length calculations.

You cannot assign target address 7 to any device; it is reserved for the host adapter on the main logic board.

If a tape drive is installed in the system, you must assign it target address 5.

If a CD-ROM is installed in the system, you must assign it target address 6.

If all external mass storage devices use 68-pin connectors, connect all non-Sun devices to the system first and Sun devices last in the chain. Sun devices use autotermination.

If external mass storage devices consist of 68-pin devices and 50-pin devices, connect the Sun 68-pin devices to the system first and terminate the chain with a 50-pin device and its terminator.

---

# About Power Budget Constraints



12A

16A

---

You must ensure that your configuration does not exceed the power budget constraints of the system.

---

This section describes the following three areas in which system power budget constraints occur:

- Maximum rated values for the +3.3, +5, and +12 VDC power supply outputs
- Total power supply output capacity
- Current limit of the AC power outlet

“How to Determine System Power Requirements” on page 84 provides the information that you need to calculate your power budget. It includes a worksheet that lists the amps required for the basic system and all internal options at +3.3 VDC, +5 VDC, and +12 VDC. It also provides a procedure that steps you through the worksheet to calculate the values that you need.

You must determine the power requirements of your configuration when you first install the system and also whenever you add an option. Therefore, you should save the worksheet and store it in a safe and convenient location so that you don’t have to recalculate the power budget for the entire system when you install a new option.

## +3.3 VDC, +5 VDC, and +12 VDC Maximum Rated Values

Using the worksheet and procedure provided in “How to Determine System Power Requirements,” you first calculate the DC current draw on each power supply output (+3.3 VDC, +5 VDC, and +12 VDC). You must ensure that the total for each is within the maximum rated value for that output. The following table provides the maximum rated values for one supply and two supply configurations.

---

Power Supply Output	Maximum Rated Value	
	One Power Supply	Two Power Supplies <sup>1</sup>
+3.3 VDC	47 A	94 A
+5 VDC	65 A	130 A
+12 VDC	16 A	32 A

---

1. A third supply can only be used to provide redundancy — not to increase power capacity.



---

**Caution** – The power supply configuration cannot support the maximum values on all three outputs at the same time because that would exceed the total power supply output capacity. The load can be distributed between the outputs in any way that does not violate their maximum values or exceed the total output capacity of the power supply configuration. For a single supply configuration, the combined +3.3 V and +5 V output cannot exceed 400 W. For a two power supply configuration, the combined output cannot exceed 800 W. Therefore, you must also calculate the total DC current draw on the +3.3 V and +5 V power supply outputs.

---

## Power Supply Output Capacity

Using your values for the DC current draw on each power supply output, you then calculate the total power consumption (total watts) of your system. You must ensure that the total watts required for your system does not exceed the maximum output capacity of the power supply configuration.

The maximum output capacity of a single power supply is 560 watts. The maximum output capacity of two power supplies is 1120 W.

You can also use the total watts required to determine the proper power supply configuration for your system—how many supplies you need to power your system and to provide power supply redundancy, if required. See “About Power Supplies” on page 66 for information about power supplies and configuration rules.

In addition, you can use the total watts (also known as DC watts) to calculate AC watts, thermal dissipation and Volt-Amps for your configuration. These values are used in facility planning. For convenience, these calculations are provided in “How to Determine System Power Requirements” on page 84.

---

**Note** – The system has built-in protection against exceeding the output capacity of the power supply configuration. If your configuration exceeds the recommended operational capacity of the power supply configuration, the general fault indicator (⚡) illuminates on the LED and control panel but the system continues to operate until you can correct the problem. If the configuration exceeds the safety threshold for power supply operation, then the system shuts itself off automatically. See “About the Status and Control Panel” on page 9 for information about the general fault indicator.

---

## Total AC Current Draw

Using your value for total watts required by the system, you can calculate the total AC current draw by the system. You must ensure that the AC current draw does not exceed the maximum current limit for the 15-Amp power outlet.

In the United States and Canada, the maximum is 80 percent of the outlet's total capacity, which is 12 A. For areas outside of the United States and Canada, contact local agencies for local electrical codes about specific information on local AC branch limitations.

---

# How to Determine System Power Requirements

## Before You Begin

You must perform the following tasks:

- Review information about power budgets; see “About Power Budget Constraints” on page 81.
- Review information about power supply redundancy; see “About Power Supplies” on page 66.

After you have reviewed the sections listed above, you can use the “System Power Requirements Worksheet” on page 88 and the procedure provided in this section to determine the following power requirements of your system configuration:

- DC amps at +3.3 V, +5 V, and +12 V
- Total DC watts
- Total AC amps

The worksheet divides the Sun options available for your system into the following categories: base systems, CPU options, memory options, internal peripheral options, PCI cards, graphics options, and miscellaneous options. It also provides a section at the end for third-party options. Blank lines have been left at the end of each section so that you can add new options when they become available.

The worksheet lists the current draw of each item at +3.3 V, +5 V, and +12 V, where possible. In some cases, the power specifications can only be obtained from the information that is shipped with the product.

This section also includes sample configurations and their calculations as well as information on what to do if your system exceeds power budget constraints.

## How to Calculate Your DC Power Requirements

This procedure presumes that you know the DC current draw on each power supply output for each system option. In some cases, the documentation that is supplied with the option may only provide the total watts required for the option. In this case, you should calculate the +3.3 V and +5 V total (Step 8 in the following procedure) with the information you have available. The number you obtain will not be



completely accurate, but it should still allow you to judge if your system is going to exceed the limit. Then, when you calculate the total DC watts (Step 10 in the following procedure), you must remember to include the total watts for the option.

It is not unusual for the information supplied with PCI cards to only provide the total watts required for the card. To calculate the per output totals and the +3.3 V and +5 V total more accurately, use the following guidelines to divide the total DC current draw among the power supply outputs:

- For a 15 W card, calculate 2.3 A at +3.3 V; 1.5 A at +5 V; and 0.5 A at +12 V
- For a 25 W card, calculate 3.8 A at +3.3 V; 2.5 A at +5 V; and 0.5 A at +12 V

**1. Locate the “System Power Requirements Worksheet” on page 88. In the quantity column (Qty), fill in how many of each type of option you have in the system.**

For instance, if you have twelve 4.2-Gbyte disk drives, fill in the number 12 in that row and column of the worksheet.

**2. Multiply the quantity with the amps for each power output, and fill in the results in the appropriate columns of the worksheet.**

For example, if you have twelve 4.2-Gbyte disk drives, then you would multiply 12 by 0.8 and record the result in the Total Amps @ 5 V column. Then multiply 12 by 1.0 and record the result in the Total Amps @ 12 V column of the worksheet. Because the drive doesn't use the +3.3 V output, you leave that blank. See the following example.

Step 1. Fill in the quantity of the option.

Step 2. Multiply the quantity with amps and record results here.

Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
	4.2 GB Drive	12			0.8	9.6	1.0	12.0

**3. Complete Step 1 and Step 2 for all of your system options.**

4. Calculate the total for each of the following columns: Total Amps @ 3.3 V, Total Amps @ 5V, and Total Amps @ 12V. Record each sum in the appropriate spaces in Line 2 at the end of the worksheet.


These figures represent the total DC amps required from each of the three power supply outputs: +3.3 V, +5 V, and +12 V.

5. Compare the total in Line 2 with the value located immediately above it in Line 1.

You are comparing the total amps per output with the maximum rated value for that output. The maximum ratings in Line 1 are provided as a pair of values, where the first value in each pair is for a single power supply and the second value is for a system configured with two or three power supplies. See the following example.

Step 4. Add totals for each column and record them in Line 2.

Step 5. Compare values in Lines 1 and 2.



Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
1	DC Amp Maximum Rating			47/94		65/130		16/32
2	DC Amp Total Per Output			22.9		36.6		9.9

6. Is the total of each column in Line 2 less than its maximum rated value given in Line 1?

- If yes, proceed to Step 7.
- If no, see “What to Do If Your System Exceeds Power Supply Capacity” on page 94.

7. Multiply the total DC amps per output recorded in Line 2 with the value immediately below it in Line 3 and record the results in Line 4.

8. Add the total amps for 3.3 V and 5 V, and record the sum in Line 5.

9. Is the combined value for 3.3 V and 5 V less than 400 W?

If you have two supplies, is the value in Line 5 less than 800 W?

- If yes, proceed to Step 10.
- If no, proceed to “What to Do If Your System Exceeds Power Supply Capacity” on page 94.

**10. Add together the three numbers in Line 4 and record the sum in Line 6.**

This is the total DC watts required by your system configuration. Remember that you must add in the numbers for options for which you only have the total watts. See the following example.

- Step 7. Multiply value in Line 2 with value beneath it in Line 3. Record results in Line 4.
- Step 8. Add first two numbers in Line 4 and record the sum in Line 5.
- Step 10. Add the numbers in Line 4 and record the sum in Line 6.

Line No.	Option	Qty	+3.3 VDC Amps	Amps @ 3.3 V X Qty	+5 VDC Amps	Amps @ 5 V X Qty	+12 VDC Amps	Amps @ 12 V X Qty
2	DC Amp Total Per Output			22.9		36.6		9.9
3	Multiply this number with the number in Line 2 above			X 3.3		X 5		X 12
4	DC Watts per Output			75.6		183.00		118.8
5	DC Watts for 3.3 V plus 5 V	258.6	Total must not exceed 400 watts (per supply).					
6	Total DC Watts	377.4	Total must not exceed 560 watts (per supply).					

**11. Is the value in Line 6 less than 560 W?**

If you have two supplies, is the value in Line 6 less than 1120 W?

- If yes, proceed to “How to Calculate Your AC Power Requirements” on page 95.
- If no, proceed to “What to Do If Your System Exceeds Power Supply Capacity” on page 94.

# System Power Requirements Worksheet

Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
	Base System <sup>1</sup>	1	9.0					
<b>CPU Options</b>								
	250 MHz CPU with 1 MB E-cache and DC/DC converter		2.5		4.0			
	300 MHz CPU with 2 MB E-cache and DC/DC converter		3.0		4.8			
<b>Memory Options</b>								
	16 MB DIMM				0.8			
	32 MB DIMM				0.8			
	64 MB DIMM				0.8			
	128 MB DIMM				0.8			
<b>Internal Storage Device Options</b>								
	4.2 GB UltraSCSI disk drive				0.8		1.0	
	7-14 GB 8-mm tape drive				1.0		0.9 (pk)	
	14 GB 8mm tape drive				3.2		1.4 (pk)	
	4-8 GB DDS2 tape drive - HP				1.2		0.4	
	4-8 GB DDS2 tape drive - Seagate				0.8		0.4	
	12-24 GB DDS3 tape drive				1.2		0.3	
	2.5 GB QIC tape drive				0.5		0.9	
	SunCD 12 CD-ROM				1.0		0.6	
	SunCD 4 Internal CD-ROM				1.0		0.6	
	1.44 MB diskette drive				0.8 (pk)			

Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
<b>PCI Cards</b>								
	Dual single-ended UltraSCSI disk controller				0.4			
	15 W PCI card		2.3		1.5		0.5	
	25 W PCI card		3.8		2.5		0.5	
<b>Graphics Options</b>								
	Creator-series graphics card		2.0		0.4			
<b>Miscellaneous</b>								
	Audio Module				0.1		0.2	
	MII-to-AUI transceiver <sup>2</sup>						0.4	
<b>Third Party Options</b>								

Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
<b>1</b>	<b>DC Amp Maximum Rating</b>			47/94 <sup>3</sup>		65/130		16/32
<b>2</b>	<b>DC Amp Total Per Output</b>							
<b>3</b>	<b>Multiply this number with the number from line 2 above</b>			X 3.3		X 5		X 12
<b>4</b>	<b>DC Watts Per Output</b>							
<b>5</b>	<b>DC Watts for 3.3 V plus 5 V</b>			<b>Total must not exceed 400 watts (per supply).</b>				
<b>6</b>	<b>Total DC Watts</b>			<b>Total must not exceed 560 watts (per supply).</b>				

1. The base system value includes a chassis with seven fans, the main logic board, LED interface board, power distribution board, and disk backplanes. (It does NOT include CPU modules, memory modules, or internal storage devices; values for those options must be entered separately.)
2. If the MII transceiver is plugged into a wall outlet, then do not use the +12 VDC value in your calculations.
3. The first value is for a system with one power supply; the second is for a system with two or three power supplies.

# Sample Calculation of DC Watts

The following sample power budget is for a system that is configured with these options:

- Two 300-MHz CPU modules
- Eight 64-MB DIMMs
- Two 4.2-GB hard disk drives
- One SunCD 12 CD-ROM drive
- One diskette drive
- One Creator-series graphics card
- One audio module
- One MII-to-AUI transceiver (using system power)

Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
	Base System <sup>1</sup>	1	9.0	9.0				
<b>CPU Options</b>								
	250 MHz CPU with 1 MB E-cache and DC/DC converter		2.5		4.0			
	300 MHz CPU with 2 MB E-cache and DC/DC converter	2	3.0	6.0	4.8	9.6		
<b>Memory Options</b>								
	16 MB DIMM				0.8			
	32 MB DIMM				0.8			
	64 MB DIMM	8			0.8	6.4		
	128 MB DIMM				0.8			

Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
<b>Internal Storage Device Options</b>								
	4.2 GB UltraSCSI disk drive	2			0.8	1.6	1.0	2.0
	7-14 GB 8-mm tape drive				1.0		0.9 (pk)	
	14 GB 8mm tape drive				3.2		1.4 (pk)	
	4-8 GB DDS2 tape drive - HP				1.2		0.4	
	4-8 GB DDS2 tape drive - Seagate				0.8		0.4	
	12-24 GB DDS3 tape drive				1.2		0.3	
	2.5 GB QIC tape drive				0.5		0.9	
	SunCD 12 CD-ROM	1			1.0	1.0	0.6	0.6
	SunCD 4 Internal CD-ROM				1.0		0.6	
	1.44 MB diskette drive	1			0.8 (pk)	0.8		
<b>PCI Cards</b>								
	Dual single-ended UltraSCSI disk controller				0.4			
	15 W PCI card		2.3		1.5		0.5	
	25 W PCI card		3.8		2.5		0.5	
<b>Graphics Options</b>								
	Creator-series graphics card	1	2.0	2.0	0.4	0.4		



Line No.	Option	Qty	+3.3 VDC Amps	Total Amps @ 3.3 V	+5 VDC Amps	Total Amps @ 5 V	+12 VDC Amps	Total Amps @ 12 V
<b>Miscellaneous</b>								
	Audio Module	1			0.1	0.1	0.2	0.2
	MII-to-AUI transceiver <sup>2</sup>	1					0.4	0.4
<b>Third Party Options</b>								
<b>1</b>	<b>DC Amp Maximum Rating</b>			<b>47/94<sup>3</sup></b>		<b>65/130</b>		<b>16/36</b>
<b>2</b>	<b>DC Amp Total Per Output</b>			<b>17.0</b>		<b>19.9</b>		<b>3.2</b>
<b>3</b>	<b>Multiply this number with number from line 2 above</b>			<b>X 3.3</b>		<b>X 5</b>		<b>X 12</b>
<b>4</b>	<b>DC Watts Per Output</b>			<b>56.1</b>		<b>99.5</b>		<b>38.4</b>
<b>5</b>	<b>DC Watts for 3.3 V plus 5 V</b>	<b>155.6</b>		<b>Total must not exceed 400 watts (per supply).</b>				
<b>6</b>	<b>Total DC Watts</b>	<b>194.0</b>		<b>Total must not exceed 560 watts (per supply).</b>				

1. The base system value includes a chassis with seven fans, the main logic board, LED interface board, power distribution board, and disk backplanes. (It does NOT include CPU modules, memory modules, or internal storage devices; values for those options must be entered separately.)
2. If the MII transceiver is plugged into a wall outlet, then do not use the +12 VDC value in your calculations.
3. The first value is for a system with one power supply; the second is for a system with two or three power supplies.

# What to Do If Your System Exceeds Power Supply Capacity

If the DC amp total for *any* of the power supply outputs or the total DC watts is greater than the maximum rated value, you must take one of these steps:

- Add another power supply if possible. If you have exceeded the values for a two power supply system, then you cannot add another power supply to solve the problem; a third power supply can only be used for redundancy.
- If adding another supply isn't possible, then you must remove as many configuration items as necessary to lower the DC amp total for the power supply output in question to an acceptable level.

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**Note** – See “About Power Budget Constraints” on page 81 for information about DC power ratings.

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As a warning, the general fault indicator (☛) on the LED and control panel illuminates if any of the outputs is operating too close to its maximum rated value or if the power supply configuration is operating too close to its output capacity. In either case, the system continues to operate until you can correct the problem by taking one of the steps outlined above. If the configuration exceeds the safety threshold for power supply operation, the general fault indicator illuminates briefly, and the system shuts down automatically. (See “About the Status and Control Panel” on page 9 for information about the general fault indicator.)

# How to Calculate Your AC Power Requirements

You must ensure that the AC current draw does not exceed the maximum current limit for a 15-Amp power outlet. In the United States and Canada, the maximum is 80 percent of the outlet's total capacity, which is 12 A. For areas outside of the United States and Canada, contact local agencies for local electrical codes about specific information on local AC branch limitations.

This procedure shows you how to calculate AC amps, AC watts, BTUs and Volt-Amps (VA). You can use the AC watts to help you to estimate your power costs. In addition, you need to know the AC watts in order to calculate BTUs and VA. You can use the BTUs to help you to determine the cooling requirements for your facility. You can use the VA to help you to determine the wiring requirements for your system.

## 1. Determine the value of the AC watts (also known as $P_{true}$ ) for your configuration:

$$P_{true} = \text{DC watts} \times \frac{1}{PS_{Eff}}$$

Where: DC watts is the total from Line 6 of your worksheet

$\frac{1}{PS_{Eff}}$  is the reciprocal of the power supply efficiency

$$PS_{Eff} = 0.68$$

## 2. Determine the value of the AC amps for your configuration:

$$\text{AC amps} = \frac{P_{true}}{\text{AC volts} \times \text{PF}}$$

Where:  $P_{true}$  is the result of Step 1 above

AC volts is the line voltage, for example, 120

$$\text{PF} = 0.98 \text{ (typical)}$$

## 3. Is the value for AC amps less than 12 A?

- If yes, you can install your internal options.
- If no, proceed to "What to Do If Your System Exceeds the Current Limit of the Power Outlet" on page 98.

**4. Calculate the AC watts (also known as  $P_{true}$ ) for your configuration as follows:**

$$P_{true} = \text{DC watts} \times \frac{1}{PS_{Eff}}$$

Where: DC watts is the total from Line 6 of your worksheet

$\frac{1}{PS_{Eff}}$  is the reciprocal of the power supply efficiency

$$PS_{Eff} = 0.68$$

**5. Calculate the BTUs for your configuration as follows:**

$$BTU_{nom} = P_{true} \times 3.412 \frac{BTU}{watt}$$

Where:  $P_{true}$  is the result of Step 1

**6. Calculate the Volt-Amps for your configuration as follows:**

$$VA = P_{true} \times \frac{1}{PF}$$

Where:  $P_{true}$  is the result of Step 1

$\frac{1}{PF}$  is the reciprocal of the power factor

$$PF = 0.98 \text{ (typical)}$$

## Sample Calculation of Total AC Amps

The following calculations are based on the configuration described on page 91.

$$P_{true} = \text{DC watts} \times \frac{1}{PS_{Eff}}$$

$$P_{true} = 194.0 \times \frac{1}{0.68}$$

$$P_{true} = 285.29$$

$$\text{AC amps} = \frac{P_{true}}{\text{AC volts} \times \text{PF}}$$

$$\text{AC amps} = \frac{285.29}{120 \times 0.98}$$

$$\text{AC amps} = 2.43$$

## What to Do If Your System Exceeds the Current Limit of the Power Outlet

In the United States and Canada, the maximum current limit for a 15 A power outlet is 80 percent of the outlet's total capacity, which is 12 A. For areas outside of the United States and Canada, contact local agencies for local electrical codes about specific information on local AC branch limitations.

After you have completed through Step 2 of the procedure provided in "How to Calculate Your AC Power Requirements" on page 95, you know the AC amps required by your configuration. You must ensure that the AC current draw does not exceed the 12 A maximum current limit for the 15 A power outlet.

If you exceed the 12 A current limit, then you must remove as many configuration items as required to lower the AC current draw of your configuration to an acceptable level.

## Parts Installation and Repair

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This chapter describes how to remove and install components within the system. For a list of part numbers for field-replaceable units and optional equipment, see “Illustrated Parts Breakdown” on page 456.

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**Note** – Installation and repair of system components are also demonstrated with photographs and video instructions on the *ShowMe How Multimedia Documentation* CD-ROM supplied with your system.

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Tasks covered in this chapter include:

### Main logic board components

- *How to Remove the Main Logic Board—page 115*
- *How to Install the Main Logic Board—page 118*
- *How to Remove a Memory Module—page 122*
- *How to Install a Memory Module—page 125*
- *How to Remove the Audio Module Card—page 128*
- *How to Install the Audio Module Card—page 131*
- *How to Remove a UPA Graphics Card—page 134*
- *How to Install a UPA Graphics Card—page 136*
- *How to Remove a CPU Module—page 139*
- *How to Install a CPU Module—page 141*
- *How to Remove a DC/DC Converter—page 143*
- *How to Install a DC/DC Converter—page 145*
- *How to Remove a PCI Card—page 147*
- *How to Install a PCI Card—page 149*
- *How to Remove the NVRAM Module—page 152*
- *How to Install the NVRAM Module—page 154*

### Backplanes

- *How to Remove the Power Distribution Board—page 157*
- *How to Install the Power Distribution Board—page 164*
- *How to Remove the Removable Media Backplane—page 170*

- *How to Install the Removable Media Backplane—page 174*
- *How to Remove the 4-Slot UltraSCSI Backplane—page 178*
- *How to Install the 4-Slot UltraSCSI Backplane—page 182*
- *How to Remove an 8-Slot UltraSCSI Backplane—page 186*
- *How to Install an 8-Slot UltraSCSI Backplane—page 191*

#### Storage devices

- *How to Remove a Disk Drive—page 197*
- *How to Install a Disk Drive—page 199*
- *How to Remove a CD-ROM Drive or Tape Drive—page 201*
- *How to Install a CD-ROM Drive or Tape Drive—page 205*
- *How to Remove the Diskette Drive—page 209*
- *How to Install the Diskette Drive—page 213*

#### Miscellaneous assemblies

- *How to Install the 8-Bay Storage Expansion Option—page 103*
- *How to Remove the Removable Media Assembly—page 216*
- *How to Install the Removable Media Assembly—page 220*
- *How to Remove the Disk Fan Tray Assembly—page 223*
- *How to Install the Disk Fan Tray Assembly—page 225*
- *How to Remove the CPU Fan Tray Assembly—page 227*
- *How to Install the CPU Fan Tray Assembly—page 229*
- *How to Remove the Upper Blower Assembly—page 231*
- *How to Install the Upper Blower Assembly—page 234*
- *How to Remove a Power Supply—page 237*
- *How to Install a Power Supply—page 239*
- *How to Remove the AC Line Filter Assembly—page 241*
- *How to Install the AC Line Filter Assembly—page 245*
- *How to Remove the Speaker Assembly—page 248*
- *How to Install the Speaker Assembly—page 250*
- *How to Remove the LED Interface Board—page 252*
- *How to Install the LED Interface Board—page 255*
- *How to Remove a Rear Panel Insert—page 257*
- *How to Install a Rear Panel Insert—page 260*

#### Internal cables

- *How to Remove the Disk Fan Tray/Interlock Cable—page 264*
- *How to Install the Disk Fan Tray/Interlock Cable—page 267*
- *How to Remove the Removable Media Power Cable—page 271*
- *How to Install the Removable Media Power Cable—page 273*
- *How to Remove the Removable Media SCSI Cable—page 275*
- *How to Install the Removable Media SCSI Cable—page 278*
- *How to Remove a SCSI Drive Power Cable—page 281*



- *How to Install a SCSI Drive Power Cable—page 284*
- *How to Remove the SCSI Drive Data Cable—page 286*
- *How to Install the SCSI Drive Data Cable—page 289*
- *How to Remove the 4-Slot UltraSCSI Power Cable—page 293*
- *How to Install the 4-Slot UltraSCSI Power Cable—page 295*
- *How to Remove the 4-Slot UltraSCSI Data Cable—page 297*
- *How to Install the 4-Slot UltraSCSI Data Cable—page 303*
- *How to Remove an 8-Slot UltraSCSI Power Cable—page 309*
- *How to Install an 8-Slot UltraSCSI Power Cable—page 311*
- *How to Remove an 8-Slot UltraSCSI Data Cable—page 313*
- *How to Install an 8-Slot UltraSCSI Data Cable—page 316*
- *How to Remove the LED Interface Cable—page 320*
- *How to Install the LED Interface Cable—page 322*
- *How to Remove the Diskette Power Cable—page 324*
- *How to Install the Diskette Power Cable—page 326*
- *How to Remove the Diskette Data Cable—page 328*
- *How to Install the Diskette Data Cable—page 330*
- *How to Remove an I<sup>2</sup>C Cable—page 332*
- *How to Install an I<sup>2</sup>C Cable—page 335*
- *How to Remove the Keypad Cable—page 337*
- *How to Install the Keypad Cable—page 339*

*Other information covered in this chapter includes:*

- *About Handling Boards—page 102*

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# About Handling Boards

To prevent damage to boards, observe the following cautions and guidelines.



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**Caution** – When working on the main logic board, use an antistatic mat that has at least 0.25 inch (6 mm) of cushioning. This cushioning protects underside components and prevents harmful board flexing.

The main logic board and related modules and cards have surface-mount components that may break when the board is flexed.

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

- 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 or cards on a hard surface. Use a cushioned antistatic mat. 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.

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# How to Install the 8-Bay Storage Expansion Option



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**Caution** – If you are installing this part as an option, you must ensure that it does not make your configuration exceed the system power budget; see “How to Determine System Power Requirements” on page 84 for more information.

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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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The 8-bay storage expansion option kit contains the following parts:

- Dual-channel single-ended UltraSCSI controller PCI card
- 8-slot UltraSCSI backplane
- I<sup>2</sup>C cable
- 8-slot UltraSCSI power cable
- 8-slot UltraSCSI data cable

The dual-channel UltraSCSI controller card may be installed in any available PCI slot. For maximum performance, the system should be configured, if possible, with no more than one dual-channel UltraSCSI host adapter on each PCI bus. For additional information on PCI buses and cards, see “About Peripheral Component Interconnect (PCI) Buses” on page 57.

The dual-channel UltraSCSI PCI host adapter card supplied with the 8-bay storage expansion option has two internal SCSI connectors and two external SCSI connectors. When installed as part of the 8-bay storage expansion option, only the internal connectors are used. Do not connect external SCSI devices to a SCSI channel that is used to support internal disk drives. Additional single-ended and differential UltraSCSI host adapters are available for controlling external SCSI storage devices.

If you are installing two 8-bay storage expansion option kits, install the controller card for the upper 8-slot backplane in a PCI slot located above the controller card used for the lower 8-slot backplane.

If you are installing two 8-bay storage expansion option kits at this time, it is easier to perform each step twice as you follow the procedure, rather than repeat the entire procedure to install the second option kit. Insert the lower 8-slot backplane before inserting the upper 8-slot backplane.

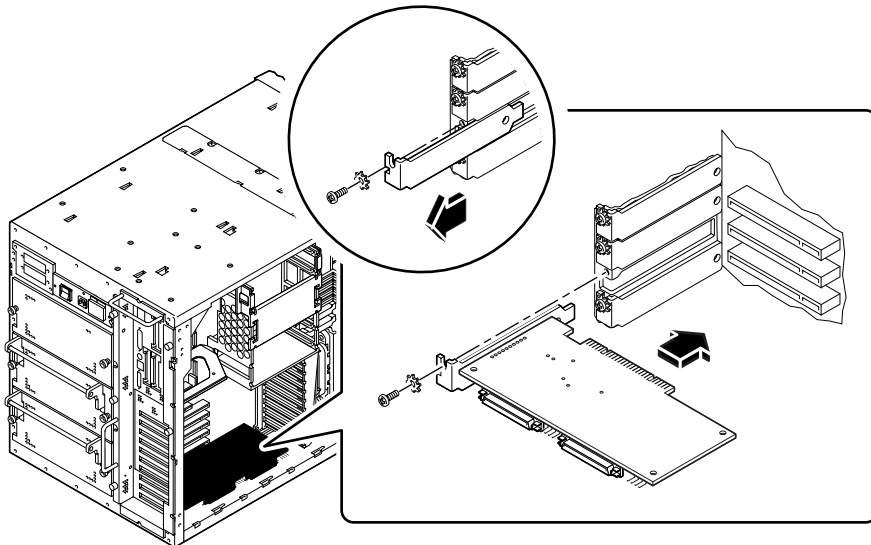
## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

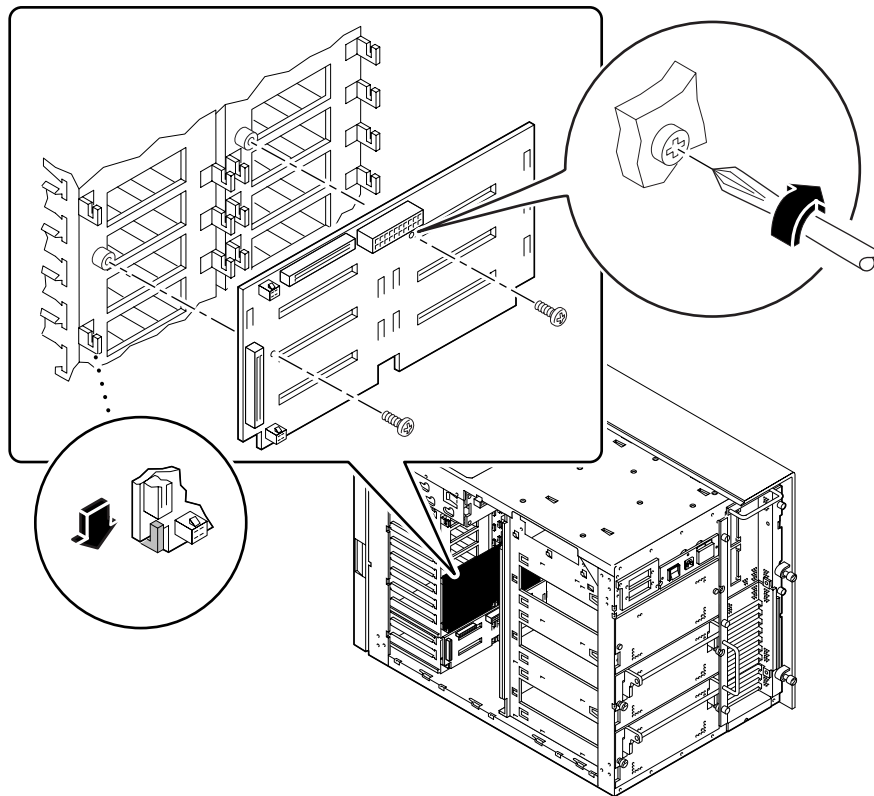
## What to Do

1. **Remove the filler panel for the PCI slot you intend to use.**
  - a. **Remove the Phillips screw that secures the PCI filler panel to the rear panel.**
  - b. **Pull out the filler panel.**



2. Insert the PCI card into the appropriate slot on the main logic board.
  - a. Align the left side of the card with the appropriate opening on the rear panel.
  - b. Push the card into the corresponding slot on the main logic board.
3. Secure the PCI card faceplate to the rear panel with the Phillips screw.
4. On the right side of the enclosure, remove the two screws that secure the 8-slot backplane filler panel to the disk cage, and remove the filler panel. Remove both backplane filler panels if you are installing the lower 8-slot backplane.
5. Insert the 8-slot UltraSCSI backplane down into the 12 mounting hooks at the rear of the disk cage.

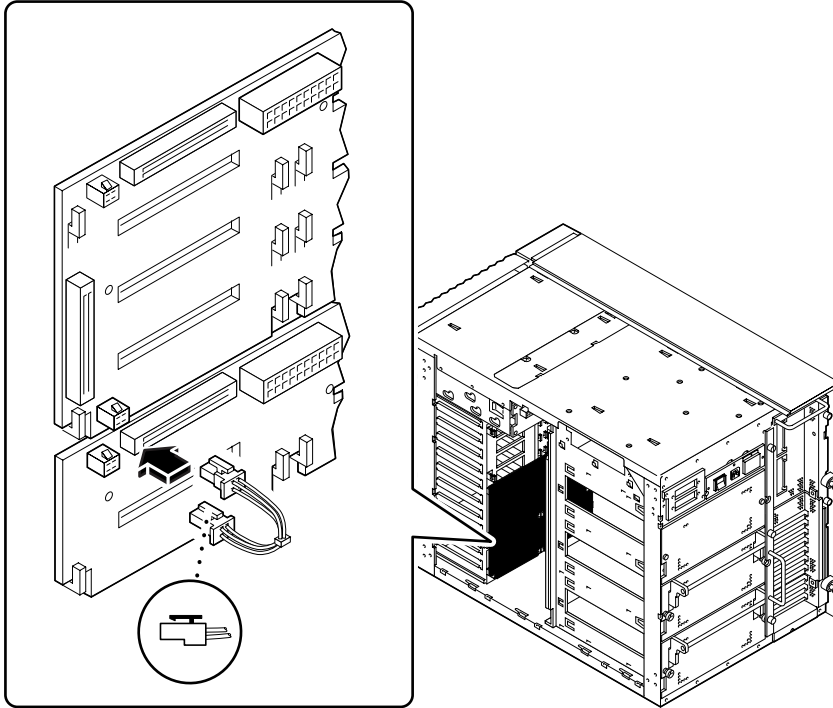
Use the lowest available set of hooks; do not mount a backplane at the top of the disk cage if the center portion of the cage has no backplane.



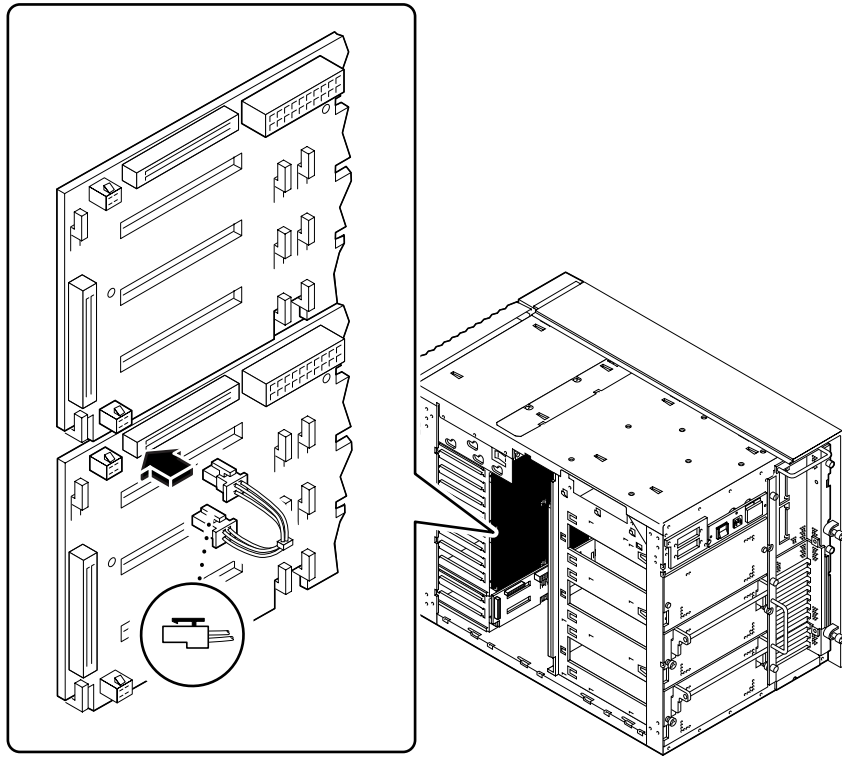
6. Secure the backplane to the disk cage using the two Phillips screws provided in the option kit.

## 7. Connect the I<sup>2</sup>C cable.

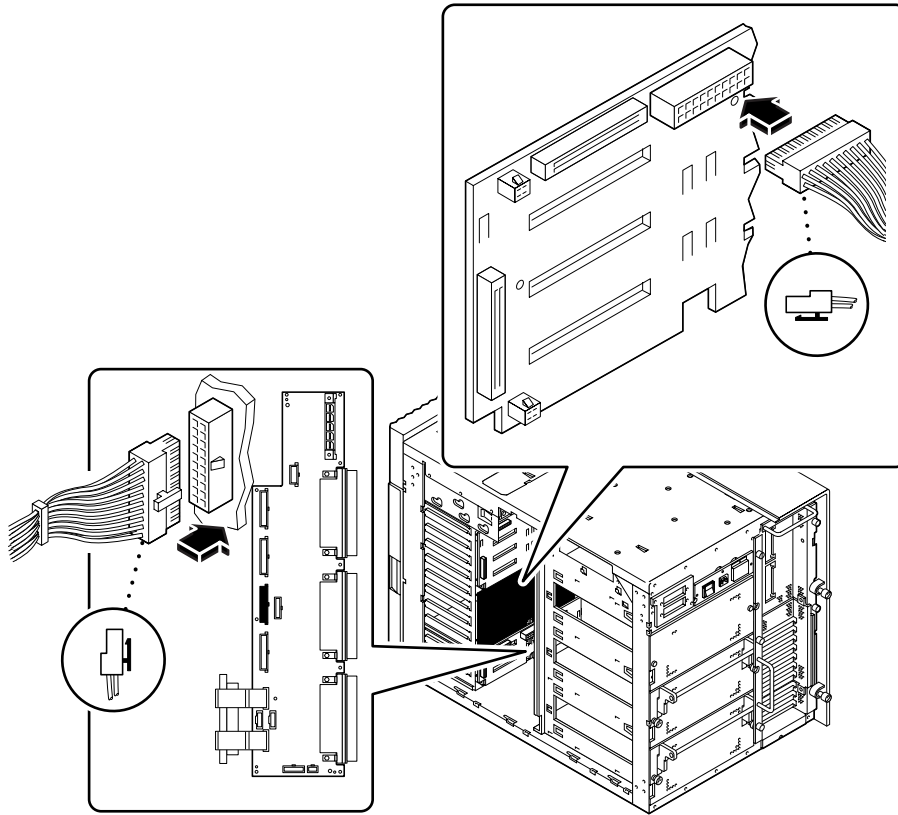
- *If you are installing the lower 8-slot backplane, connect the I<sup>2</sup>C cable between connector P0500 on the 4-slot backplane and connector P0600 on the 8-slot backplane.*



- *If you are installing the upper 8-slot backplane, connect the I<sup>2</sup>C cable between connector P0601 on the lower 8-slot backplane and connector P0600 on the upper 8-slot backplane.*



- 8. Connect the 8-slot UltraSCSI power cable to the backplane at connector J0101.**  
Make sure that the tab on the bottom of the connector snaps into place.

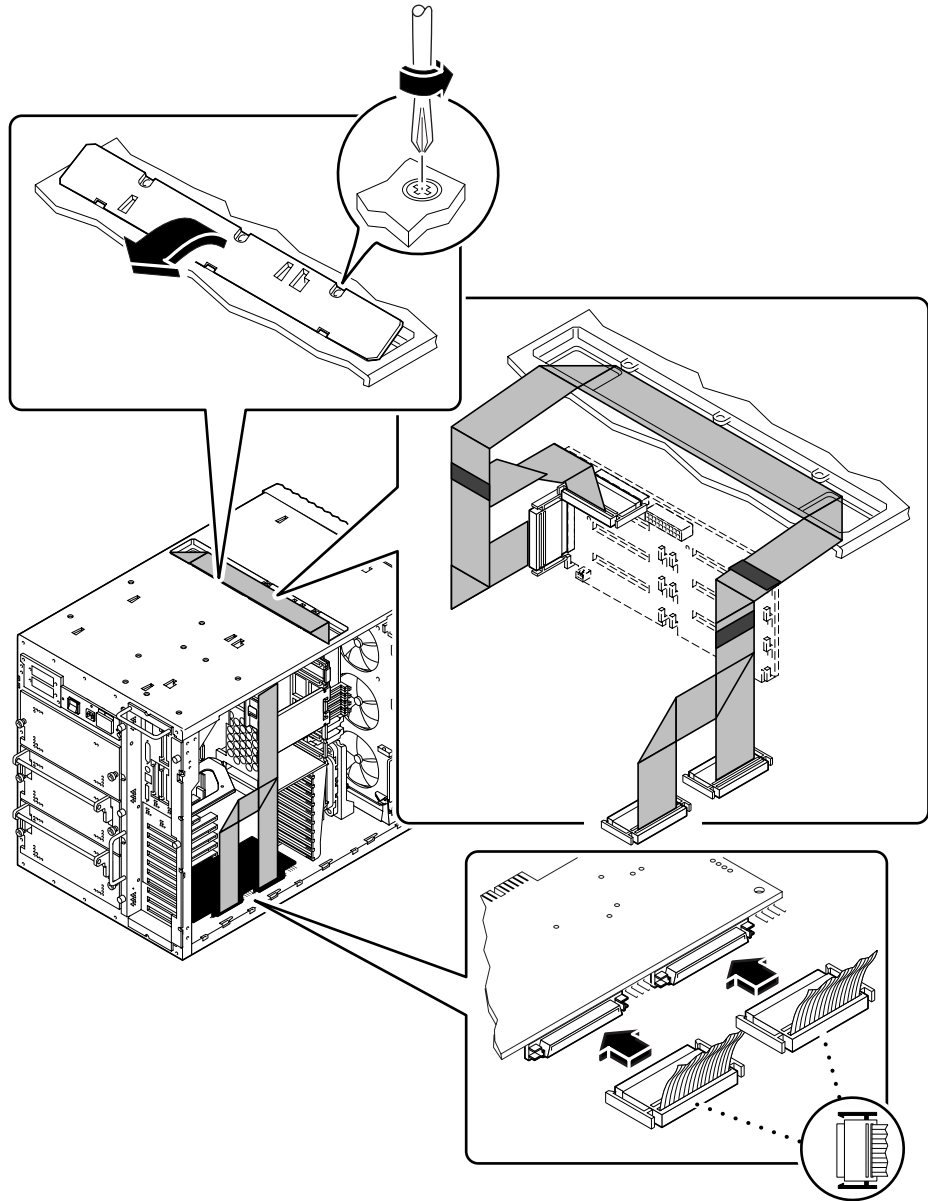


- 9. Connect the other end of the 8-slot UltraSCSI power cable to the power distribution board.**
- *If you are installing the lower 8-slot backplane, use connector J0303 on the power distribution board.*
  - *If you are installing the upper 8-slot backplane, use connector J0304 on the power distribution board.*

Be sure that the tab on the right side of the connector snaps into place.



**10. Remove the three small Phillips screws that secure the cable access panel to the top of the system chassis.**



**11. Tilt the front edge of the access panel upward and lift it free from the chassis.**

- 12. Insert the 8-slot UltraSCSI data cable into the cable access port on the top of the system chassis.**

Position the cable in the access port with connectors P2-A and P2-B toward the left side of the enclosure (where the main logic board is located). If you are installing the upper 8-slot backplane, you must position the cable between the two existing data cables in the access port.

- 13. On the left side of the enclosure, carefully route the cable so that it rests on top of the shelf located directly above the top CPU module.**

Take care to avoid damaging the cable on any sharp sheet metal edges.

- 14. On the left side of the enclosure, connect the two cable connectors to the associated UltraSCSI controller PCI card.**

Connect P2-A to the connector closest to the rear panel, and P2-B to the connector closest to the front of the card.

If you are installing two expansion option kits, the UltraSCSI data cable on the outside (on top in the access port) must connect to the PCI card in the lower slot.

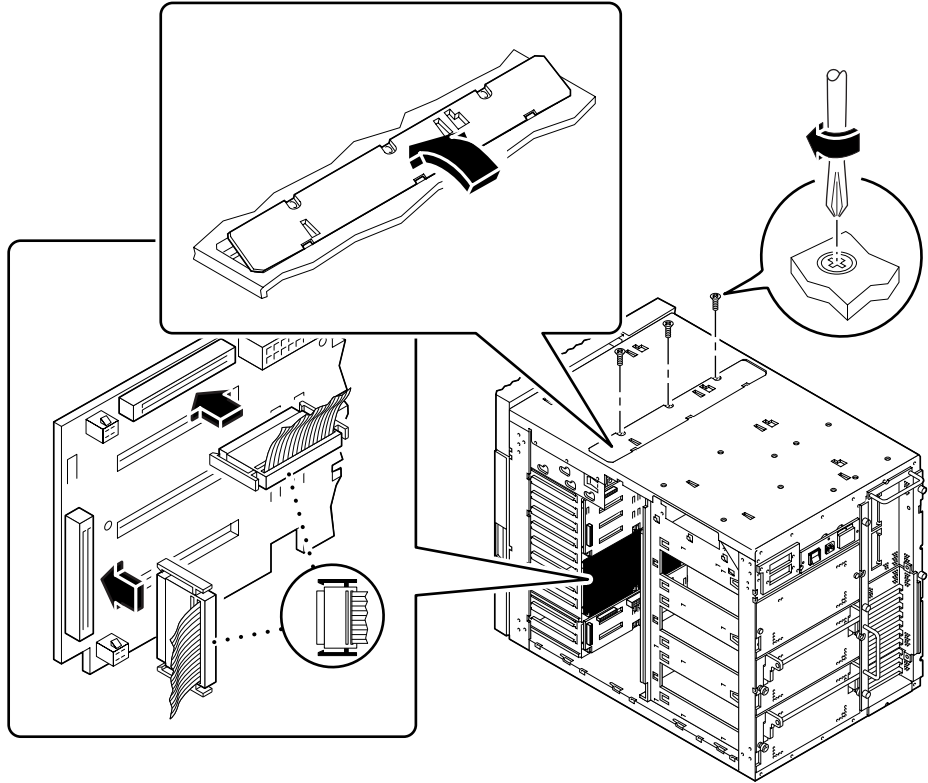
- 15. If the 8-slot UltraSCSI data cable has excess slack, carefully fold the cable and secure the fold using the cable clip attached to the CPU card cage.**

Do not crease the cable when you fold it.

**16. Connect the other end of the cable to the 8-slot backplane.**

Connect P1-B to the upper connector, J0402, and connect P1-A to the lower connector, J0102.

If you are installing two expansion option kits, the UltraSCSI data cable on the outside (on top in the access port) must connect to the lower 8-slot backplane.



**17. If the 8-slot UltraSCSI data cable has excess slack, carefully fold the cable and secure the fold using the cable clip attached to the disk fan tray assembly.**

Do not crease the cable when you fold it.

**18. Replace the cable access panel on top of the system chassis.**

Align the three tabs on the edge of the panel with the corresponding slots in the system chassis.

**19. Secure the access panel with the three Phillips screws.**

**20. Fill in information on the four labels at the ends of the 8-slot UltraSCSI data cable.**

This identification is important when replacing a cable, backplane, or PCI card, particularly when two 8-bay storage expansion options are installed.

**a. On the left side of the system, fill in the two labels on the 8-slot UltraSCSI data cable for connectors P2-A and P2-B.**

Fill in the number of the PCI slot used and check the box to indicate either the upper backplane or lower backplane.

**b. On the right side of the system, fill in the two labels on the 8-slot UltraSCSI data cable for connectors P1-A and P1-B.**

Check the box to indicate either the upper backplane or lower backplane.

---

**Note** – After reassembling the system, be sure to perform the steps in the following section to reconfigure and reboot your system so that it can use the 8-bay storage expansion option.

---

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Left Side Panel” on page 38
- “How to Install the Right Side Panel” on page 34

To install disk drives for the new backplane(s), complete this task:

- “How to Install a Disk Drive” on page 199

Before the system can properly recognize the new UltraSCSI controller card(s), you must perform the following procedure:

**1. Power on the system.**

See “How to Power On the System” on page 28.

**2. When the system banner is displayed on the monitor, immediately enter the `Stop-a` sequence on the Sun keyboard.**

If you are using an alphanumeric terminal instead of a monitor, press the Break key on the terminal’s keyboard.

**3. When the `ok` prompt is displayed, enter the following command:**

```
ok setenv disk-led-assoc 0 x y
```

where:

- `x` is an integer between 1 and 10 identifying the PCI slot number where the lower UltraSCSI controller is installed
- `y` is an integer between 1 and 10 identifying the PCI slot number where the upper UltraSCSI controller is installed

For example, if the controller cards are installed in PCI slots 5 and 7, enter the following:

```
ok setenv disk-led-assoc 0 5 7
```

For a system with only one controller card installed in PCI slot 2, enter the following:

```
ok setenv disk-led-assoc 0 2
```

**4. Enter the following command at the `ok` prompt:**

```
ok reset
```

**5. When the system banner is displayed on the monitor, immediately enter the `Stop-a` sequence on the Sun keyboard.**

If you are using an alphanumeric terminal instead of a monitor, press the Break key on the terminal's keyboard.

**6. Enter the following command to perform a reconfiguration boot:**

```
ok boot -r
```

This command rebuilds the device trees for the system, incorporating any newly installed options so that they can be recognized by the system. After the reconfiguration boot has successfully completed, the system prompt should be displayed.

---

# Main Logic Board Components

This section describes how to remove and install main logic board components. For a list of part numbers, see “Illustrated Parts Breakdown” on page 456.

Tasks covered in this section include:

- *How to Remove the Main Logic Board—page 115*
- *How to Install the Main Logic Board—page 118*
- *How to Remove a Memory Module—page 122*
- *How to Install a Memory Module—page 125*
- *How to Remove the Audio Module Card—page 128*
- *How to Install the Audio Module Card—page 131*
- *How to Remove a UPA Graphics Card—page 134*
- *How to Install a UPA Graphics Card—page 136*
- *How to Remove a CPU Module—page 139*
- *How to Install a CPU Module—page 141*
- *How to Remove a DC/DC Converter—page 143*
- *How to Install a DC/DC Converter—page 145*
- *How to Remove a PCI Card—page 147*
- *How to Install a PCI Card—page 149*
- *How to Remove the NVRAM Module—page 152*
- *How to Install the NVRAM Module—page 154*

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# How to Remove the Main Logic Board



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

---

## Before You Begin

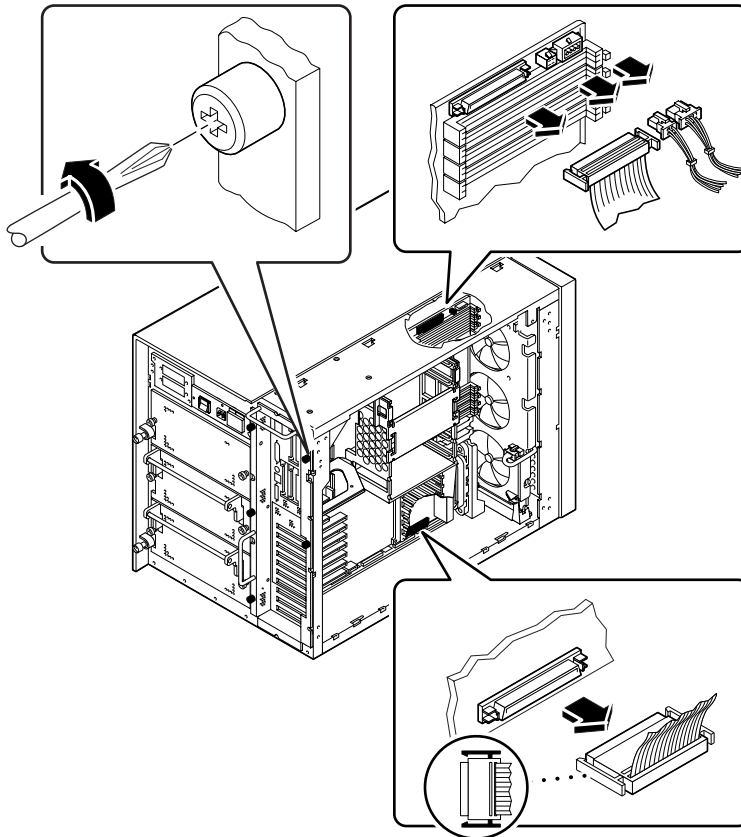
Before you remove the main logic board, you must remove all removable components from it, so that you can transfer them to the new main logic board after you install it. Complete these tasks to remove the necessary components:

- Disconnect any external cables from the rear panel of the main logic board. Make sure to note which cable is attached to each connector. See “Locating Rear Panel Features” on page 7.
- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the CPU Fan Tray Assembly” on page 227
- “How to Remove a CPU Module” on page 139
- “How to Remove a DC/DC Converter” on page 143
- “How to Remove a Memory Module” on page 122
- “How to Remove a PCI Card” on page 147, if one or more PCI cards are installed
- “How to Remove a UPA Graphics Card” on page 134, if one or more graphics cards are installed
- “How to Remove the Audio Module Card” on page 128, if there is an audio module installed
- “How to Remove the NVRAM Module” on page 152

# What to Do

## 1. Disconnect all internal cables from the main logic board:

- a. Disconnect the removable media SCSI cable, at connector J4701; press the tabs on both sides of the connector to release the cable.
- b. Disconnect the upper blower power cable at connector J4705.
- c. Disconnect the 4-slot UltraSCSI data cable, at connector J5601; press the tabs on both sides of the connector to release the cable.



2. *If one or more 8-slot UltraSCSI data cables are installed, disconnect them from their UltraSCSI controller cards and lay the cables across the top of the chassis.*

This will keep them out of the way when you remove the main logic board.

3. **Loosen the five large captive screws that secure the main logic board to the rear of the chassis.**



#### 4. Remove the main logic board.

Carefully slide the board all the way out of the chassis, using the handles at the rear of the board.



---

**Caution** – If you have not removed all CPU modules, take care that the CPU ejection levers do not catch on the chassis.

---

#### 5. Place the main logic board on an antistatic mat.

#### 6. *If two UPA graphics cards were installed on the board, remove the dual graphics rear panel insert.*

See “How to Remove a Rear Panel Insert” on page 257.

## What Next

To replace the main logic board, complete this task:

- “How to Install the Main Logic Board” on page 118

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# How to Install the Main Logic Board



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

---



---

**Caution** – UltraSCSI data cables are fragile and should be handled with care.

---

## Before You Begin

You must remove all removable components from the old main logic board so that you can transfer them to the replacement board. For more information, see:

- “How to Remove the Main Logic Board” on page 115

*If the replacement board does not have the same rear panel insert as the old board, remove it, and replace it with the insert from the old board. Install the rear panel insert that you removed from the replacement board on the old board for return to Sun. For more information, see:*

- “How to Remove a Rear Panel Insert” on page 257
- “How to Install a Rear Panel Insert” on page 260

## What to Do

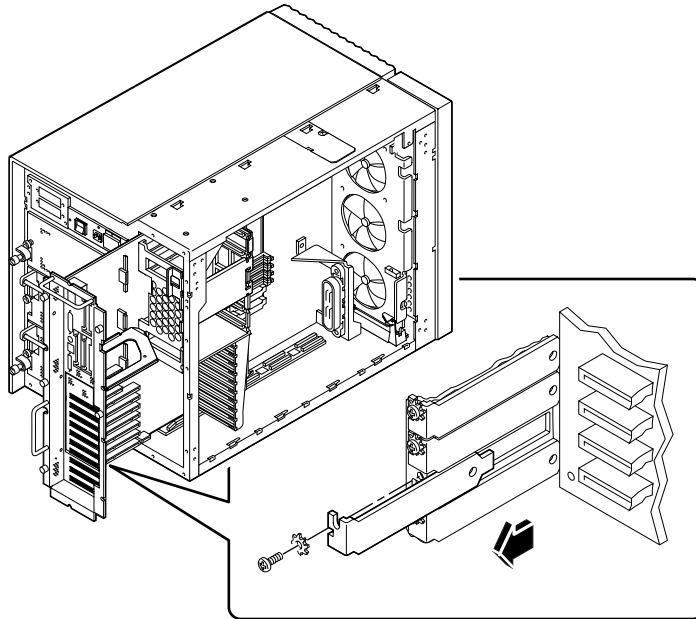
1. *If you have one or more PCI cards to transfer to the replacement board, **remove each corresponding PCI filler panel from the replacement board.***

Each empty PCI slot has a protective metal filler panel that keeps dust and stray objects from entering the server chassis. After you remove the panels, the PCI section of the replacement board and the defective board should look the same.

- a. **Remove the Phillips screw that secures the filler panel to the replacement board.**

**b. Remove the PCI filler panel.**

Keep the filler panel and screw for possible future use.



- 2. If you have the audio module card or any UPA graphics cards installed, remove the corresponding filler panels from the replacement board.**

Keep the filler panel for possible future use.

- 3. Set the jumpers on the replacement main logic board so that they are the same as the settings on the old board.**

See “About the Main Logic Board Jumpers” on page 71 for more information about jumper locations and settings.

- 4. Carefully push the main logic board into the chassis.**

The connector should insert completely at the bottom right of the board.

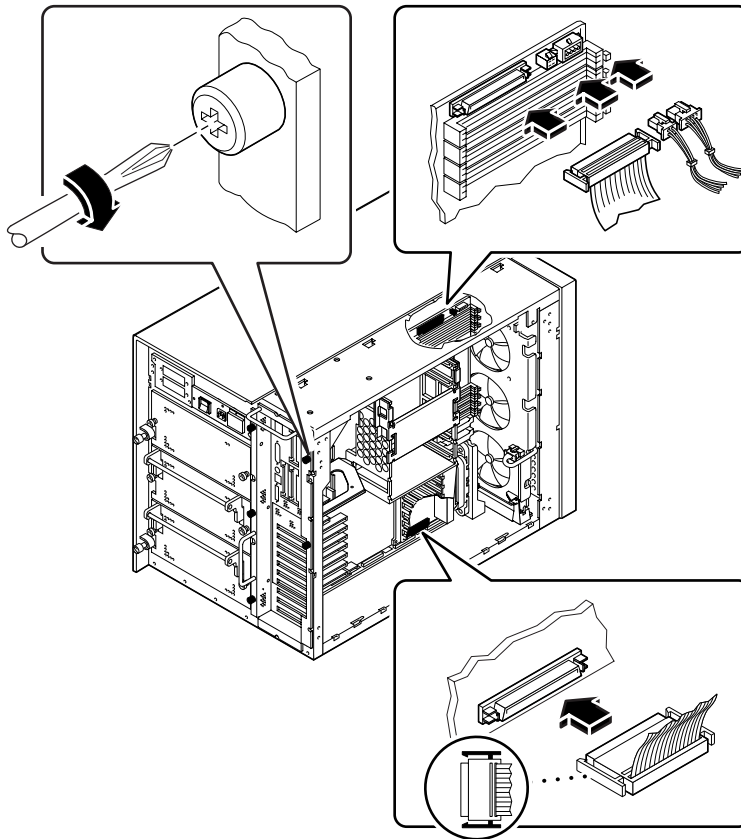


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**Caution** – If you have not removed CPU modules, take care that the CPU ejection levers do not catch on the chassis.

---

**5. Tighten the five large captive screws at the rear of the chassis.**



**6. Connect all internal cables to the main logic board:**

- a. The removable media SCSI cable, at connector J4701
- b. The upper blower power cable, at connector J4705
- c. The 4-slot UltraSCSI data cable, at connector J5601

**7. If you disconnected 8-slot UltraSCSI data cables from their UltraSCSI controller cards, reconnect them.**

# What Next

Remove the NVRAM module from the replacement board and install it on the old board for return to Sun. See “How to Install the NVRAM Module” on page 154.

Complete these tasks to transfer the components that you removed from the old main logic board to the new board:

- “How to Install the NVRAM Module” on page 154
- “How to Install the Audio Module Card” on page 131, if an audio module card was installed
- “How to Install a UPA Graphics Card” on page 136, if one or more graphics cards were installed
- “How to Install a PCI Card” on page 149, if one or more PCI cards were installed
- “How to Install a CPU Module” on page 141
- “How to Install a DC/DC Converter” on page 145
- “How to Install a Memory Module” on page 125

To reassemble the system, complete these tasks:

- “How to Install the CPU Fan Tray Assembly” on page 229
- “How to Install the Left Side Panel” on page 38
- Connect any external cables to the rear panel of the main logic board; see “Locating Rear Panel Features” on page 7

---

# How to Remove a Memory Module

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the CPU Fan Tray Assembly” on page 227



---

**Caution** – Dual inline memory modules (DIMMs) are made of electronic components that are extremely sensitive to static electricity. Static from your clothes or work environment can destroy the modules.

Do not remove any DIMM from its antistatic packaging until you are ready to install it on the main logic board. Handle the modules only by their edges. Do not touch the components or any metal parts. Always wear a grounding strap when you handle the modules.

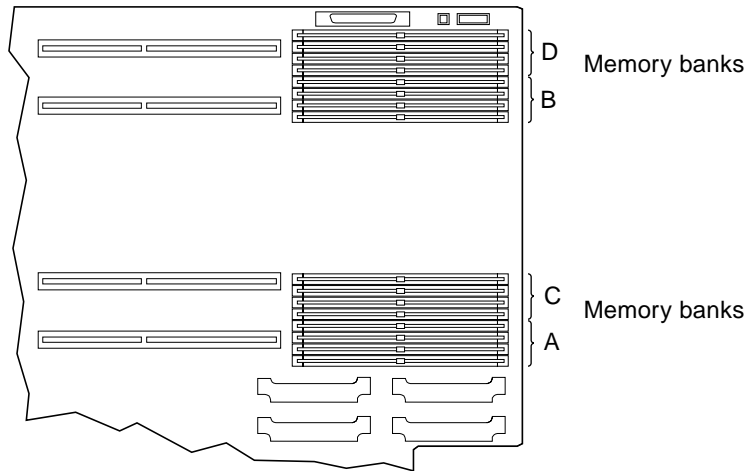
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# What to Do

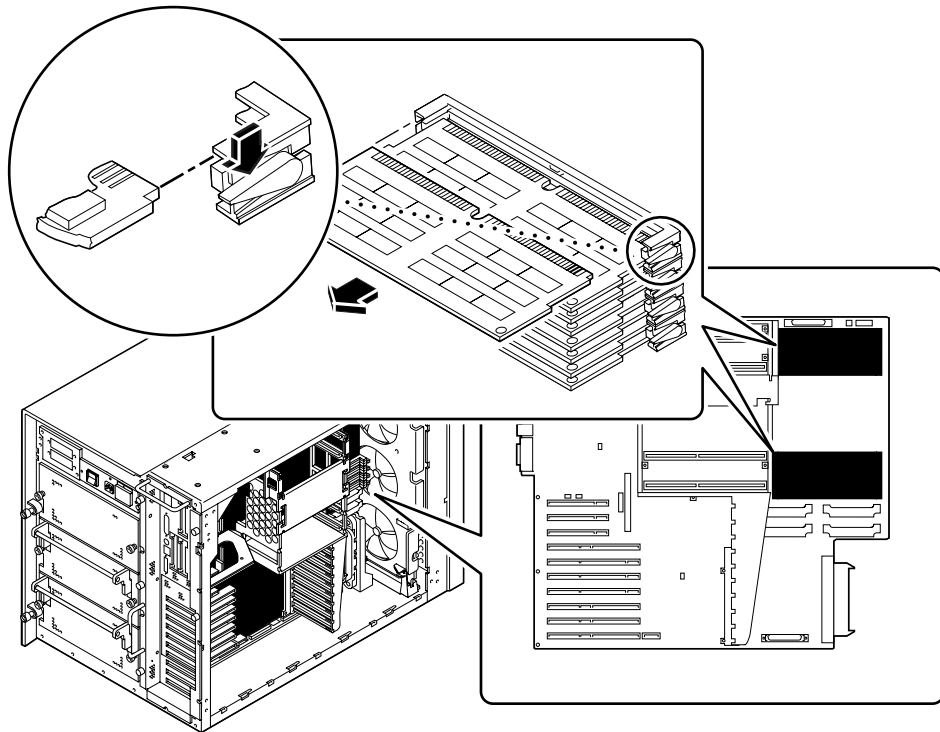
## 1. Locate on the main logic board the memory module that you want to remove.

The sockets are arranged in four banks, as shown in the illustration.

- U1901 through U1904 - bank A
- U1801 through U1804 - bank B
- U1701 through U1704 - bank C
- U1601 through U1604 - bank D



- 2. Push the ejection lever away from the memory module to eject it from the socket.**  
The lever is to the right of the sockets. There is one lever for each pair of sockets.



- 3. Grasp both corners of the memory module and pull it out of the socket.**  
Place the memory module on an antistatic mat.

## What Next

To replace the memory module, complete this task:

- “How to Install a Memory Module” on page 125



---

# How to Install a Memory Module



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**Caution** – If you are installing this part as an option, you must ensure that it does not make your configuration exceed the system power budget; see “How to Determine System Power Requirements” on page 84 for more information.

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## Before You Begin



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**Caution** – Dual inline memory modules (DIMMs) are made of electronic components that are extremely sensitive to static electricity. Static from your clothes or work environment can destroy the modules.

Do not remove any DIMM from its antistatic packaging until you are ready to install it on the main logic board. Handle the modules only by their edges. Do not touch the components or any metal parts. Always wear a grounding strap when you handle the modules.

---

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the CPU Fan Tray Assembly” on page 227

For information about allowable memory configurations, see “About Memory” on page 50.

# What to Do

1. Remove the new memory module from its antistatic packaging.
2. Locate the socket into which you will install the module.

The sockets are arranged in four banks, from top to bottom as shown in the illustration below. These bank locations are labeled on the top of the chassis, near the main logic board rear panel.

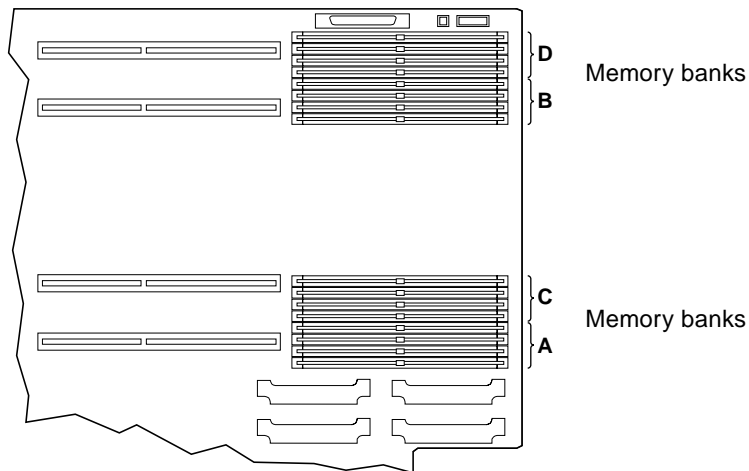
- U1901 through U1904 - bank A
- U1801 through U1804 - bank B
- U1701 through U1704 - bank C
- U1601 through U1604 - bank D

If you are installing additional memory modules, you must fill the banks in the following order: A, B, C, D.

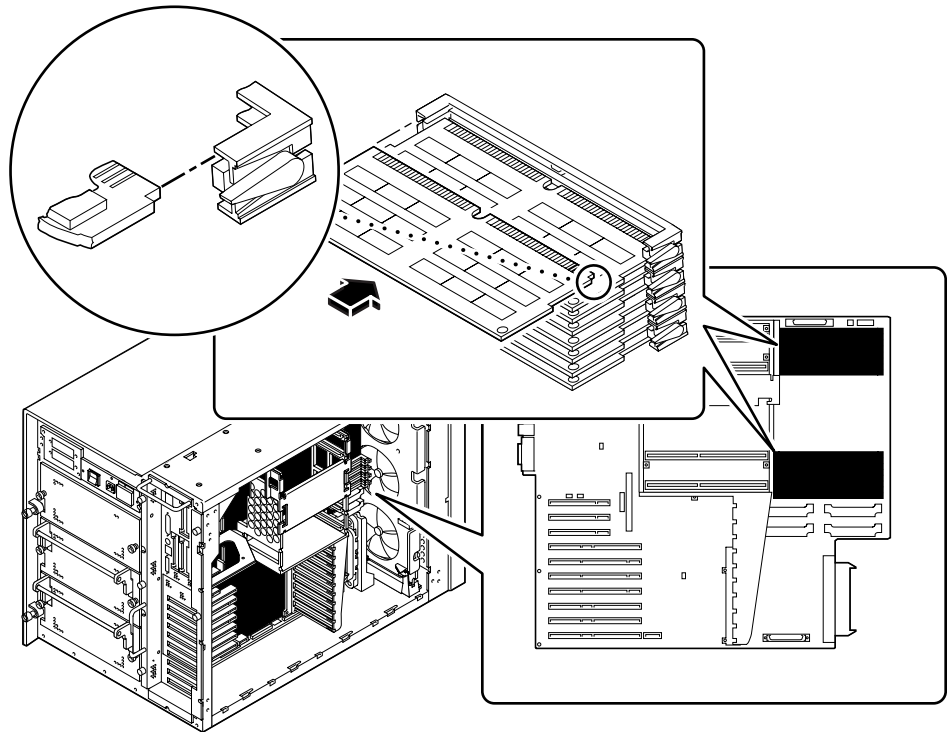
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**Note** – Each bank used must contain four modules of equal capacity (for example, four 32-Mbyte memory modules, four 64-Mbyte modules) to function properly. Do not mix capacities in any bank.

---



3. Align the memory module with its socket so that the small notch on the corner of the module is on the same side as the lever.



4. Hold the bottom edge of the module parallel to its socket. Carefully align the module so that each of its gold edge contacts is centered on a socket pin.
5. Push firmly and evenly on both ends of the memory module until the bottom edge is firmly seated in the socket.

Ensure that all contacts engage at the same time. Do not rock the module into place.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the CPU Fan Tray Assembly” on page 229
- “How to Install the Left Side Panel” on page 38

If you installed the memory module as a new option, complete this task:

- “How to Initiate a Reconfiguration Boot” on page 30

---

# How to Remove the Audio Module Card

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove a UPA Graphics Card” on page 134, if there is a UPA graphics card covering the audio card

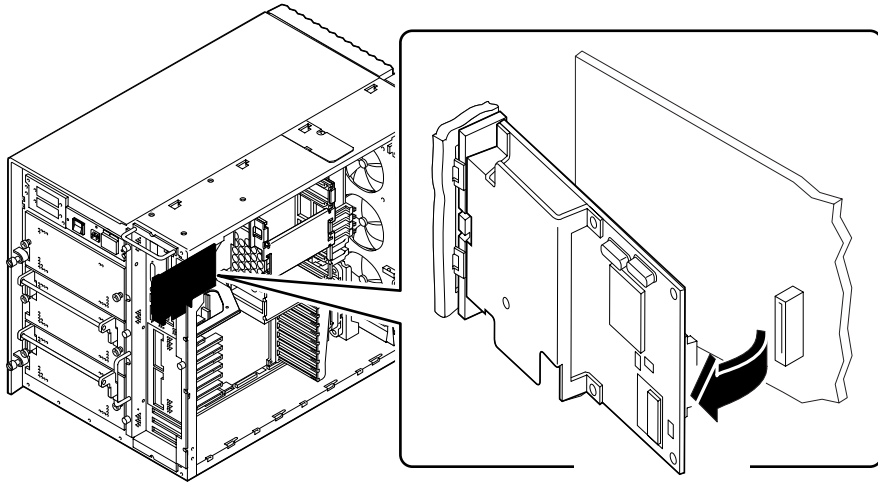
## What to Do

- 1. Disconnect any external cables attached to the audio module card.**
- 2. Disconnect any internal cables that limit access to the audio module card.**

Be sure that the cables are labeled.

**3. Disconnect the audio module card from its connector socket.**

Grasp the card at both corners and pull it away from the main logic board to disconnect it from the socket.



**4. Rotate the right side of the card toward you to release the audio module from the rear panel.**

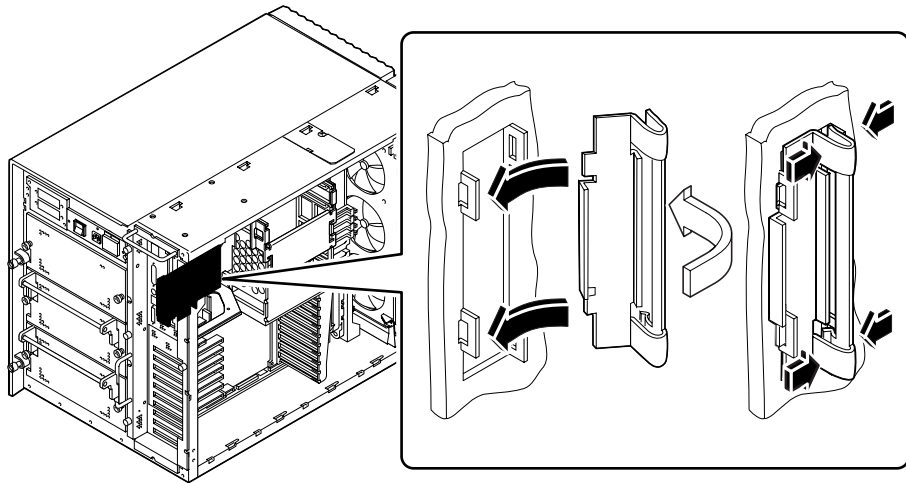
**5. Lift the card out of the chassis.**

Place the card on an antistatic mat.

**6. If you are not replacing the audio module card immediately, install a filler panel in the rear panel opening if one is available:**

**a. Insert the filler panel into the tabs on the rear panel.**

- b. Squeeze the spring clip and rotate the filler panel toward the rear panel until it locks in place.



## What Next

To replace the audio module card, complete this task:

- “How to Install the Audio Module Card” on page 131

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# How to Install the Audio Module Card



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**Caution** – If you are installing this part as an option, you must ensure that it does not make your configuration exceed the system power budget; see “How to Determine System Power Requirements” on page 84 for more information.

---

## Before You Begin

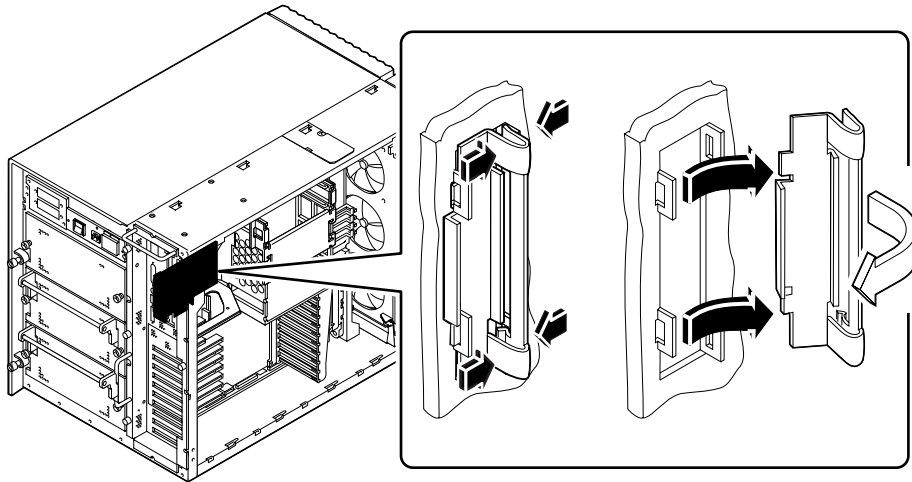
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove a UPA Graphics Card” on page 134, if there is a UPA graphics card covering the space for the audio card

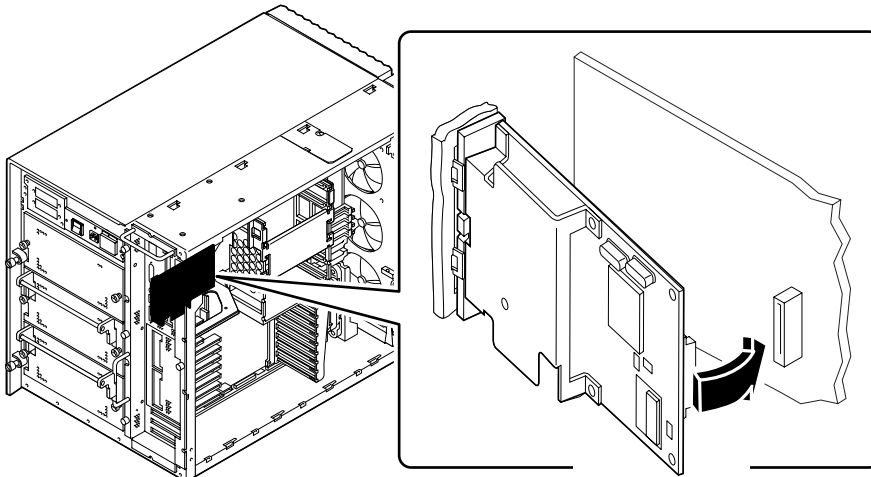
## What to Do

1. *If you are installing the audio module card for the first time, remove the filler panel:*
  - a. **Squeeze the spring clip and rotate the filler panel away from the rear panel.**

**b. Remove the filler panel from the system and reserve it for possible future use.**



**2. Holding the audio module card at an angle as shown, align it so that it slips under the central tab on the rear panel.**



**3. Rotate the right side of the card toward its connector on the main logic board.**

**4. Push the card into its connector.**

Push evenly on both right corners of the card until it is firmly seated in the connector socket.



5. **Reconnect any internal cables that you disconnected to access the audio module card.**
6. **Connect any external cables to the audio module card.**  
See “Reference for the Audio Module Connectors” on page 439.
7. **Refer to the documentation shipped with the card for important additional information.**

## What Next

If you have removed a UPA graphics card, complete this task:

- “How to Install a UPA Graphics Card” on page 136

Complete this task to reassemble the system:

- “How to Install the Left Side Panel” on page 38

If you installed the card as a new option, complete this task:

- “How to Initiate a Reconfiguration Boot” on page 30

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# How to Remove a UPA Graphics Card

## Before You Begin

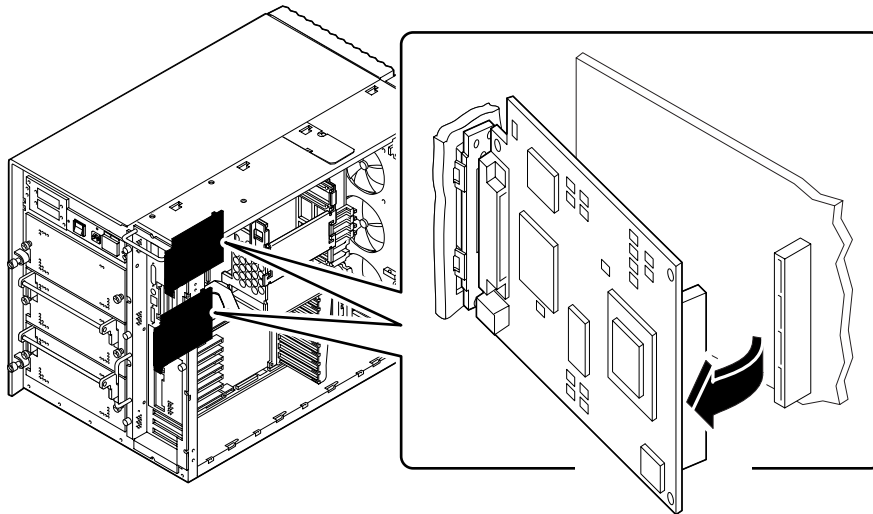
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

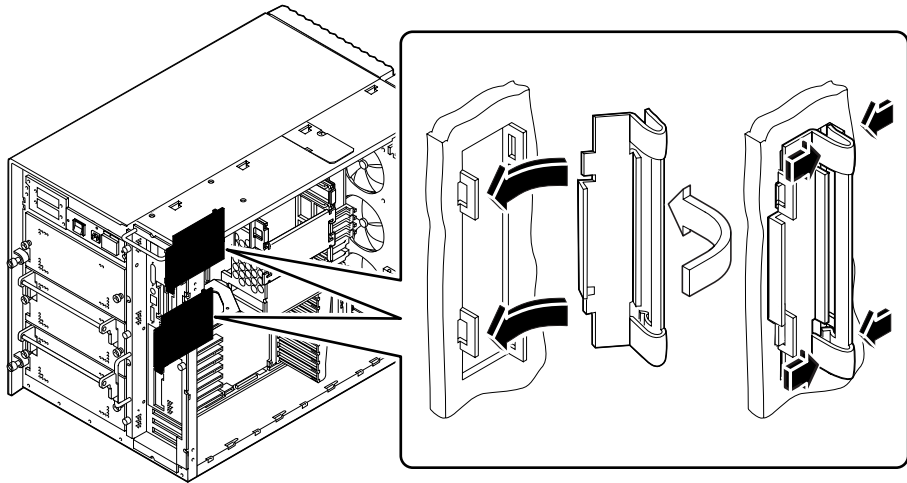
## What to Do

1. **Disconnect any cables attached to the graphics card’s faceplate.**
2. **Disconnect any internal cables that limit access to the graphics card.**  
Be sure that the cables are labeled.
3. **Disconnect the graphics card from its connector socket(s).**

Grasp the card at both corners and pull it away from the main logic board to disconnect it from the socket(s).



4. Rotate the right side of the card toward you to release the card from the rear panel.
5. Lift the card out of the chassis.  
Place the card on an antistatic mat.
6. *If you are not replacing the graphics card immediately, install a filler panel:*
  - a. Insert the filler panel into the tabs on the rear panel.
  - b. Squeeze the spring clip and rotate the filler panel toward the rear panel until it locks in place.



## What Next

To install a graphics card, complete this task:

- “How to Install a UPA Graphics Card” on page 136

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# How to Install a UPA Graphics Card



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**Caution** – If you are installing this part as an option, you must ensure that it does not make your configuration exceed the system power budget; see “How to Determine System Power Requirements” on page 84 for more information.

---

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

If you are installing a second graphics card and your system has a PCI rear panel insert, perform these tasks to replace the PCI rear panel insert with the appropriate dual graphics rear panel insert:

- “How to Remove a Rear Panel Insert” on page 257
- “How to Install a Rear Panel Insert” on page 260

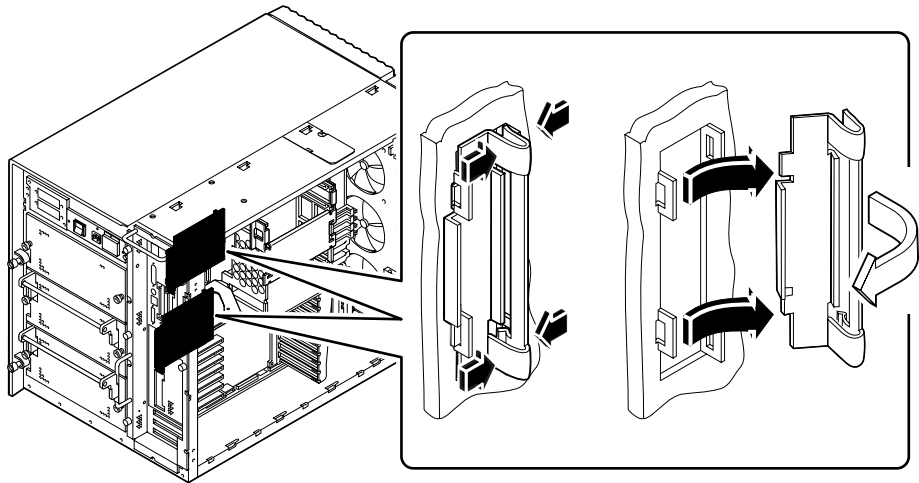
For additional information on graphics card configurations, see:

- “About UPA Graphics Cards” on page 60

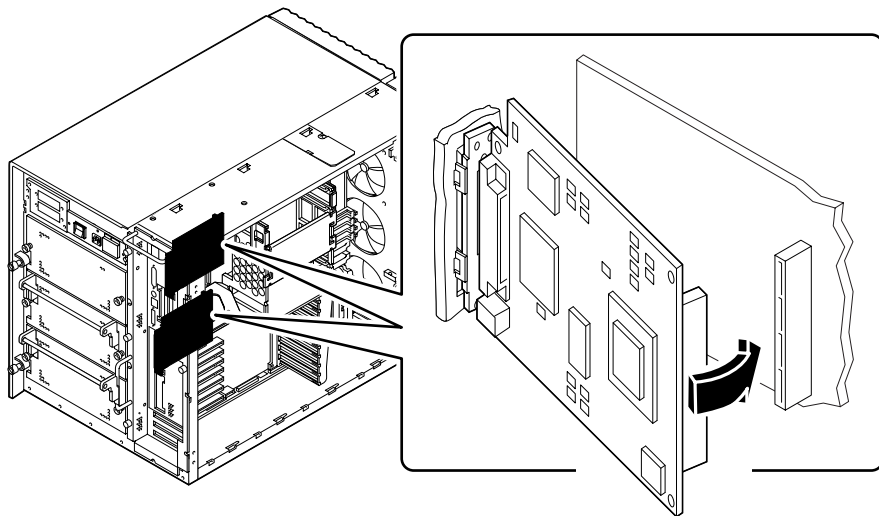
## What to Do

1. *If you are installing the graphics card for the first time, remove the filler panel:*
  - a. **Squeeze the spring clip and rotate the filler panel away from the rear panel.**

**b. Remove the filler panel from the system and reserve it for possible future use.**



**2. Holding the graphics card at an angle as shown, align it with the tabs on its opening(s) in the rear panel.**



- 3. Swing the right side of the card toward its connector(s) on the main logic board.**
- 4. Push the card into its connector(s).**

Push evenly at both right corners of the card so that it is fully seated.
- 5. Reconnect any internal cables that you disconnected to access the graphics card.**
- 6. Connect any external cables to the graphics card.**

See “Locating Rear Panel Features” on page 7.
- 7. Refer to the documentation shipped with the card for important additional information.**

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Left Side Panel” on page 38

If you installed the card as a new option, complete this task:

- “How to Initiate a Reconfiguration Boot” on page 30

---

# How to Remove a CPU Module

Before you begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36

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**Note** – CPU modules are delicate. Be sure to take appropriate precautions to avoid damaging them through electrostatic discharge. For more information, see “How to Avoid Electrostatic Discharge” on page 40.

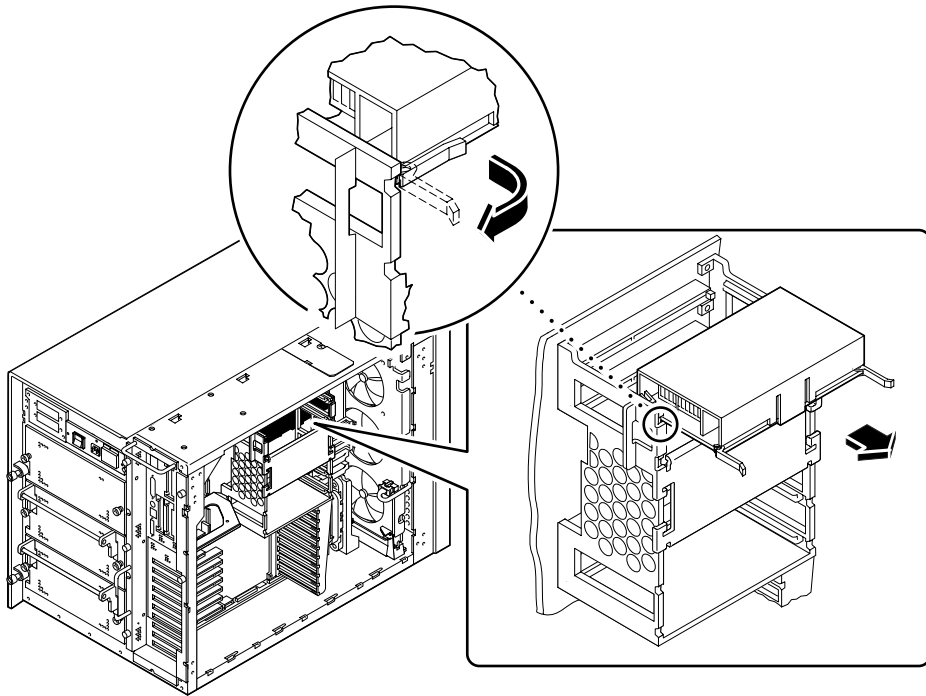
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## What to Do

1. **Locate on the main logic board the CPU module that you want to remove.**
2. **Lift the ejection levers away from the CPU module to release it from the CPU cage.**

The ejection levers are located on each side of the CPU module. Using both thumbs, push the levers away from the CPU module.

3. Pull evenly on the corners of the CPU module and slide it all the way out of the CPU cage.



4. Place the CPU module on an antistatic mat.

## What Next

To replace a CPU module, complete this task:

- “How to Install a CPU Module” on page 141



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# How to Install a CPU Module



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**Caution** – If you are installing this part as an option, you must ensure that it does not make your configuration exceed the system power budget; see “How to Determine System Power Requirements” on page 84 for more information.

---

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

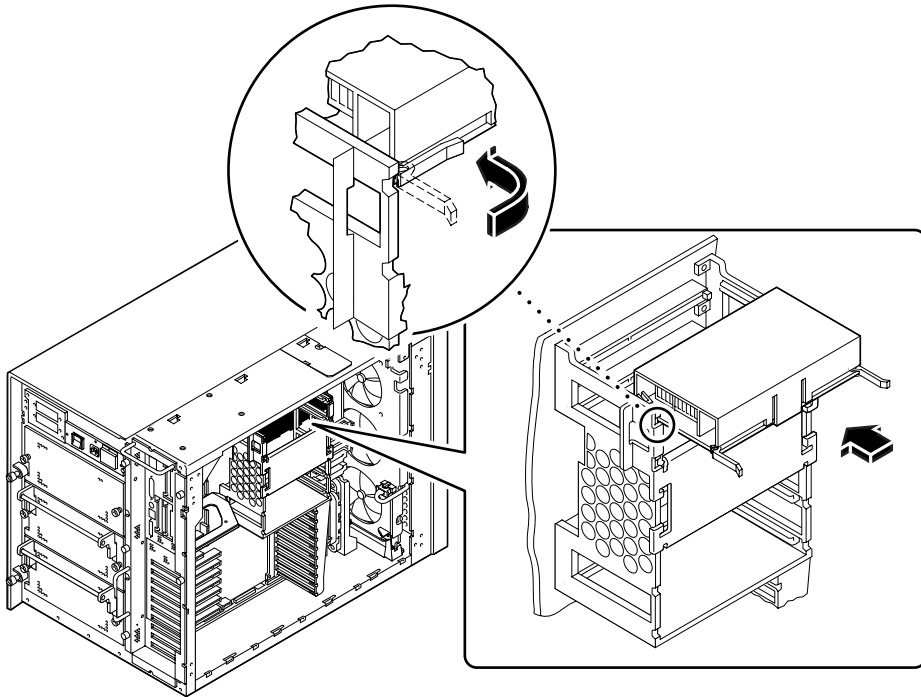
Know the configuration guidelines for installing CPU modules; see

- “About CPU Modules” on page 53

## What to Do

1. **On the main logic board, locate the slot for the CPU module that you are installing.**
2. **Align the edges of the CPU board with the grooves on the CPU cage.**
3. **Slide the CPU module evenly into the CPU slot on the main logic board.**  
Push on both sides of the CPU module until it is firmly seated in the slot.
4. **Hook each ejection lever onto its side of the CPU cage.**

5. Push the ejection levers toward the center of the module.



## What Next

Make sure that the CPU modules and DC/DC converter modules are installed in the correct locations. For additional information, see:

- “About DC/DC Converters” on page 55
- “About CPU Modules” on page 53

Complete the following tasks to reassemble the system:

- “How to Install the Left Side Panel” on page 38

If you installed the CPU module as a new option, complete this task:

- “How to Initiate a Reconfiguration Boot” on page 30

---

# How to Remove a DC/DC Converter

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

If you are removing a DC/DC converter from socket DC-A1 or DC-B1, you need to remove the two DIMMs closest to the DC/DC converter. For instructions, see:

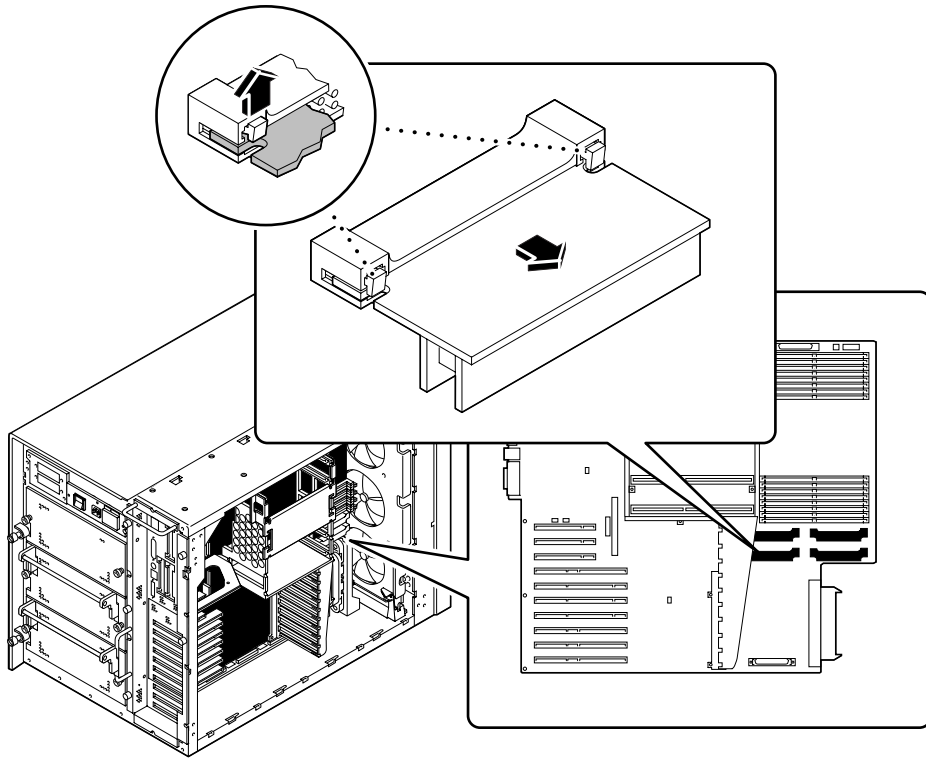
- “How to Remove a Memory Module” on page 122

## What to Do

- 1. Push up the holding clips that secure the DC/DC converter module in place.**

The clips are located on each side of the module. Push up the clip on one side first, then the other.

- 2. Pull the DC/DC converter module all the way out of the slot.**  
Grab the metal plate on each side and pull out the converter.



- 3. Place the DC/DC converter on an antistatic mat.**

## What Next

To replace a DC/DC converter module, complete this task:

- “How to Install a DC/DC Converter” on page 145

---

# How to Install a DC/DC Converter

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

If you are installing a DC/DC converter in socket DC-A1 or DC-B1, you need to remove the two DIMMs closest to the DC/DC converter socket. For detailed instructions, see:

- “How to Remove a Memory Module” on page 122

DC/DC converter modules must be installed in specific locations corresponding to the CPU module locations. For additional information, see:

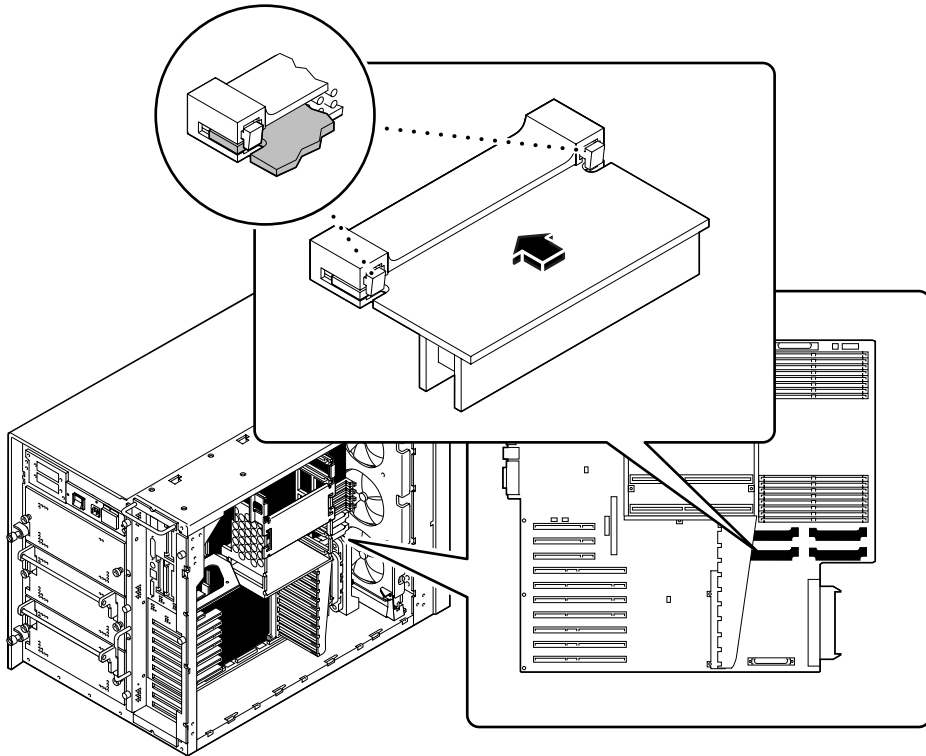
- “About DC/DC Converters” on page 55

## What to Do

1. **Locate the socket into which you will install the DC/DC converter.**

## 2. Push the DC/DC converter into the socket.

When the converter is properly seated, the two white holding clips will automatically close to secure it.



## What Next

Make sure that the DC/DC converter modules and CPU modules are installed in the correct locations. For additional information, see:

- “About DC/DC Converters” on page 55
- “About CPU Modules” on page 53

Complete the following tasks to reassemble the system:

- “How to Install a Memory Module” on page 125
- “How to Install the Left Side Panel” on page 38

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# How to Remove a PCI Card

## Before You Begin

Complete these tasks:

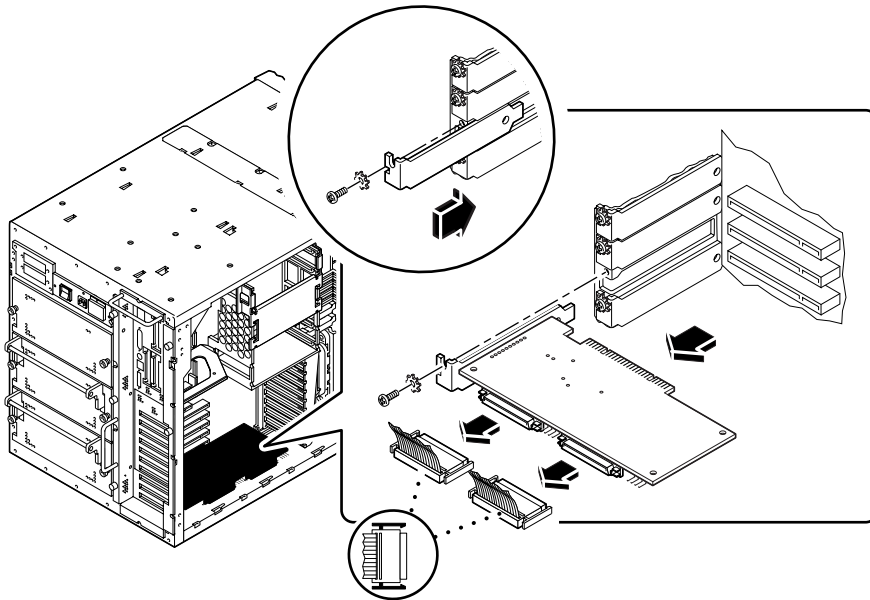
- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

## What to Do

- 1. Disconnect all external cables from the faceplate of the PCI card.**
- 2. Disconnect all cables connected to the internal connectors of the PCI card.**
- 3. Remove the Phillips screw that secures the faceplate of the PCI card to the rear panel of the system.**

Use a magnetized screwdriver, if possible, to prevent the screw from falling into the system chassis.

- 4. Pull the PCI card all the way out of the slot.**  
Hold the PCI card by the edges.



- 5. Place the PCI card on an antistatic mat.**
- 6. If you are not replacing the PCI card immediately, install a PCI filler panel.**  
Secure the filler panel with the screw from the PCI card faceplate.

## What Next

To replace a PCI card, complete this task:

- “How to Install a PCI Card” on page 149



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# How to Install a PCI Card



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**Caution** – If you are installing this part as an option, you must ensure that it does not make your configuration exceed the system power budget; see “How to Determine System Power Requirements” on page 84 for more information.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

Read the documentation supplied with the PCI card for information about jumper or switch settings, slot requirements, and cable connections.

Know what type of PCI card you are installing or replacing and where the card belongs on the main logic board; see:

- “About Peripheral Component Interconnect (PCI) Buses” on page 57

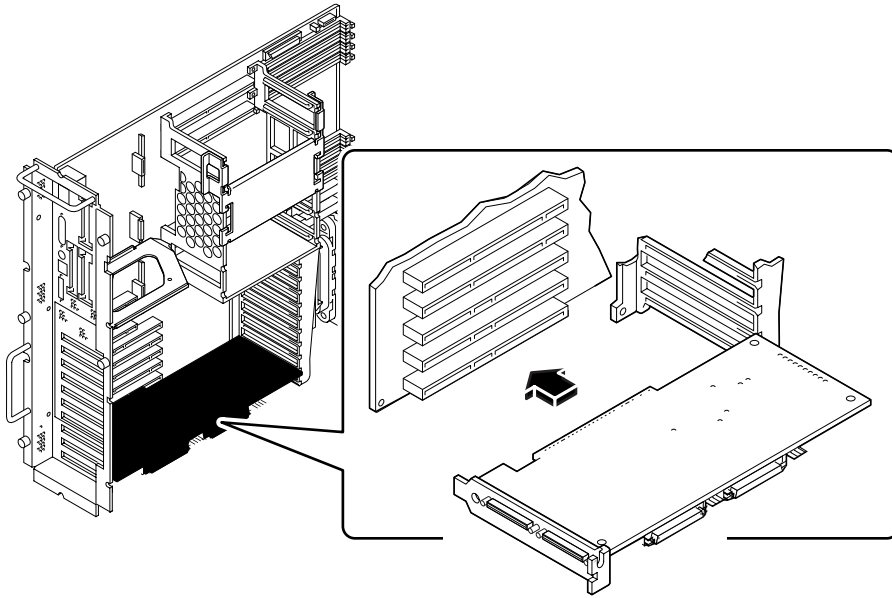
## What to Do

1. **If you are installing a new PCI card, remove the filler panel. Otherwise, go to step 2.**
  - a. **Remove the Phillips screw that secures the PCI filler panel to the rear panel.**
  - b. **Pull out the filler panel.**
2. **Insert the PCI card into the appropriate slot on the main logic board.**

To install a PCI long card:

  - a. **Insert the left side of the PCI card into the appropriate opening on the rear panel. At the same time, insert the right side of the card into the corresponding groove on the CPU cage.**

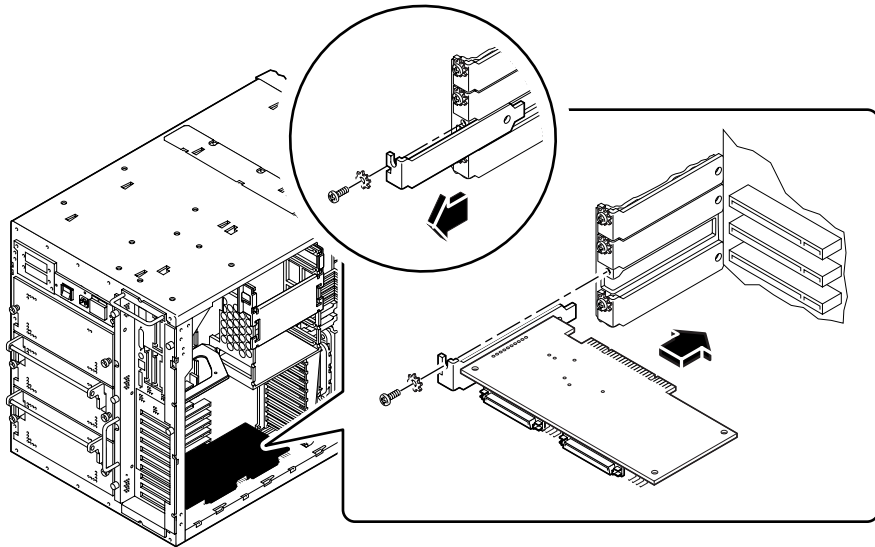
**b. Push the card into the slot on the main logic board.**



To install a PCI short card,

**a. Align the left side of the card with the appropriate opening on the rear panel.**

**b. Push the card into the corresponding slot on the main logic board.**



**3. Secure the PCI card faceplate to the rear panel with the Phillips screw.**

**4. If necessary, connect any internal cables to the PCI card's internal connectors.**

Refer to the instructions supplied with the PCI card. For the UltraSCSI PCI Controller card; see

- “How to Install an 8-Slot UltraSCSI Data Cable” on page 316

**5. If necessary, connect any external cables to the PCI card.**

Refer to the instructions supplied with the card.

## What Next

Complete the following task to reassemble the system:

- “How to Install the Left Side Panel” on page 38

If you installed the PCI card as a new option, complete this task:

- “How to Initiate a Reconfiguration Boot” on page 30

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# How to Remove the NVRAM Module



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

If your system has two graphics cards installed, remove the lower graphics card that obstructs the NVRAM module, see:

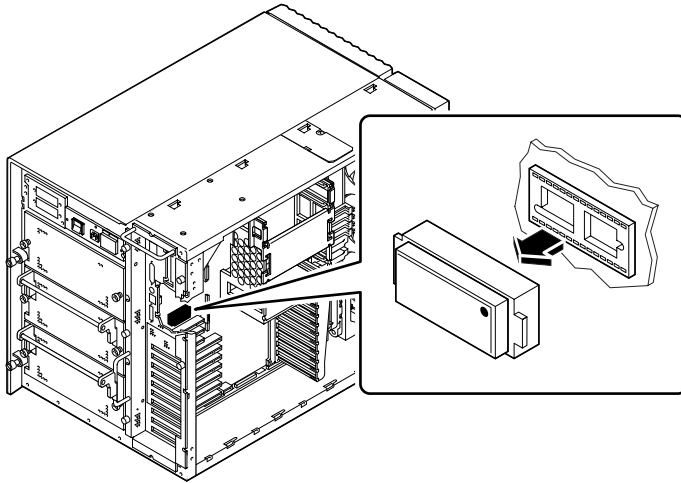
- See “How to Remove a UPA Graphics Card” on page 134

## What to Do

1. **Locate the NVRAM module on the main logic board.**

**2. Pull out the NVRAM module.**

Hold the NVRAM module by the tabs at both ends and firmly pull it toward you to lift the entire package off the board.



**3. Place the NVRAM module on an antistatic mat.**

## What Next

To replace the NVRAM module, complete this task:

- “How to Install the NVRAM Module” on page 154

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# How to Install the NVRAM Module



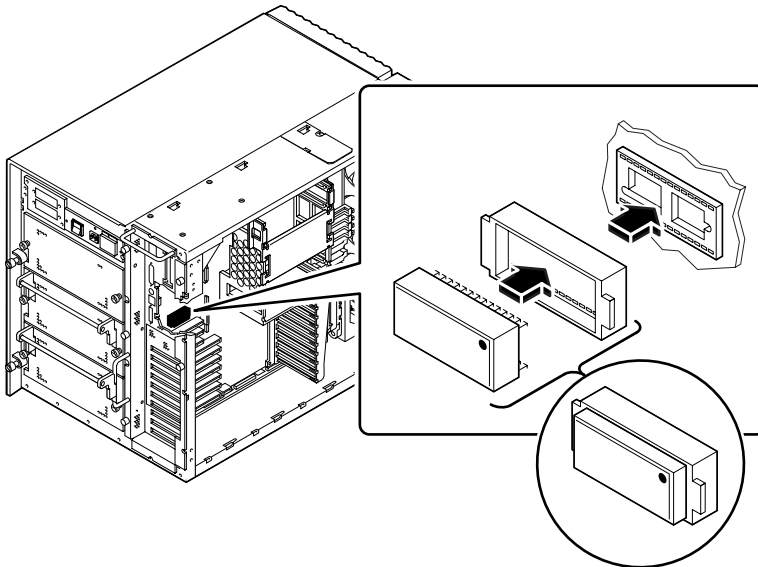
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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

- 1. Insert the NVRAM module into its socket on the main logic board.**  
The carrier is keyed so that the NVRAM module can be installed only one way.
- 2. Push down on the NVRAM module until it sits firmly in the socket.**



## What Next

Complete the following tasks to reassemble the system:

- “How to Install a UPA Graphics Card” on page 136 (if you removed one earlier)
- “How to Install the Left Side Panel” on page 38

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**Note** – If you are installing a new NVRAM module, the NVRAM must be reprogrammed by a Sun authorized service representative before your system can resume normal operation.

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# Backplanes

This section describes how to remove and install system backplanes. For a list of part numbers, see “Illustrated Parts Breakdown” on page 456.

*Tasks covered in this section include:*

- *How to Remove the Power Distribution Board—page 157*
- *How to Install the Power Distribution Board—page 164*
- *How to Remove the Removable Media Backplane—page 170*
- *How to Install the Removable Media Backplane—page 174*
- *How to Remove the 4-Slot UltraSCSI Backplane—page 178*
- *How to Install the 4-Slot UltraSCSI Backplane—page 182*
- *How to Remove an 8-Slot UltraSCSI Backplane—page 186*
- *How to Install an 8-Slot UltraSCSI Backplane—page 191*



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# How to Remove the Power Distribution Board



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove a Power Supply” on page 237 (remove all power supplies)
- “How to Remove the Disk Fan Tray Assembly” on page 223

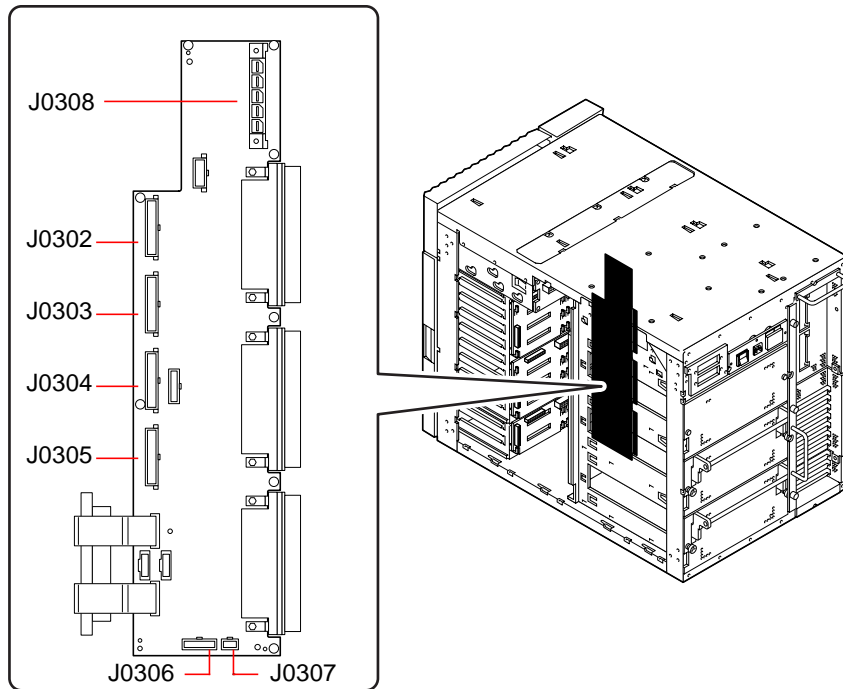
## What to Do

1. **Unplug the AC power cord from the back of the system.**

The power cord must be unplugged when you are handling the power distribution board.

2. **Unplug all cables that are connected to the power distribution board, except the flat cables at connectors J0201 and J0202.**

Press the tab on the side of the cable connectors to release the connector.



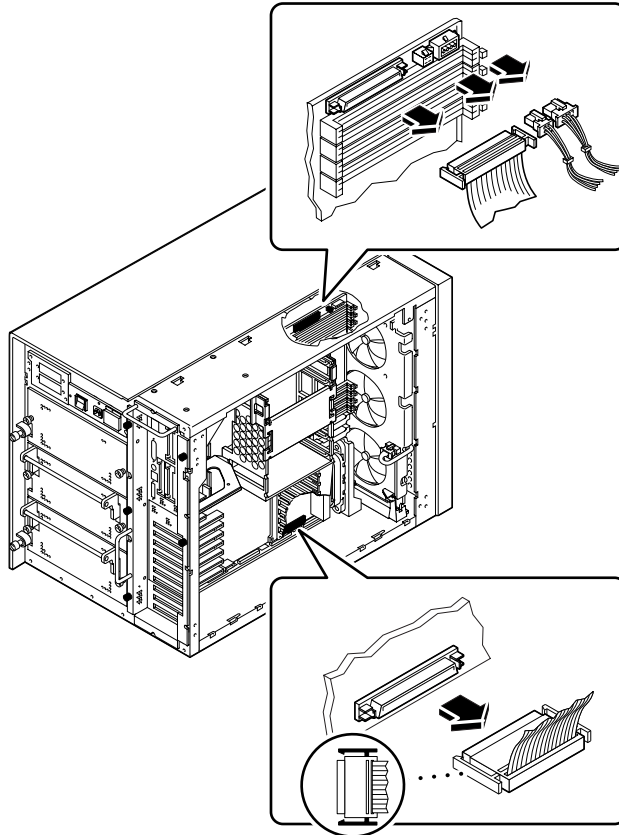
- a. **Disconnect the power cables at connectors J0302, J0303, J0304, and J0305 (if present).**
  - b. **Disconnect the AC line filter cable from the top of the power distribution board at connector J0308.**
  - c. **Disconnect the disk fan tray/interlock cable from the base of the power distribution board at connectors J0306 and J0307.**
3. **Disconnect all cables that are connected to the 4-slot and any 8-slot backplanes.**

Press the tabs on both sides of the connector to release the cables. It is easier to remove the power distribution board when these cables are disconnected.

    - a. **Disconnect the 8-slot UltraSCSI data cables (if present).**

Fold the cables over the top of the chassis to keep them out of the way.
    - b. **Disconnect the 4-slot UltraSCSI data cable from the 4-slot backplane.**

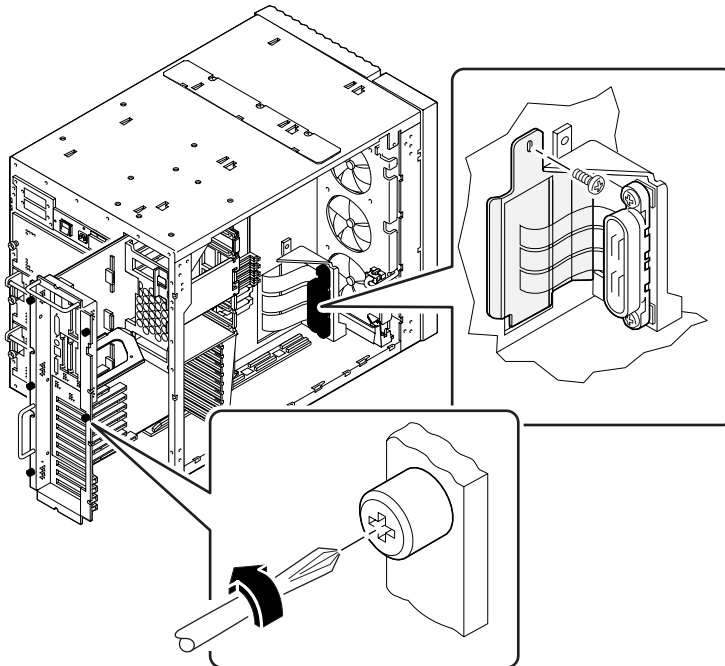
- c. **Disconnect the 8-slot and 4-slot power cables from the backplanes.**  
Press the tab on the bottom of each connector to disconnect it.
  - d. **Disconnect the I<sup>2</sup>C cables.**
- 4. Disconnect the cables that are connected to the main logic board.**



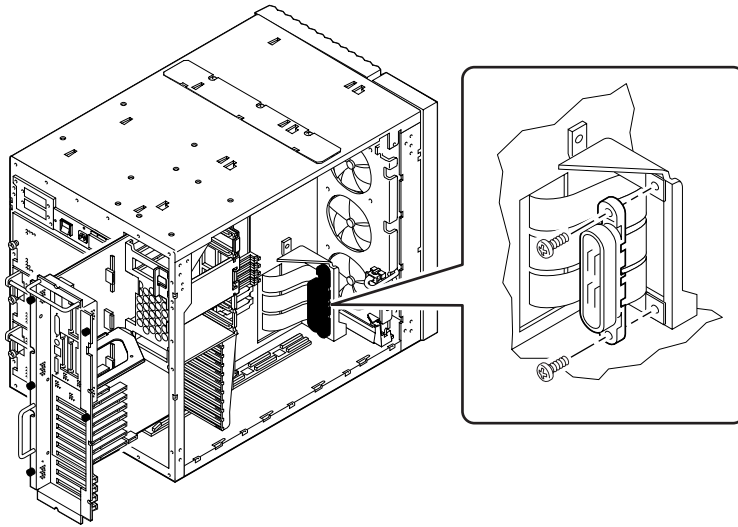
- a. **Disconnect the CPU fan tray power cable, at connector J4704.**
- b. **Disconnect the removable media SCSI cable, at connector J4701.**
- c. **Disconnect the upper blower power cable, at connector J4705.**
- d. **Disconnect the 4-slot UltraSCSI data cable, at connector J5601.**
- e. **Disconnect any internal PCI cables.**

5. Pull the main logic board approximately 6 inches (15 cm) out of the system.
  - a. Loosen the five screws on the rear panel.
  - b. Carefully slide the main logic board part way out of the chassis, using the handles at the rear of the board.
6. On the left side of the system, remove the screw that secures the plastic shield to the opening in the chassis wall, and remove the shield from the system.

The plastic shield covers the cables that are routed through the opening, and provides a protective barrier between the cables and the main logic board.



7. Remove the two large slotted screws that secure the large main logic board connector to its mounting bracket.

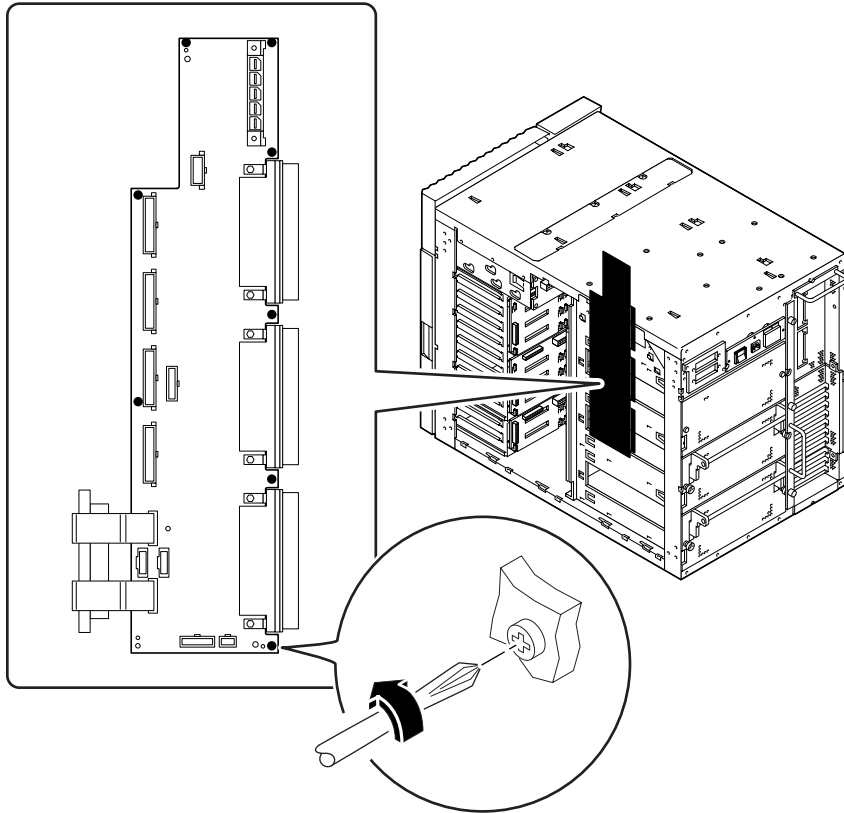


8. On the right side of the system, remove the fan tray guide from the bottom of the chassis.

Remove the screws that secure the guide to the bottom of the chassis. The guide holds the disk fan tray. You need to remove it from the chassis before you can remove the power distribution board.

**9. Remove the eight Phillips screws that secure the power distribution board to the chassis center divider wall.**

Use a magnetized screwdriver, if possible, to prevent the screws from falling into the system chassis.



**10. Remove the power distribution board from the chassis center divider wall.**

- a. With both hands on the board, pull the right side of the power distribution board away from the chassis.**

Carefully move the board from side to side to clear the power supply cage. Leave the board in the system angled forward.

- b. From the right side of the system, bend the cable that is attached to the main logic board connector and fold it flat against the board.**

- c. From the left side of the system, push the cable connector through the opening in the chassis wall.**

- d. From the right side of the system, use both hands to pull the power distribution board out of the chassis.**

Place the board on an antistatic mat.

## What Next

To replace the power distribution board, complete this task:

- “How to Install the Power Distribution Board” on page 164

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# How to Install the Power Distribution Board



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

1. **Holding the new power distribution board, bend the cable attached to the main logic board connector flat against the board.**
2. **Using both hands, insert the right side of the power distribution board into its proper location in the system.**

The board should remain angled forward on the left to allow room to insert the main logic board cable connector into the opening.

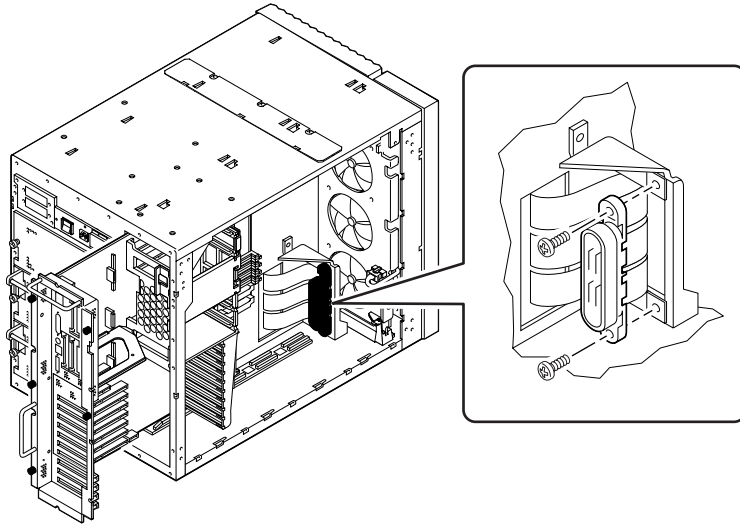
3. **Insert the main logic board cable connector through the opening in the chassis divider wall.**

Secure the large main logic board connector to its bracket on the divider wall.



4. **On the left side of the system, attach the main logic board connector to its mounting bracket on the chassis center divider wall.**

Align the connector with the bracket and loosely tighten each screw before completely tightening both screws.



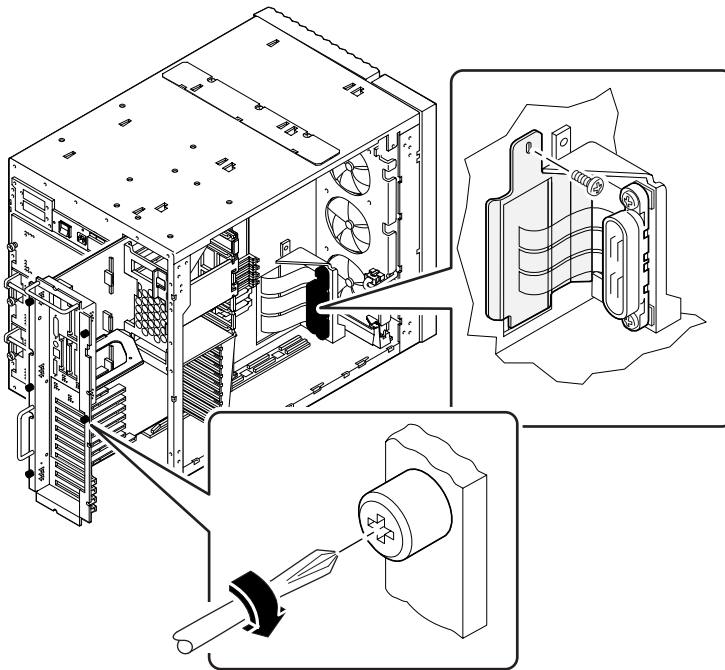
5. **Bend the blue flat cables from the power distribution board flat against the divider wall.**

This prevents the cables from interfering with the installation of the main logic board.

**6. Secure the plastic shield over the opening in the chassis wall.**

The shield covers the cables that are routed through the opening.

- a. **Position the shield so that the screw hole is at the top and the bottom flange bends away from you.**
- b. **Insert the bottom of the shield into the opening in the chassis wall.**
- c. **Align the hole on the top of the shield with the hole over the chassis opening, and secure the shield to the chassis with the Phillips screw.**

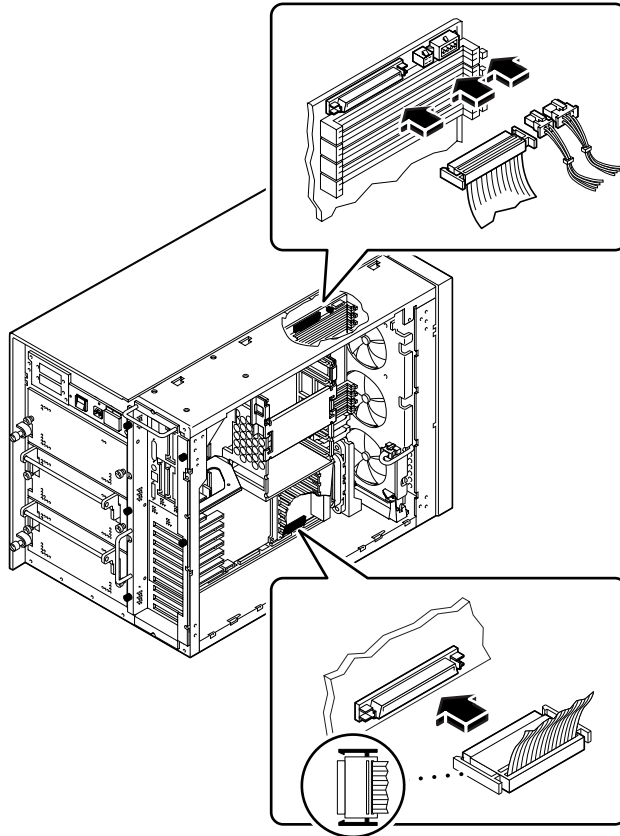


**7. Push the main logic board back into the system chassis.**

**8. Tighten the five screws on the rear panel.**

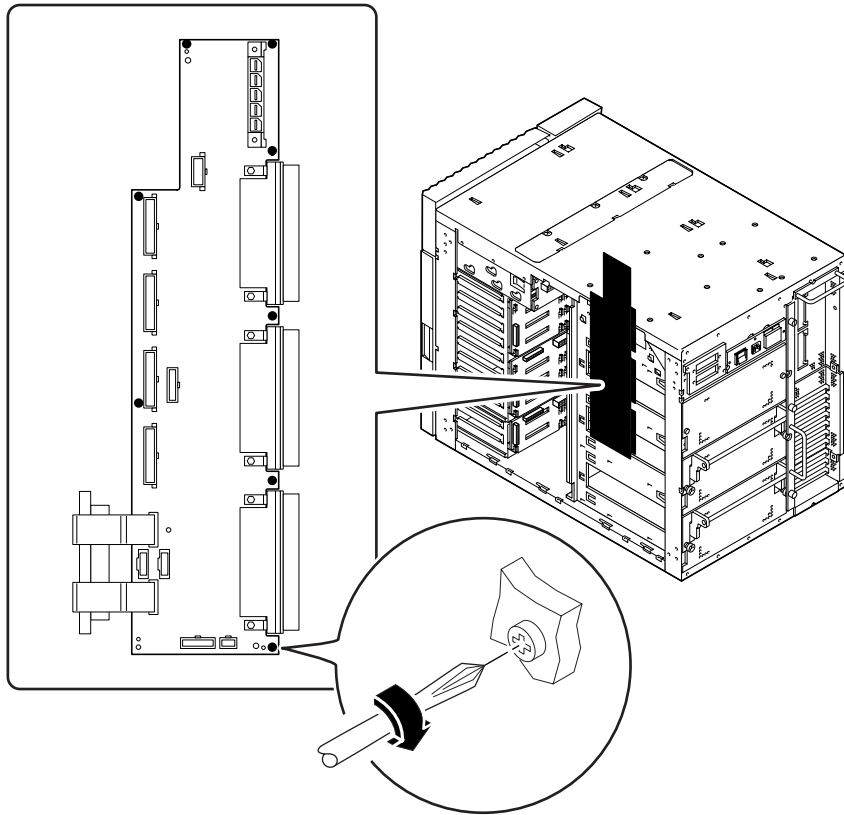
**9. Reconnect the cables to the main logic board:**

- a. Connect the removable media SCSI cable, at connector J4701.**
- b. Connect the 4-slot UltraSCSI data cable, at connector J5601.**
- c. Connect the CPU fan tray power cable, at connector J4704.**
- d. Connect the upper blower power cable, at connector J4705.**



**10. Secure the power distribution board to the center divider wall by fastening the eight Phillips screws.**

Align the holes on the power distribution board to the posts on the chassis. Each screw fastens to a post. Fasten the two screws on the left side first, then the two screws on the top and finally the four screws on the right side of the power board.



**11. Reconnect the cables to the power distribution board.**

These cables were disconnected when you removed the power distribution board.

- a. **Connect the disk fan tray/interlock cable to the base of the power distribution board at connectors J0306 and J0307.**
- b. **Connect the AC line filter cable to the top of the power distribution board at connector J0308.**
- c. **Connect the remaining power cables to the power distribution board at connectors J0302, J0303, J0304, and J0305.**

**12. Reconnect all cables to the 4-slot and any 8-slot backplanes.**

These cables were disconnected to make it easier to remove the power distribution board. If necessary, consult the installation procedure for each cable.

- a. Connect the 4-slot and any 8-slot UltraSCSI data and power cables.**
- b. Connect the I<sup>2</sup>C cables.**

**13. Secure the disk fan tray guide to the bottom of the chassis with the two Phillips screws.**

**14. Plug in the AC power cord to rear of the system.**

## What Next

Complete the following tasks to reassemble the system:

- “How to Install a Power Supply” on page 239
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Left Side Panel” on page 38
- “How to Install the Right Side Panel” on page 34

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# How to Remove the Removable Media Backplane



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

## What to Do

### 1. Disconnect all data and power cables from the removable media backplane.

Place the removable media assembly right side up on a table.

If there is a drive in the lower bay, disconnect the power and the data cables through the bottom of the assembly.

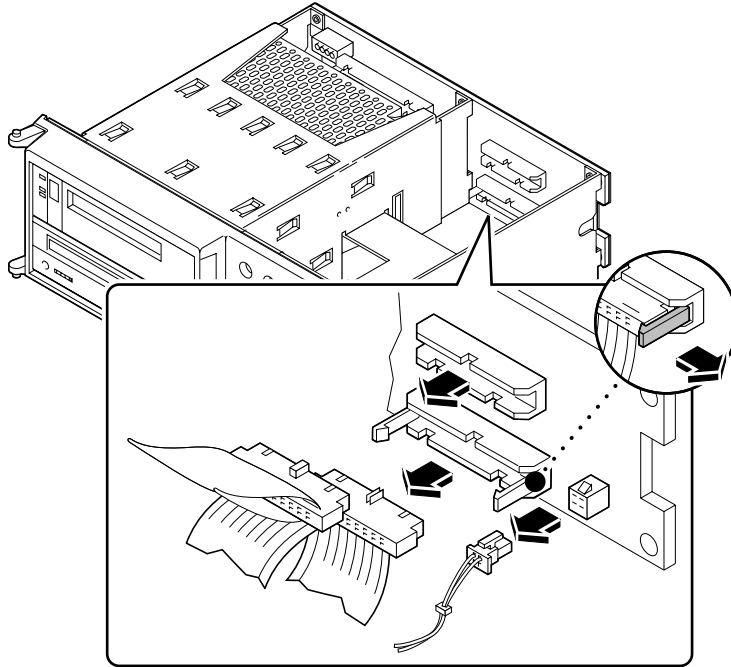
#### a. Unplug the LED interface cable at connector J0104.

Pull on the plastic pull tab to disconnect the cable.

**b. Disconnect the diskette data cable at connector J0102.**

Press out the ejector levers to release the data cable from its connector.

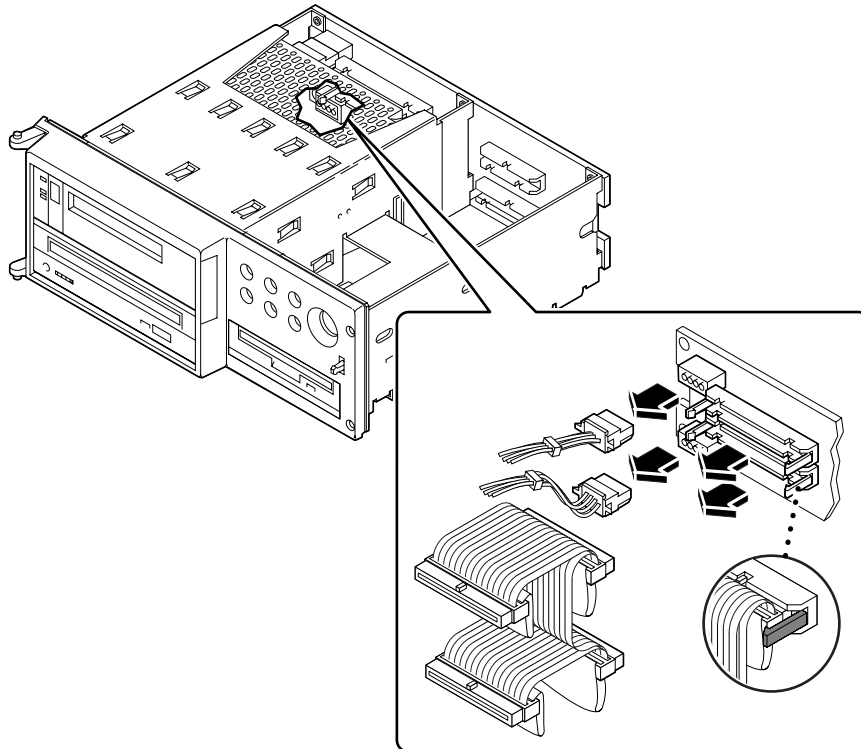
**c. Disconnect the diskette power cable at connector P0101.**



**d. Disconnect the SCSI drive data cable at connectors J0201 and J0202.**

Press the ejection levers outward to release the cable from its connectors.

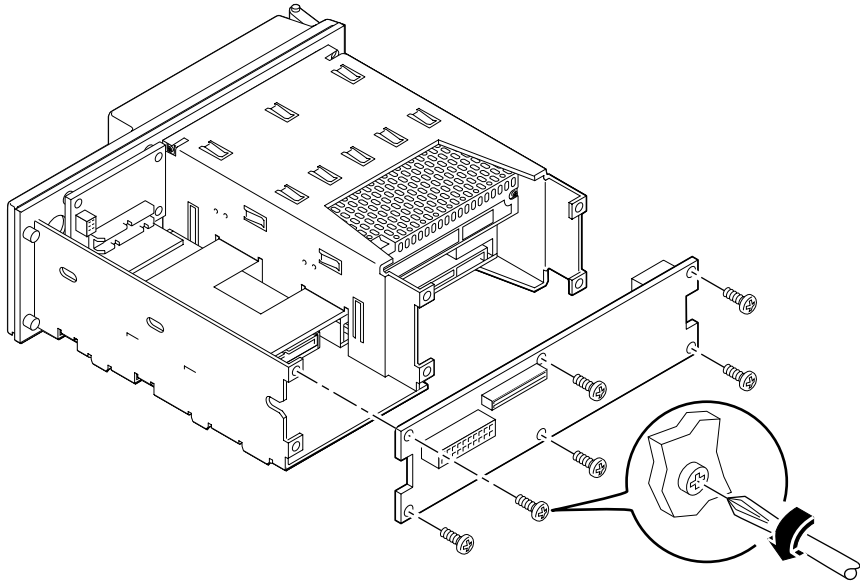
**e. Detach the two SCSI drive power cables at connectors P0201 and P0202.**





2. Remove the six Phillips screws that secure the backplane to the rear of the removable media assembly.

Stand the removable media assembly upright on its front panel for easier access to the screws.



3. Remove the backplane from the removable media assembly, and place it on an antistatic mat.

## What Next

To replace the removable media backplane, complete this task:

- “How to Install the Removable Media Backplane” on page 174

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# How to Install the Removable Media Backplane



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

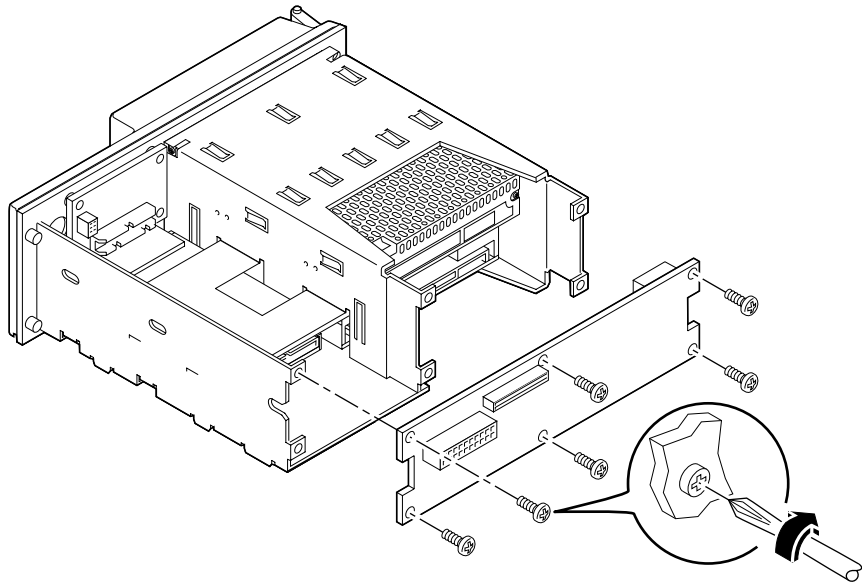
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## What to Do

- 1. Place the backplane against the removable media assembly.**

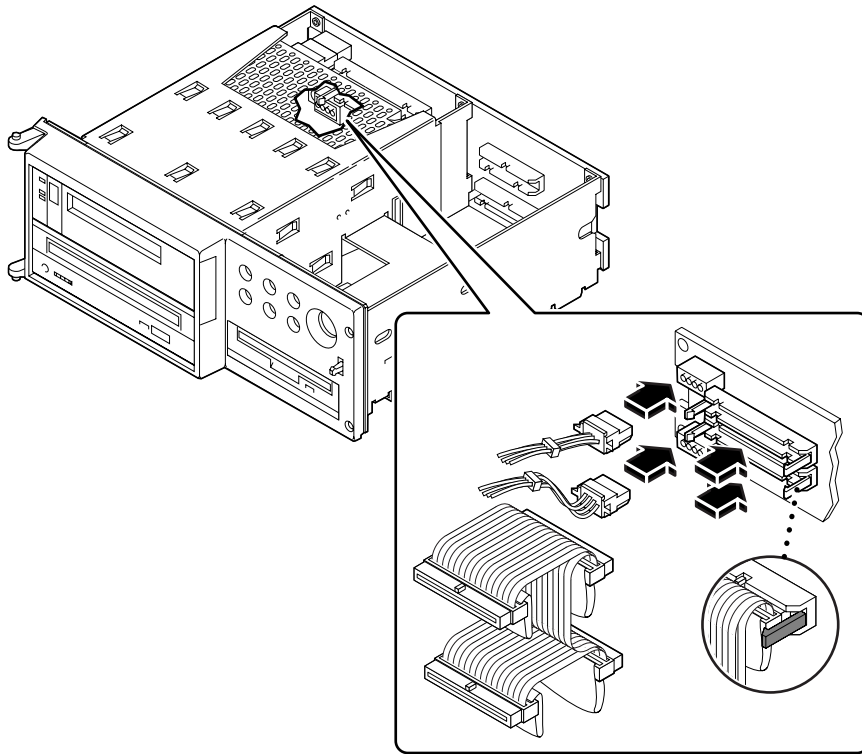
Make sure that the backplane is oriented with the drive connectors facing into the opening of the removable media assembly.

2. **Secure the backplane to the removable media assembly with the six Philips screws you removed earlier.**



3. **Connect all power and data cables to the backplane.**
  - a. **Connect the two SCSI drive data cables at connector J0201 and connector J0202.**

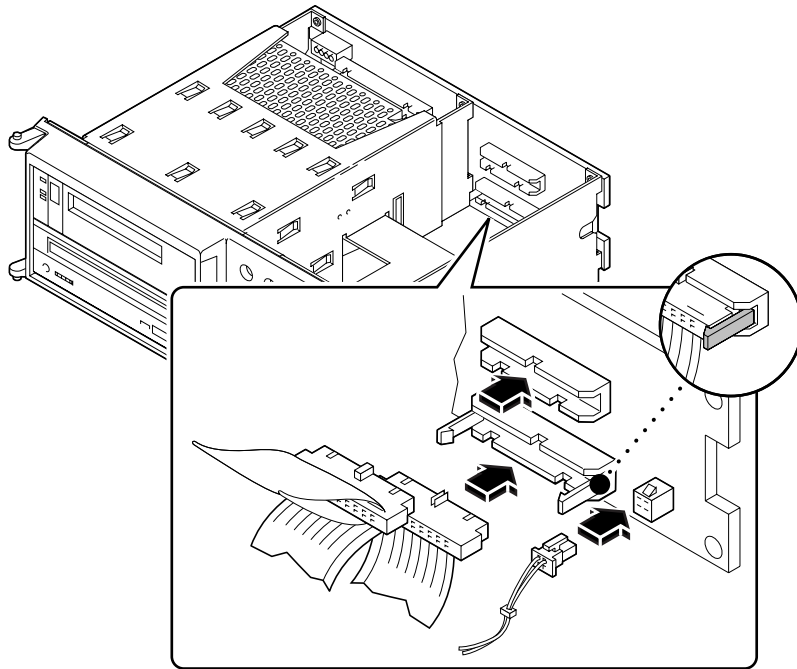
- b. Connect the two SCSI drive power cables at connector P0201 and connector P0202.**



- c. Connect the diskette data cable at connector J0102.**

- d. Connect the diskette power cable at connector P0101.**

e. Connect the LED interface cable at connector J0104.



## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the 4-Slot UltraSCSI Backplane



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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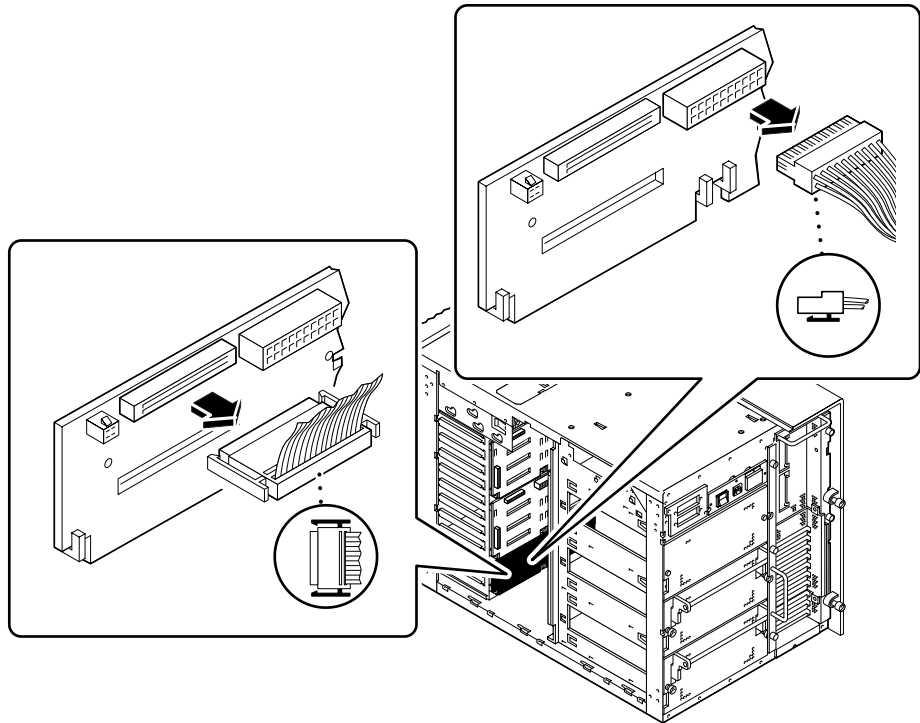
## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove a Disk Drive” on page 197; you must remove all disks from the disk cage
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove an 8-Slot UltraSCSI Backplane” on page 186, if one or more 8-slot backplanes are installed

# What to Do

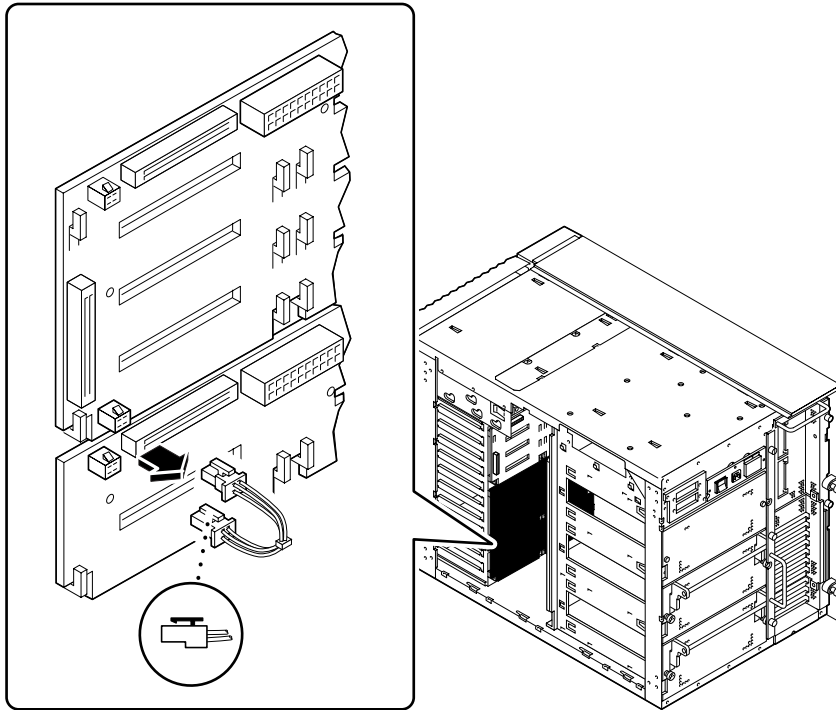
1. **Disconnect the 4-slot UltraSCSI data cable from the backplane at connector J0102.**  
Press the tabs on both sides of the connector to release the cable.



2. **Disconnect the 4-slot UltraSCSI power cable from the backplane at connector J0101.**  
Press the tab on the bottom of the connector to release the cable.

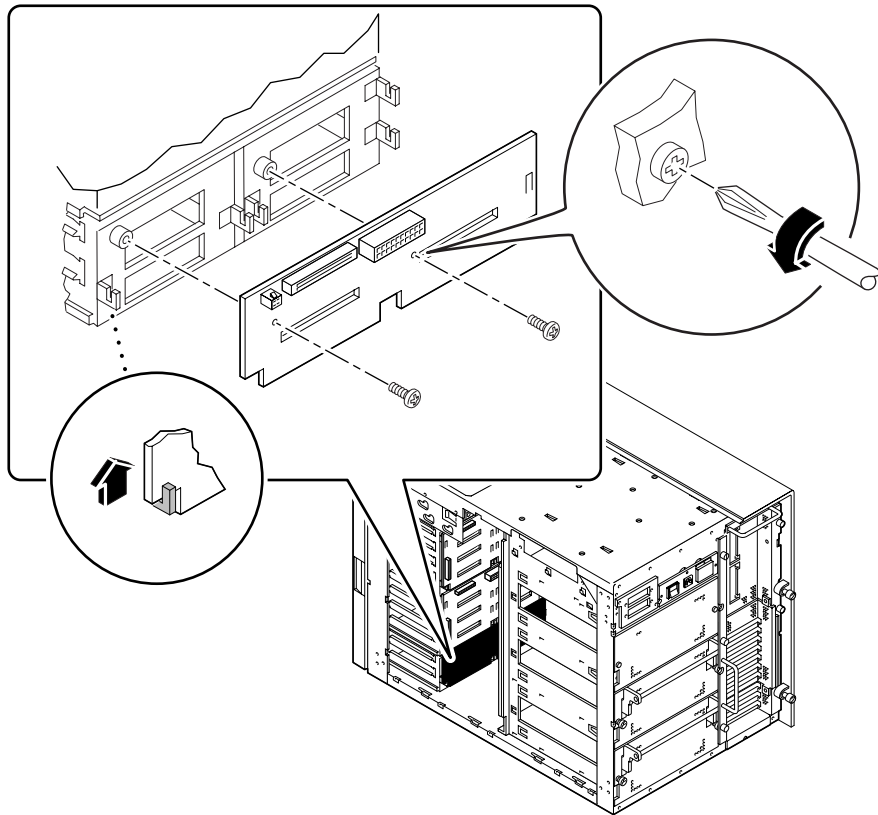
3. *If your system is configured to include one or more 8-slot UltraSCSI backplanes, disconnect the I<sup>2</sup>C cable at connector P0500.*

Press the tab on top of the connector to release the cable.





4. Remove the two screws that secure the backplane to the disk cage.  
Use a Phillips screwdriver.



5. Lift the backplane free from the five mounting hooks near the base of the disk cage, and remove it from the system.  
Place the backplane on an antistatic mat.

## What Next

To replace the backplane, complete this task:

- “How to Install the 4-Slot UltraSCSI Backplane” on page 182

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# How to Install the 4-Slot UltraSCSI Backplane



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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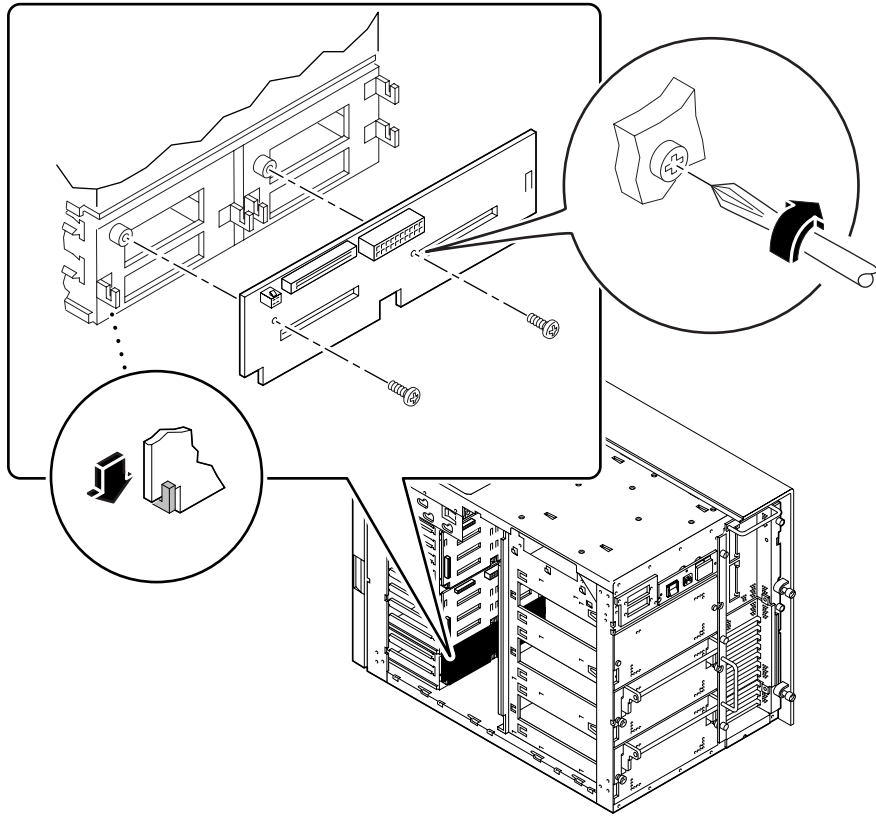
**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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# What to Do

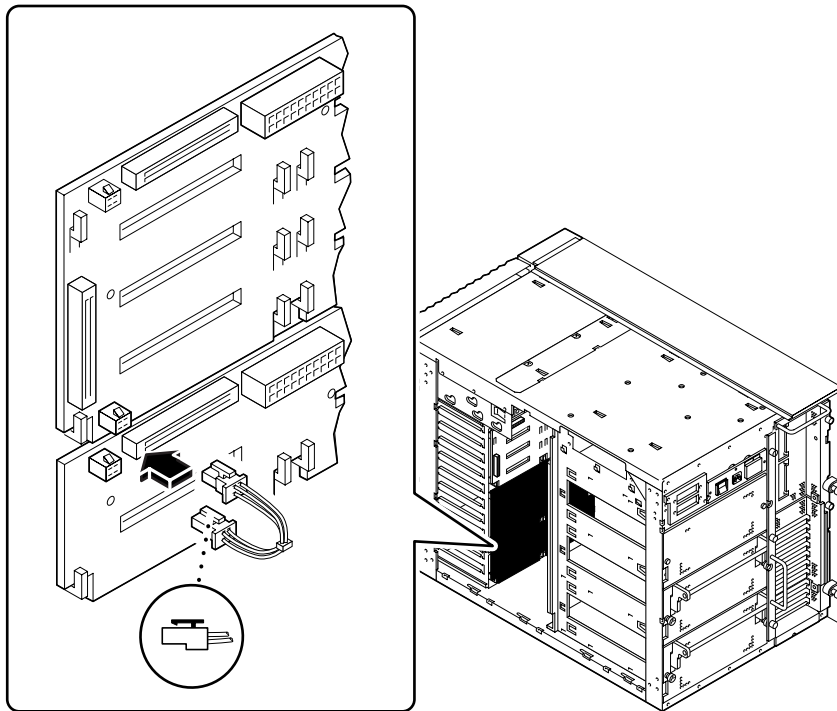
1. **Insert the 4-slot Ultra SCSI backplane down into the five mounting hooks near the base of the disk cage.**

Push down on the edge of the backplane only.



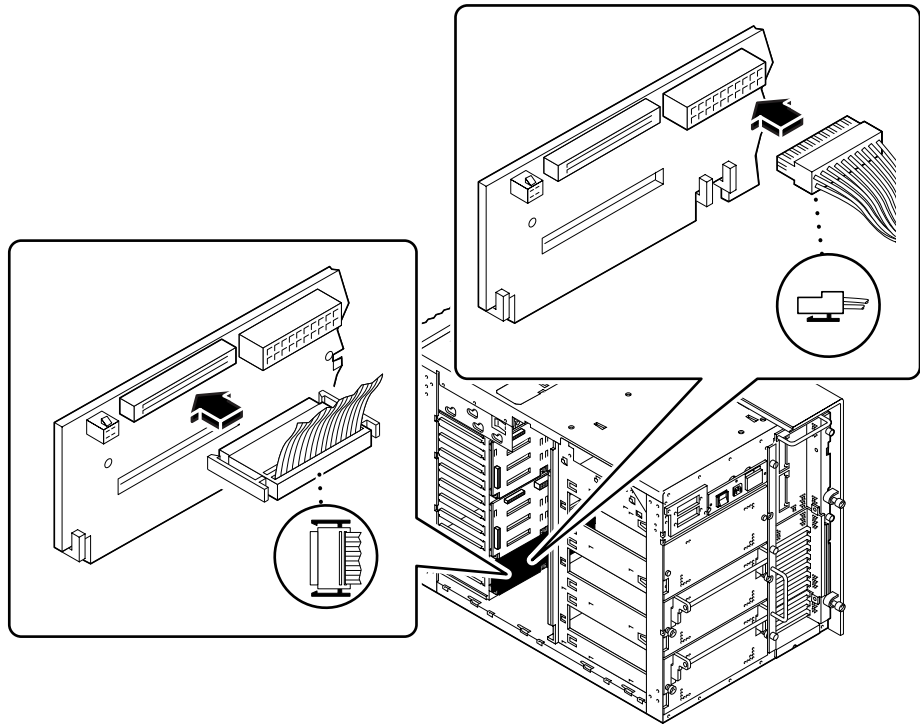
2. **Fasten the two Phillips screws that secure the backplane to the disk cage.**

3. *If your system is configured to include one or more 8-slot UltraSCSI backplanes, connect the I<sup>2</sup>C cable at connector P0500.*



4. **Connect the 4-slot UltraSCSI power cable to the backplane at connector J0101.**

5. Connect the 4-slot UltraSCSI data cable to the 4-slot SCSI backplane at connector J0102.



## What Next

If you removed one or more 8-slot backplanes, complete this task:

- “How to Install an 8-Slot UltraSCSI Backplane” on page 191

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34
- “How to Install a Disk Drive” on page 199; replace any disk drives you removed from the disk cage

---

# How to Remove an 8-Slot UltraSCSI Backplane



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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## Before You Begin

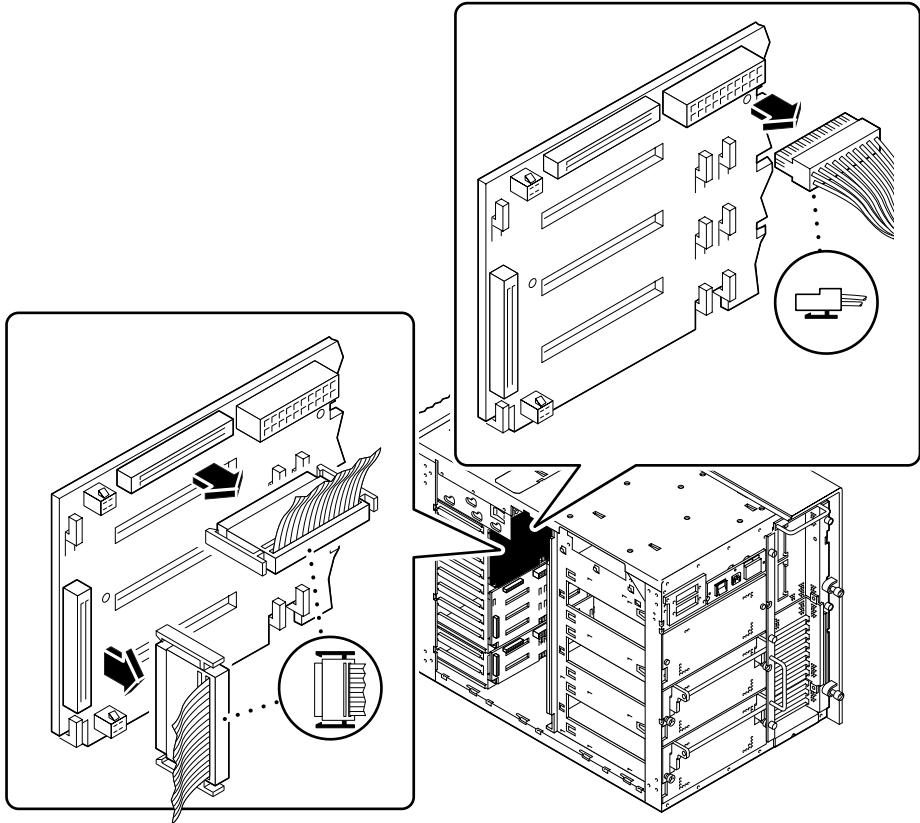
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove a Disk Drive” on page 197; you must remove all disks connected to any backplanes you plan to remove
- “How to Remove the Disk Fan Tray Assembly” on page 223
- If there is another 8-slot backplane or backplane filler panel installed above the one you need to replace, you must remove it first.

# What to Do

1. **Disconnect the two 8-slot UltraSCSI data cable connectors from the backplane at connectors J0102 and J0402.**

Press the tabs on both sides of the connectors to release the cable.



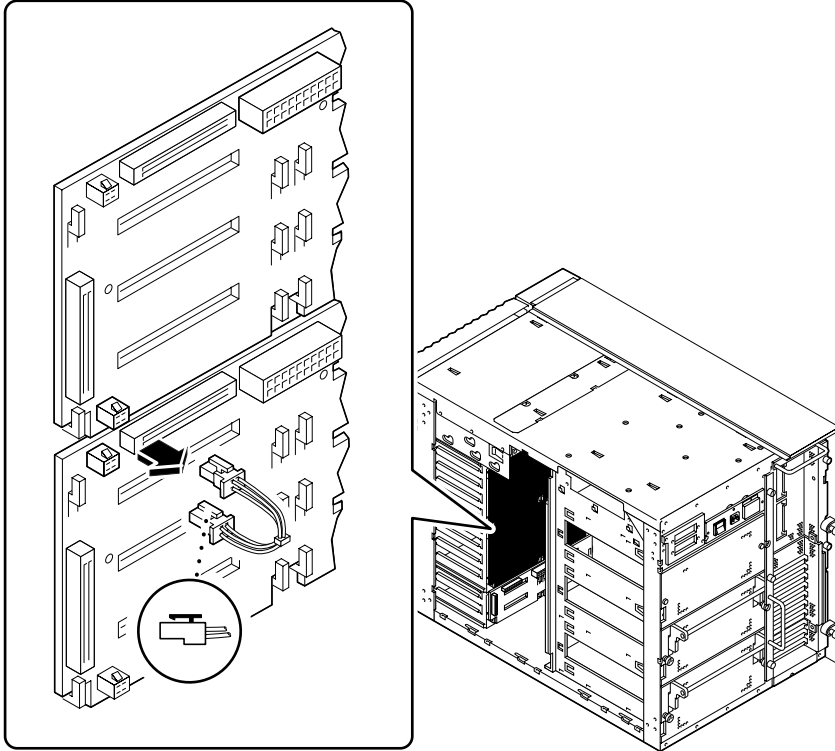
2. **Disconnect the 8-slot UltraSCSI power cable from the backplane at connector J0101.**

Press the tab on the bottom of the connector to release the cable.

**3. Disconnect the I<sup>2</sup>C cable at connector P0600.**

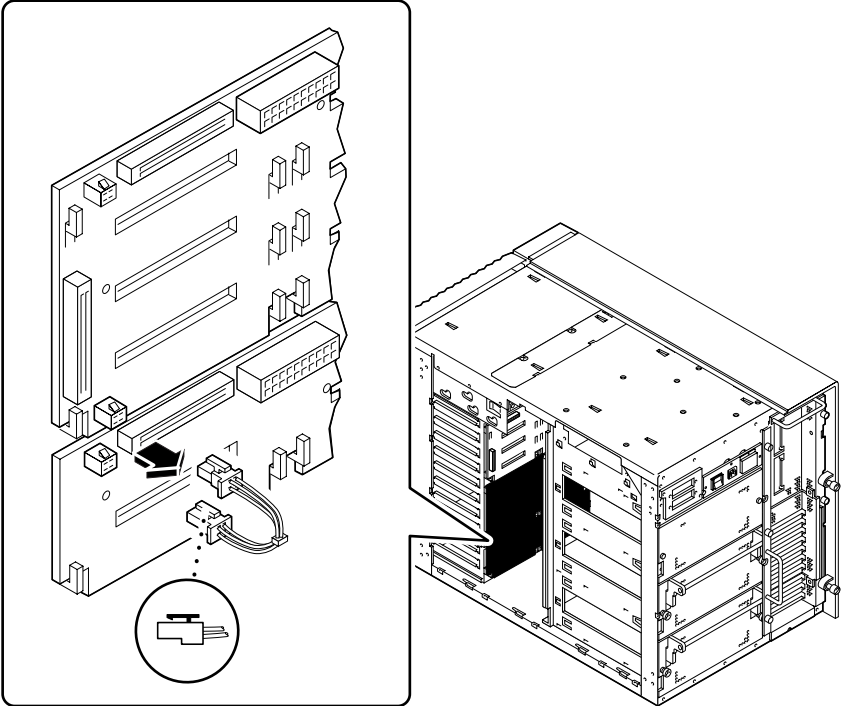
Press the tab on top of the connector to release the cable.

*If you are removing the upper 8-slot backplane, disconnect the cable as shown below:*

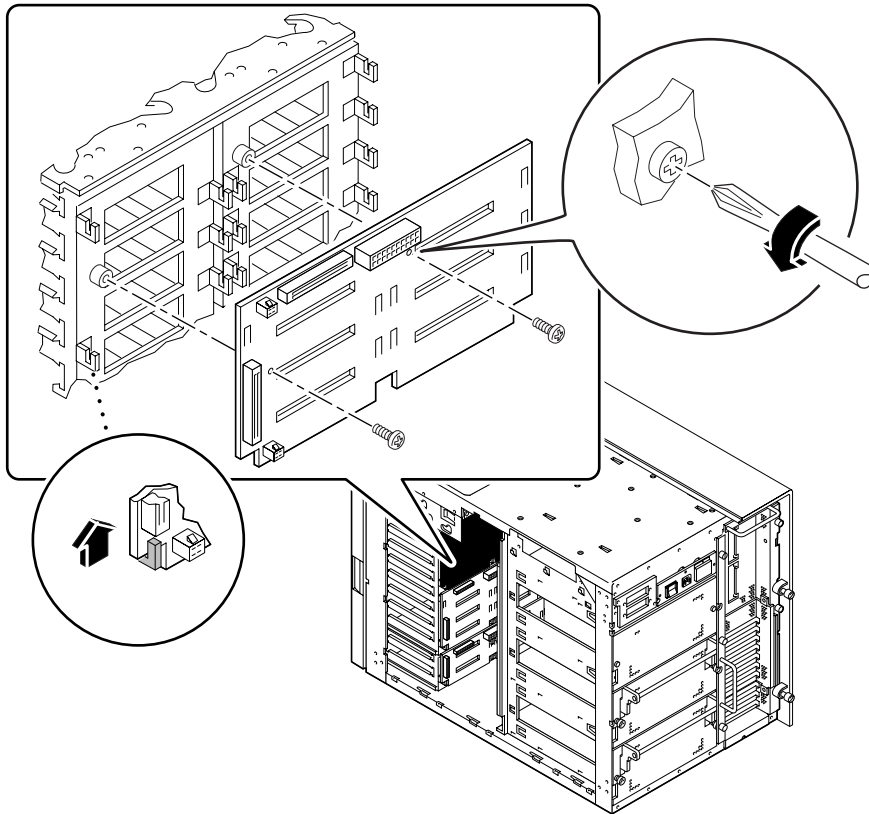




*If you are removing the lower 8-slot backplane, disconnect the cable as shown below:*



4. Remove the two Phillips screws that secure the backplane to the disk cage.



5. Lift the backplane free from the 12 mounting hooks on the disk cage and remove it from the system.

Place the backplane on an antistatic mat.

## What Next

To replace the backplane, complete this task:

- “How to Install an 8-Slot UltraSCSI Backplane” on page 191

---

# How to Install an 8-Slot UltraSCSI Backplane



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

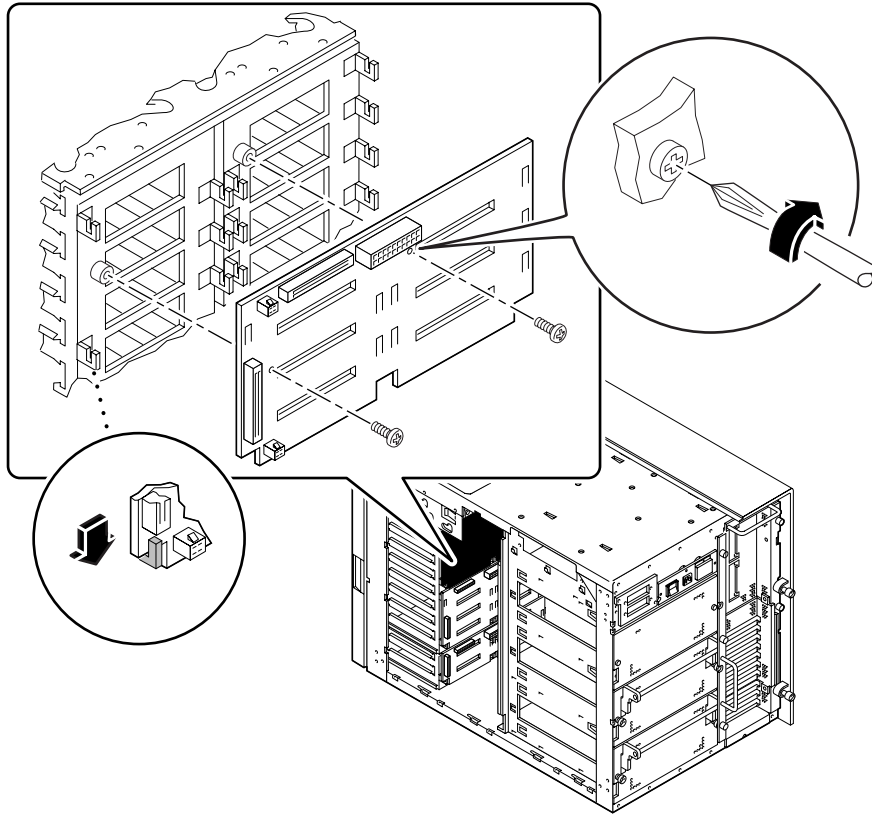
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If you are installing two 8-slot backplanes, install the lower one first.

# What to Do

1. **Insert the 8-slot Ultra SCSI backplane down into the 12 mounting hooks on the disk cage.**

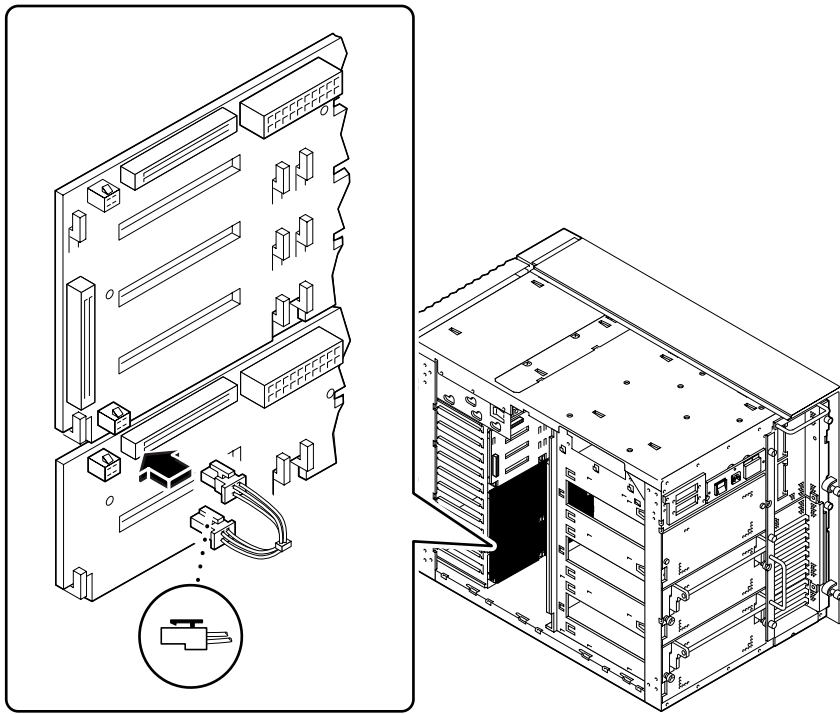
Push down on the edge of the backplane only.



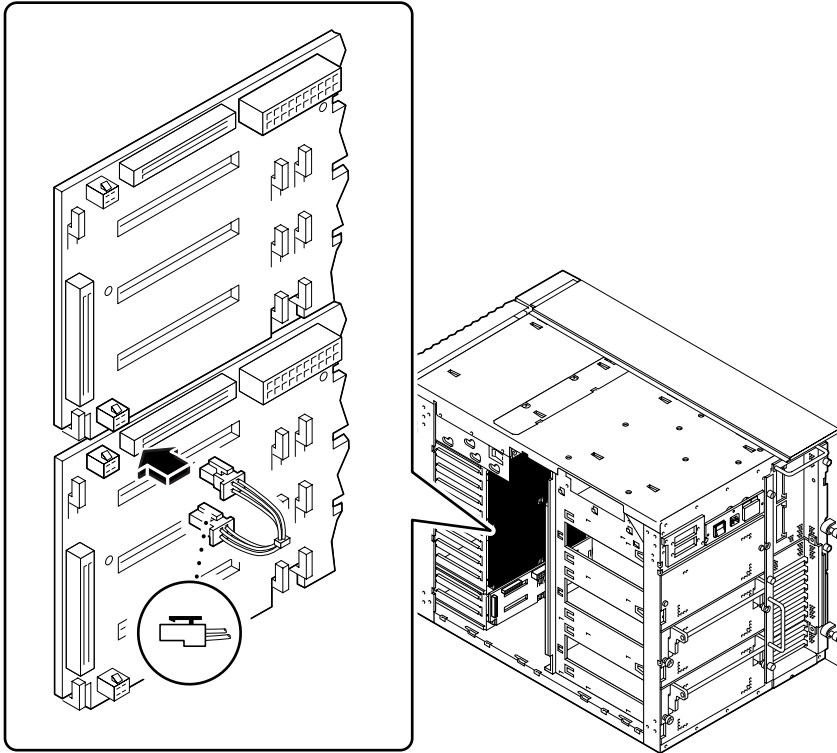
2. **Fasten the two Phillips screws that secure the backplane to the disk cage.**

**3. Connect the I<sup>2</sup>C cable to connector P0600.**

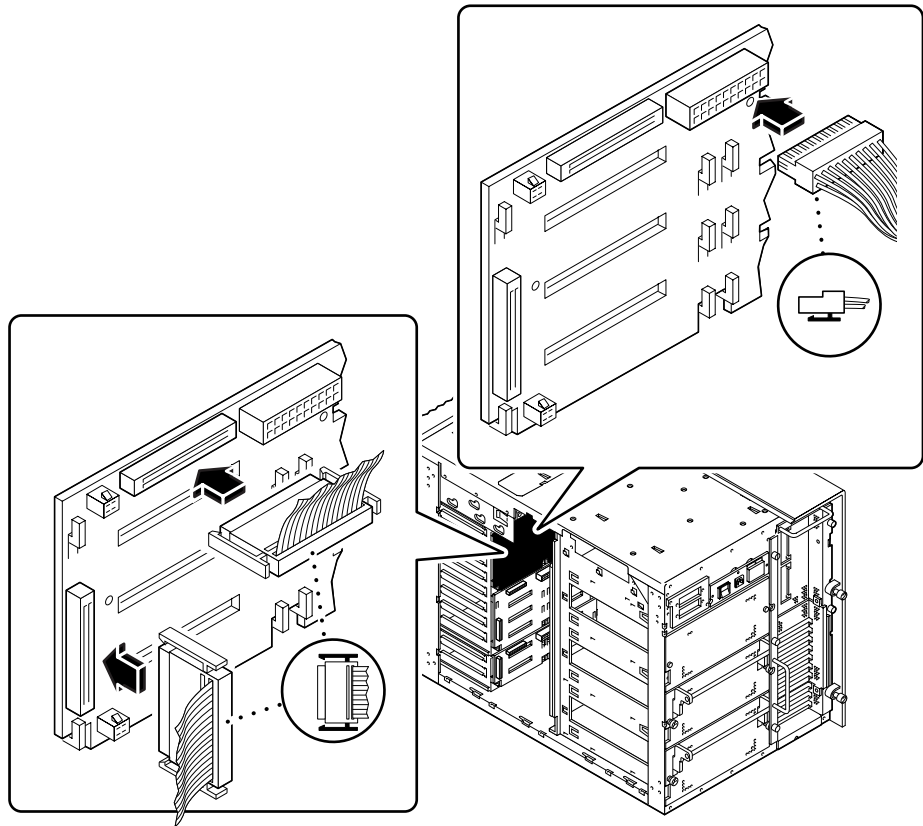
*If you are installing the lower 8-slot backplane, connect the cable as shown below:*



*If you are installing the upper 8-slot backplane, connect the cable as shown below:*



4. **Connect the 8-slot UltraSCSI power cable to the backplane at connector J0101.**  
Make sure that the tab on the bottom of the connector snaps into place.



5. **Connect the two 8-slot UltraSCSI data cable connectors to the backplane.**  
Connect P1-A to connector J0102 and P1-B to connector J0402.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34
- “How to Install a Disk Drive” on page 199; replace any disk drives you removed from the disk cage

---

# Storage Devices

This section describes how to remove and install storage devices. For a list of part numbers, see “Illustrated Parts Breakdown” on page 456.

*Tasks covered in this section include:*

- *How to Remove a Disk Drive—page 197*
- *How to Install a Disk Drive—page 199*
- *How to Remove a CD-ROM Drive or Tape Drive—page 201*
- *How to Install a CD-ROM Drive or Tape Drive—page 205*
- *How to Remove the Diskette Drive—page 209*
- *How to Install the Diskette Drive—page 213*



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# How to Remove a Disk Drive

## Before You Begin

The system's "hot plug" feature lets you remove a disk drive without shutting down the operating system or turning off the system power. For more information, see:

- "About Internal Disk Drives" on page 63

You must follow antistatic precautions when handling a disk drive. For more information, see:

- "How to Avoid Electrostatic Discharge" on page 40

Attach the wrist strap to the inside bottom of the chassis, just inside the bottom door.

## What to Do

### 1. Prepare the system for disk removal.

See "About Internal Disk Drives" on page 63.

### 2. If you are not hot-plugging the disk drive, halt the operating system.

See "How to Power Off the System" on page 26.

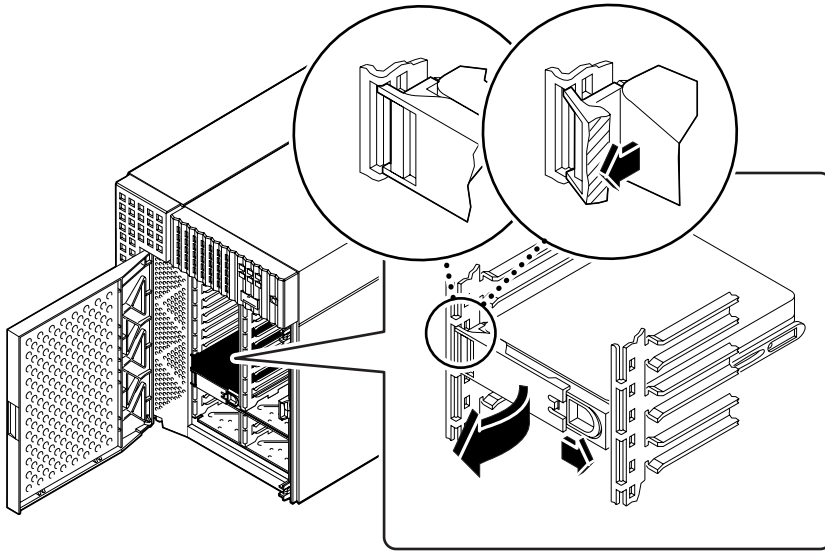
### 3. Open the bottom door.

This door covers the lower part of the system's front panel and is hinged on the left side. Unlock the door, if necessary. Pull firmly on the right side of this door and swing it out and to the left.

### 4. Locate the disk drive that you need to remove.

For information about disk status LEDs and locating faulty disk drives, see "About Internal Disk Drives" on page 63.

5. Slide the latch at the right of the drive handle to the right to release it.



6. Swing open the handle as far as it will go and pull on it to slide the drive out.

7. Place the drive on an antistatic mat.

Repeat steps 4 through 7 for any other drives that you want to remove.

## What Next

If you removed the drive to access another subassembly, perform the appropriate removal and replacement procedure now.

To replace the disk drive, complete this task:

- “How to Install a Disk Drive” on page 199

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# How to Install a Disk Drive



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**Caution** – If you are installing this part as an option, you must ensure that it does not make your configuration exceed the system power budget; see “How to Determine System Power Requirements” on page 84 for more information.

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## Before You Begin

The system’s “hot plug” feature lets you remove and install a disk drive without shutting down the operating system or turning off system power. For more information, see:

- “About Internal Disk Drives” on page 63

You must follow antistatic precautions when handling a disk drive. For more information, see:

- “How to Avoid Electrostatic Discharge” on page 40

Attach the wrist strap to the floor of the chassis, just inside the bottom door.

## What to Do

### 1. Open the bottom door.

This door covers the lower part of the system’s front panel and is hinged on the left side. Unlock the door, if necessary. Pull firmly on the right side of this door and swing it out and to the left.

### 2. Align the drive with its drive bay opening.

If you are installing the drive as a new option, install it in the lowest available slot number. Verify that a disk backplane is installed behind the selected drive bay.

Orient the drive so that the handle’s hinge is on the left and the handle is open (extended). Slide the handle latch to the right to open the handle.

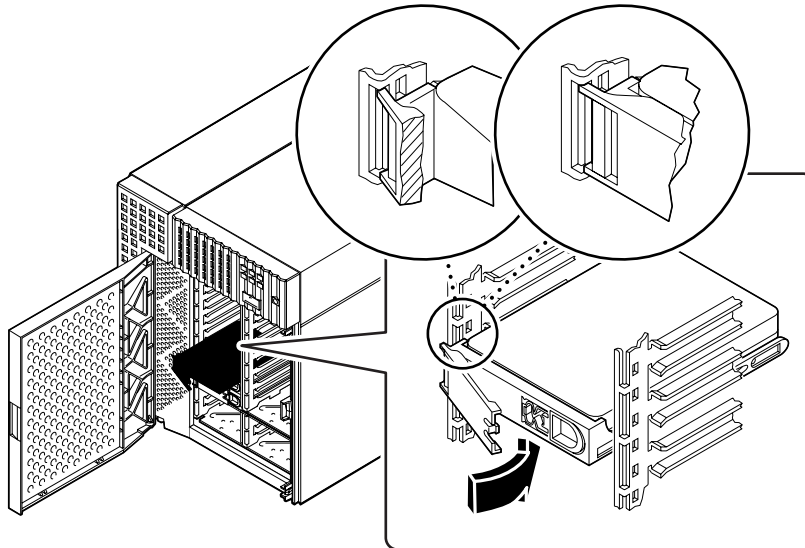
### 3. Fit the drive into the guide rails on each side of the drive bay.

### 4. Slide the disk drive into the drive bay until the handle contacts the disk cage.

**5. Swing the drive handle closed until it latches.**

Closing the handle engages the drive with its backplane connectors. If the system power is on, the green LED beside the disk slot will light to indicate that the drive is properly inserted.

Repeat steps 2 through 5 for any other drives that you want to replace.



**6. Close the bottom door, and lock it if necessary.**

Before closing the door, make sure that the keylock is turned counter-clockwise as far as it will go.

**7. To configure the system to use the new disk, see:**

- “About Internal Disk Drives” on page 63

## What Next

If you have other parts to replace, do so now. If you installed the disk as a new option, complete this task:

- “How to Initiate a Reconfiguration Boot” on page 30

---

# How to Remove a CD-ROM Drive or Tape Drive

## Before You Begin

Complete these tasks:

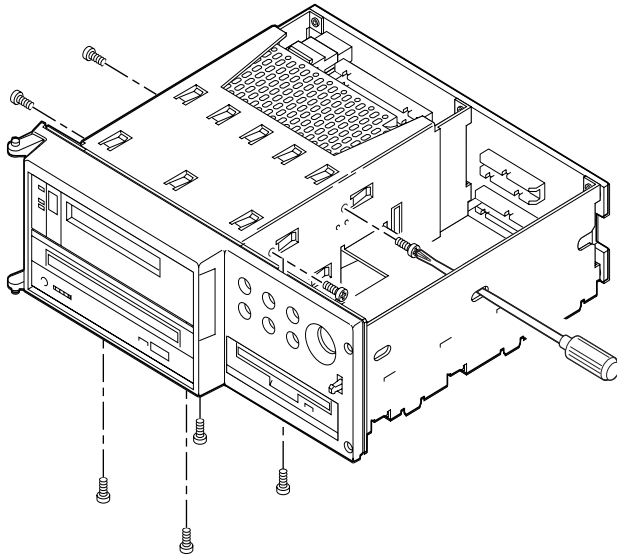
- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

## What to Do

### **1. Place the removable media assembly on a table.**

If you are removing a drive in the upper bay, position the assembly right side up; if you are removing a drive in the lower bay, position the assembly upside down.

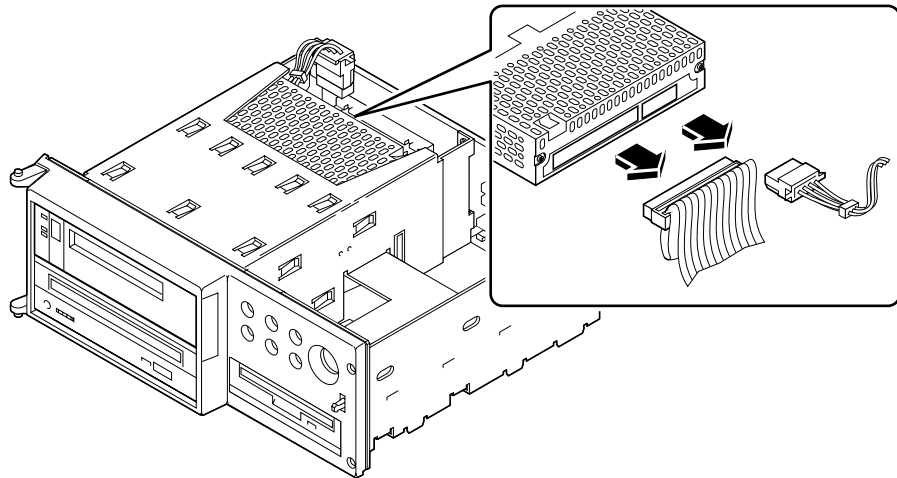
**2. Remove the four Phillips screws that secure the drive to its mounting bracket.**



- For drives in the upper bay, the screws are located on the sides of the drive. (To access the screws on the divider wall, insert a screwdriver through access holes in the right side of the removable media assembly.)
- For drives in the lower bay, the screws are located beneath the drive.
- Full-height devices may use either mounting scheme.

**3. Disconnect the SCSI drive data cable from the back of the drive.**

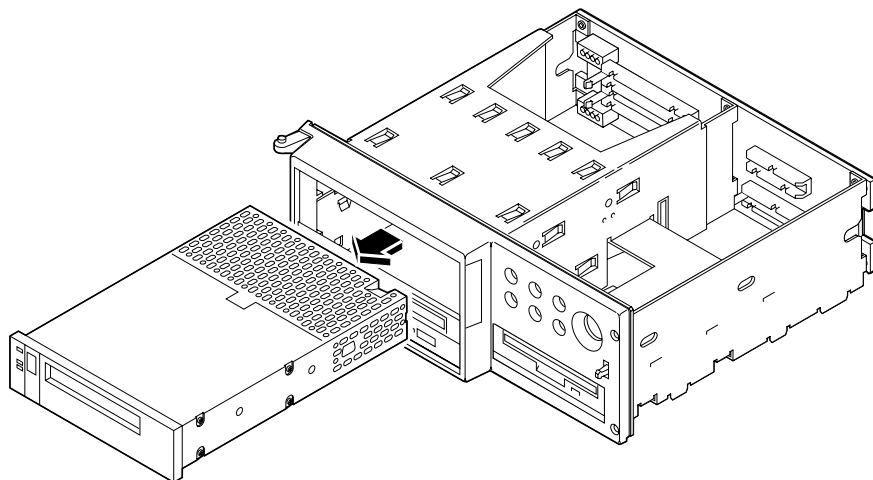
Pull on the plastic pull tab attached to the ribbon cable to disconnect it.



**4. Disconnect the SCSI drive power cable from the rear of the drive.**

**5. Push on the rear of the drive and, holding the drive's face plate, slide the drive out of the bay.**

Place the drive on an antistatic mat.



## What Next

To replace the drive, complete this task:

- “How to Install a CD-ROM Drive or Tape Drive” on page 205



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# How to Install a CD-ROM Drive or Tape Drive

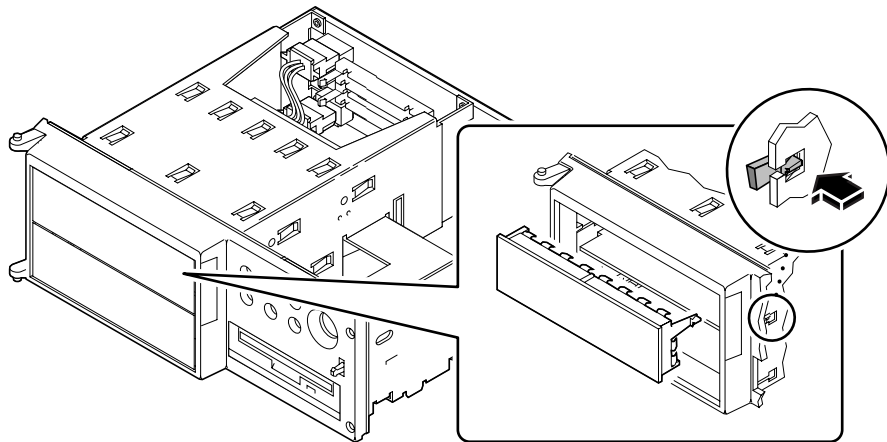
## Before You Begin

Complete these tasks:

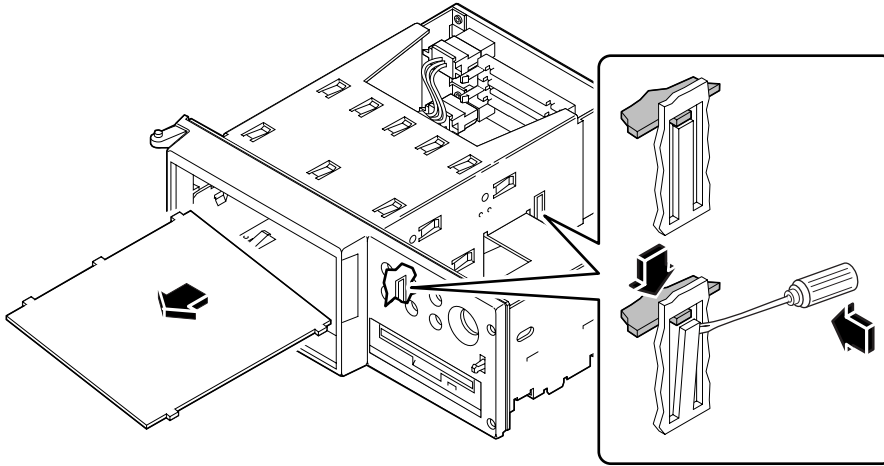
- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

## What to Do

1. **Remove the filler panel from the drive bay, if necessary:**
  - a. **Locate the small filler panel tab on the outside of the removable media assembly.**
  - b. **Press the tab inward to release it.**



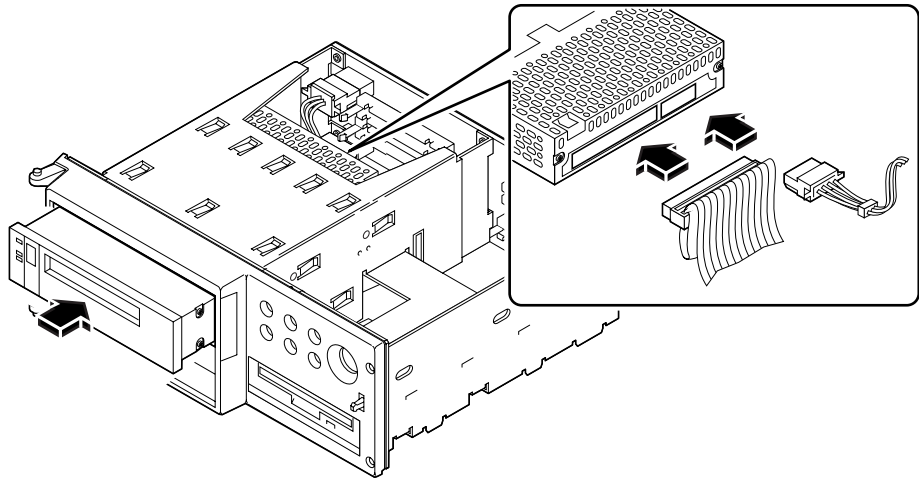
- c. Remove the filler panel and save it for possible future use.
2. *If you are installing a full-height drive, remove the divider that separates the upper and lower drive bays in the removable media assembly:*
  - a. Use a flat-blade screwdriver to flex the tabs that hold the divider in place.



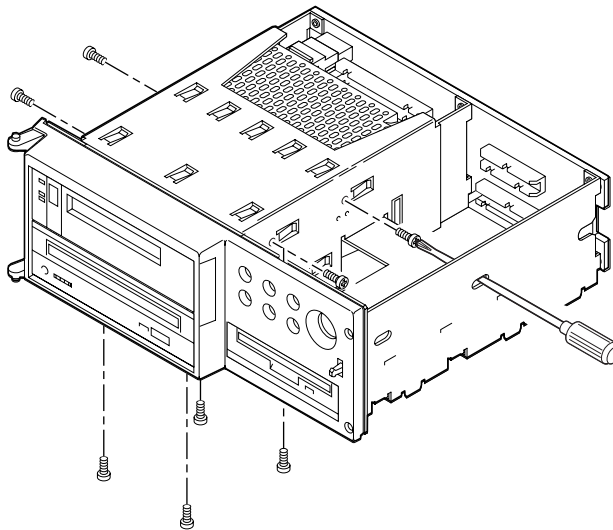
- b. Remove the divider from the removable media assembly.
  - c. *If there is a half-height drive installed in the lower bay, remove the drive to make room for the full-height drive.*  
See "How to Remove a CD-ROM Drive or Tape Drive" on page 201.
3. *If you have removed a full-height drive and are installing one or more half-height drives, you must replace the divider.*
  - a. Insert the divider at an angle into the bay, and align the three tabs on the divider with the three slots on the left side of the assembly.
  - b. Raise the right side of the divider until the tabs snap into the slots in the center divider.
4. Slide the drive part way into its bay in the removable media assembly.

**5. Connect the SCSI data cable and power cable to the rear of the drive.**

Move the drive in the bay, if necessary, to allow access to the cable connectors.



**6. Fasten the four Phillips screws that secure the drive to its mounting bracket.**



- For drives in the upper bay, the screws are located on the sides of the drive. (To access the screws on the divider wall, insert a screwdriver through access holes in the right side of the removable media assembly.)
- For drives in the lower bay, the screws are located beneath the drive.
- Full-height devices may use either mounting scheme.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

If you installed the drive as a new option, complete this task:

- “How to Initiate a Reconfiguration Boot” on page 30

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# How to Remove the Diskette Drive



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

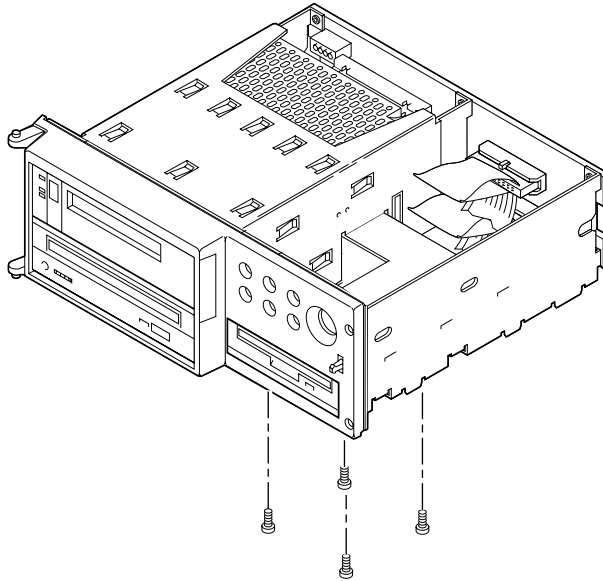
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

# What to Do

- 1. Remove the four Phillips screws that secure the diskette drive to the removable media assembly.**

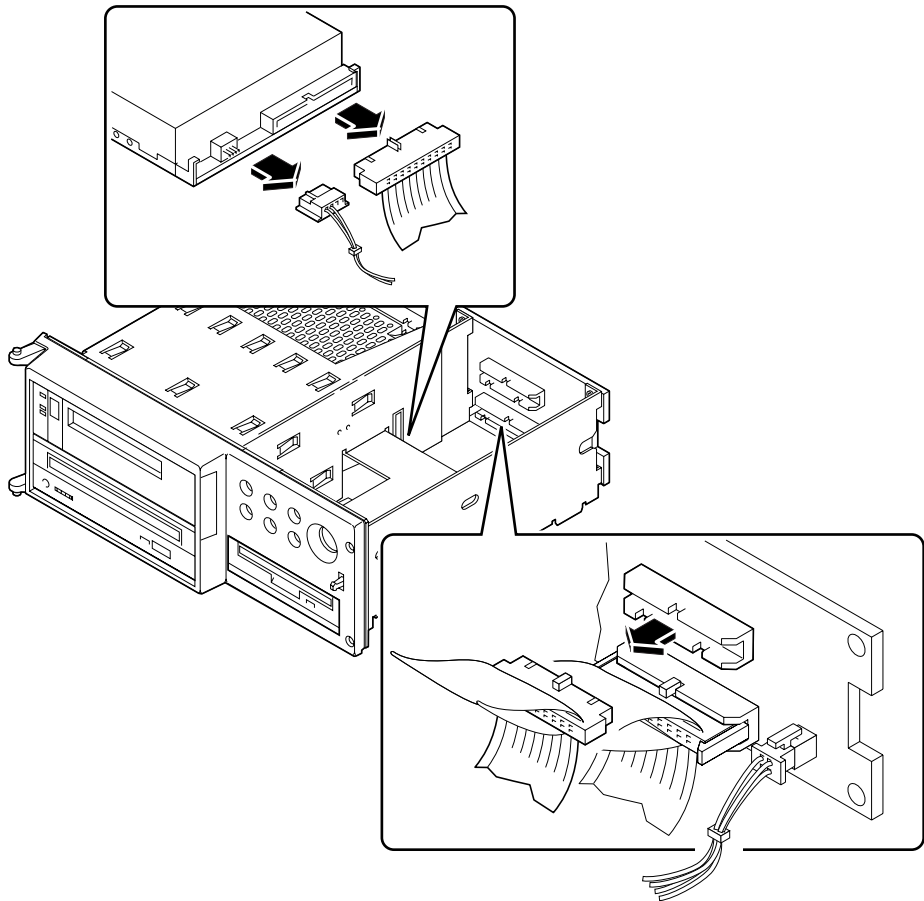
Turn the removable media assembly upside down to access the screws.



- 2. Disconnect the LED interface cable from the removable media backplane at connector J0104.**

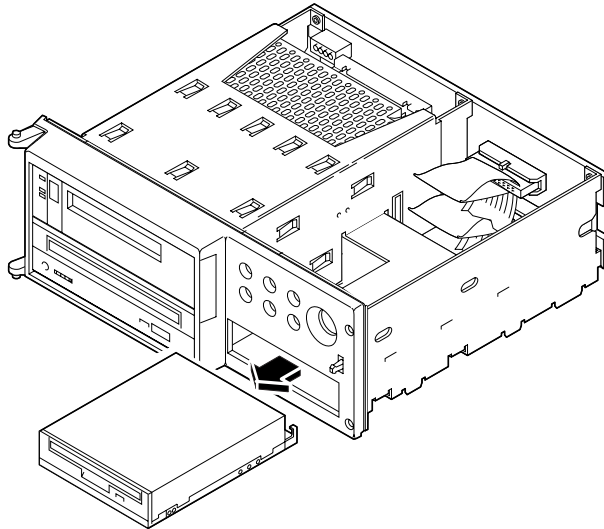
Turn the removable media assembly right side up to disconnect the cable.

3. Disconnect the diskette data cable and the diskette power cable from the rear of the diskette drive.



4. Slide the diskette drive all the way out of the assembly, and place it on an antistatic mat.

Push the drive with one hand and use the other hand to pull the drive out of the assembly.



## What Next

To replace the diskette drive, complete this task:

- “How to Install the Diskette Drive” on page 213



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# How to Install the Diskette Drive



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

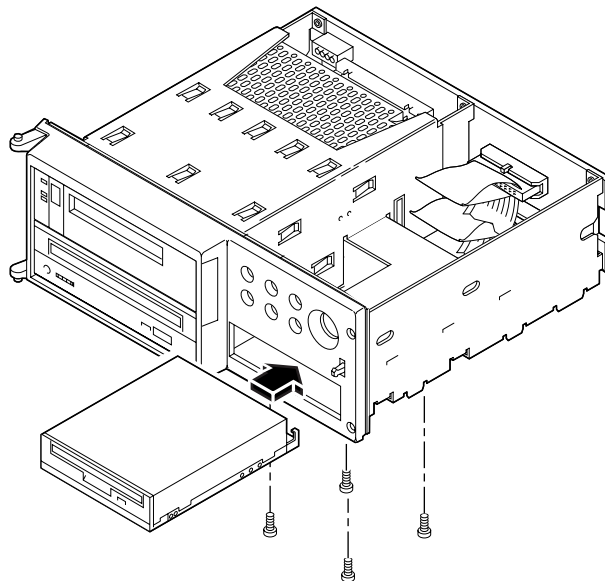
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## What to Do

**1. Insert the diskette drive into the removable media assembly.**

Place the removable media assembly on a table upside down. Carefully insert the diskette drive into the drive bay, making sure to align all four screw holes.

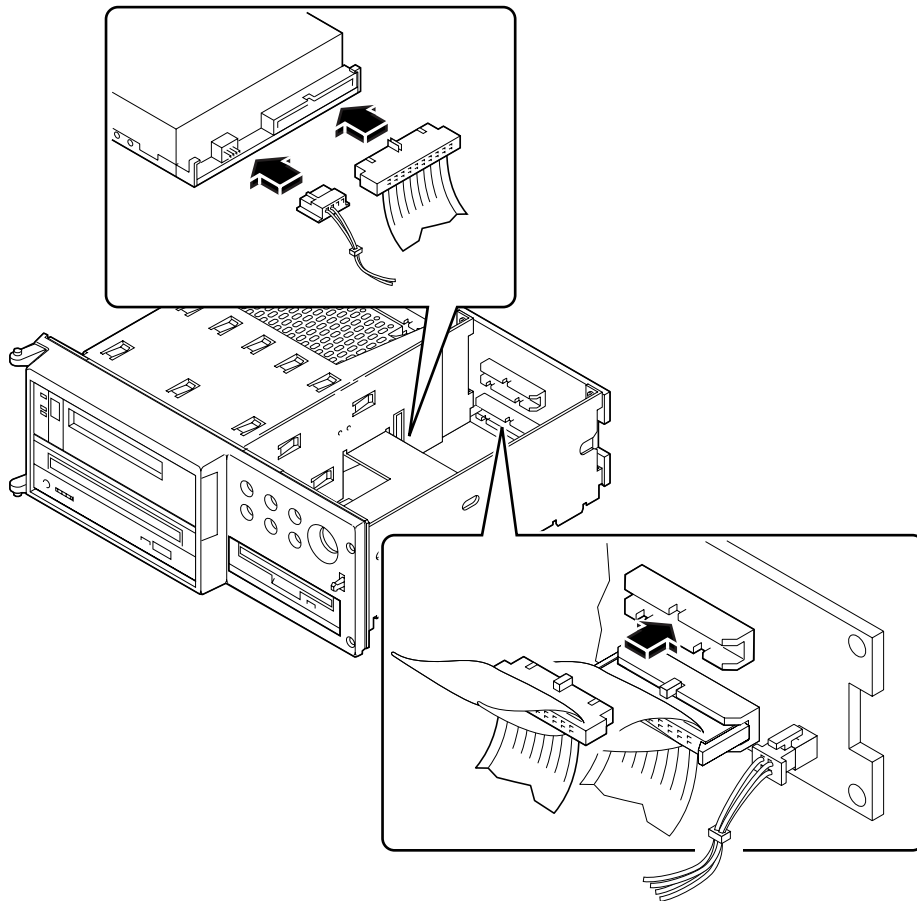
**2. Secure the diskette drive to the bottom of the removable media assembly with the four Phillips screws.**



**3. Connect the diskette data cable and the diskette power cable to the back of the diskette drive.**

Turn the removable media assembly right side up to connect the cables.

**4. Connect the LED interface cable to the removable media backplane at connector J0104.**



## What Next

Complete the following tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# Miscellaneous Assemblies

This section describes how to remove and install miscellaneous assemblies. For a list of part numbers, see “Illustrated Parts Breakdown” on page 456.

Tasks covered in this section include:

- *How to Remove the Removable Media Assembly—page 216*
- *How to Install the Removable Media Assembly—page 220*
- *How to Remove the Disk Fan Tray Assembly—page 223*
- *How to Install the Disk Fan Tray Assembly—page 225*
- *How to Remove the CPU Fan Tray Assembly—page 227*
- *How to Install the CPU Fan Tray Assembly—page 229*
- *How to Remove the Upper Blower Assembly—page 231*
- *How to Install the Upper Blower Assembly—page 234*
- *How to Remove a Power Supply—page 237*
- *How to Install a Power Supply—page 239*
- *How to Remove the AC Line Filter Assembly—page 241*
- *How to Install the AC Line Filter Assembly—page 245*
- *How to Remove the Speaker Assembly—page 248*
- *How to Install the Speaker Assembly—page 250*
- *How to Remove the LED Interface Board—page 252*
- *How to Install the LED Interface Board—page 255*
- *How to Remove a Rear Panel Insert—page 257*
- *How to Install a Rear Panel Insert—page 260*

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# How to Remove the Removable Media Assembly



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

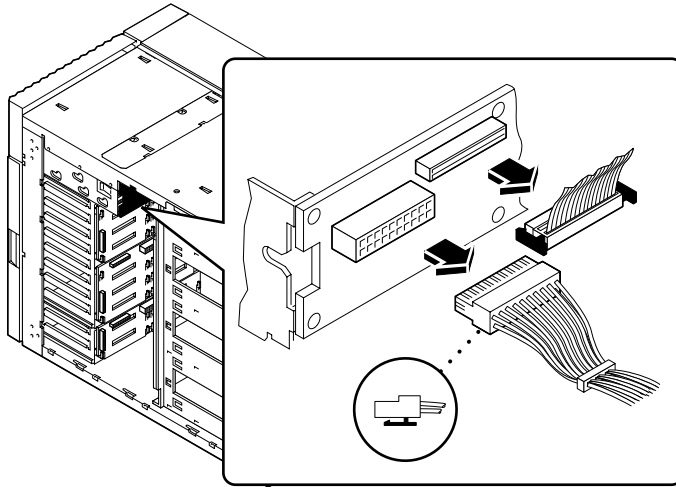
- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

You may also want to disconnect any UltraSCSI data and power cables that limit access to the removable media backplane. See the respective procedures for each type of cable.

# What to Do

## 1. Disconnect the power cable from the removable media backplane.

Press the tab underneath the power cable connector to release the cable from connector J0101.

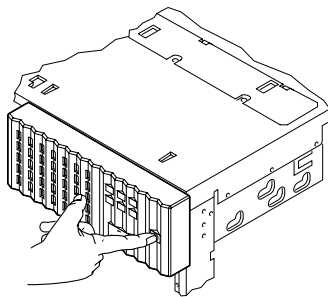


## 2. Disconnect the data cable from the removable media backplane.

Press the tabs on both sides of the data cable connector to release the cable from connector J0103.

## 3. Open the top door on the front of the system.

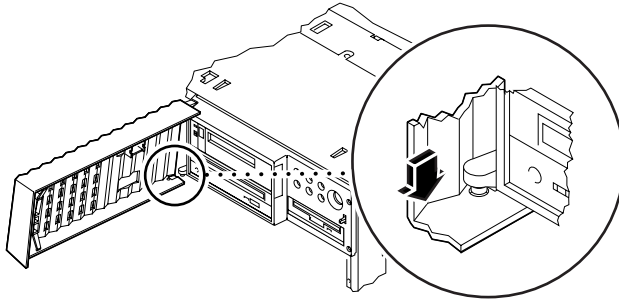
The top door covers the removable media assembly. Press the button on the right side of the door to open it.



#### 4. Remove the top door.

The door is hinged on the left side.

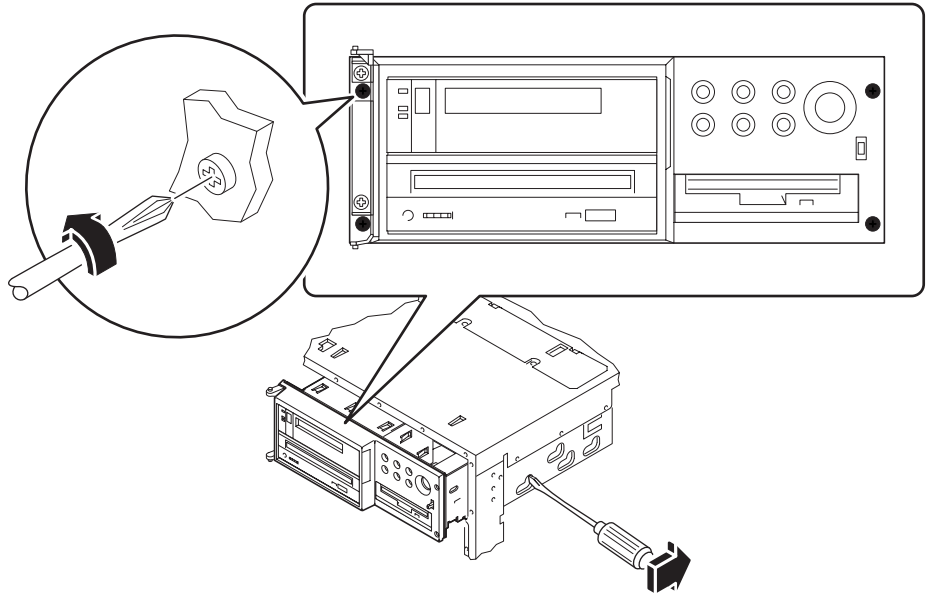
- a. Press down on the door's bottom flange to release the lower hinge post.
- b. Carefully pull the bottom corner of the door away from the chassis so that the hinge post slides through the channel in the flange.
- c. When the hinge post clears the channel, lift the door top off of the upper hinge post and remove it from the system.



#### 5. Loosen the four Phillips screws that secure the removable media assembly to the chassis.

6. Push firmly on the rear of the assembly to disengage it from the chassis, then pull the assembly all the way out of the chassis.

If necessary, use a screwdriver, as shown below, to pry the assembly out of the system.



## What Next

If you removed the removable media assembly to access another subassembly, perform the appropriate procedure now.

To replace the removable media assembly, complete this task:

- “How to Install the Removable Media Assembly” on page 220

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# How to Install the Removable Media Assembly



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

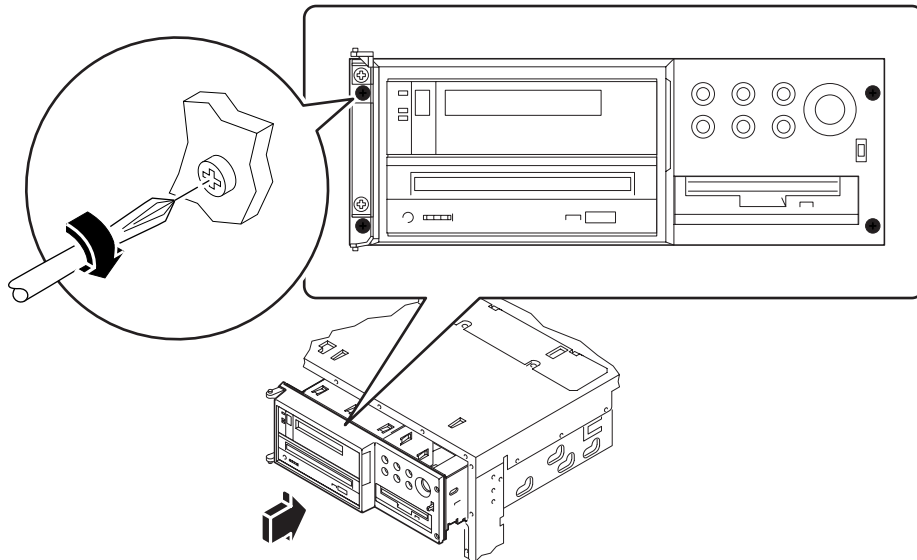
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## What to Do

1. **Carefully slide the removable media assembly most of the way into the chassis. Push the assembly the rest of the way until it is flush against the front of the chassis.**

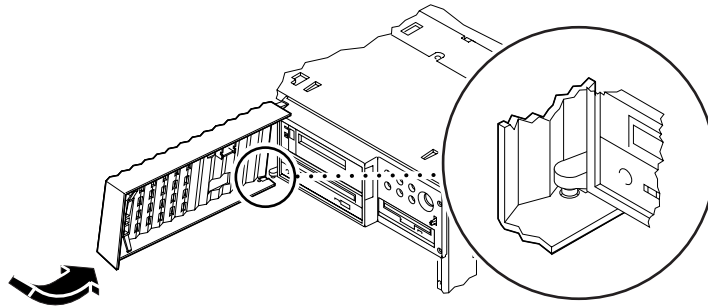
You may need to wiggle the assembly to slide it evenly into the system.

2. **Tighten the four Phillips screws that secure the removable media assembly to the chassis.**

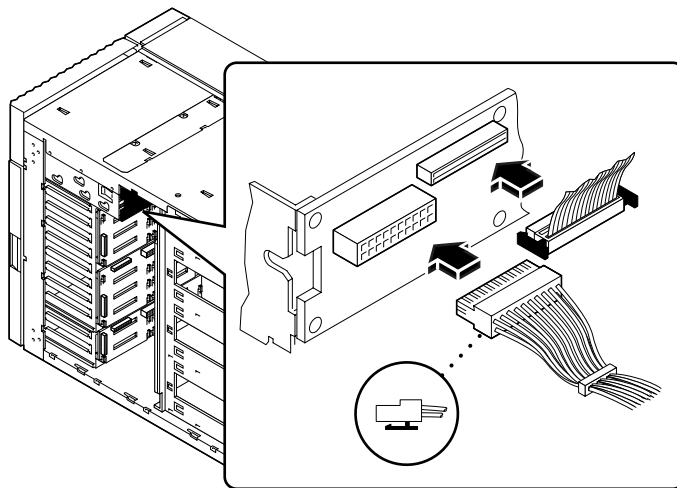




3. **Replace the door on the front of the system.**
  - a. **Slide the top of the door onto the upper hinge post.**
  - b. **Press down on the door's lower flange to insert the lower hinge post into the channel on the bottom flange.**
  - c. **Move the door so that the post slides through the channel and snaps into place.**
  - d. **Close the top door on the front of the system.**



4. **Connect the removable media SCSI cable to the removable media backplane at connector J0103.**
5. **Connect the removable media power cable to the removable media backplane at connector J0101.**



## What Next

Reconnect any cables that you removed for easier access to the removable media backplane.

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

---

# How to Remove the Disk Fan Tray Assembly

## Before You Begin

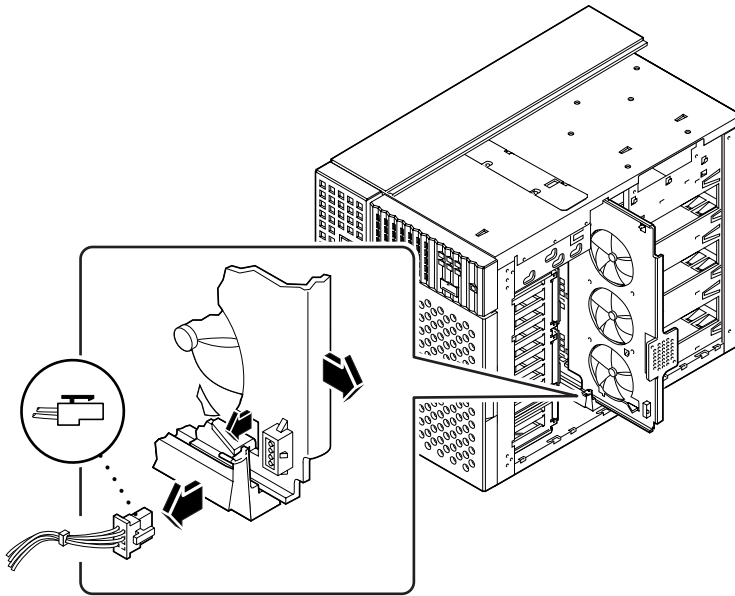
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32

## What to Do

- 1. Disconnect the disk fan tray/interlock cable from the disk fan tray assembly.**  
Press the tab on top of the connector to release the cable.
- 2. Slide any cables out of the clip attached to the disk fan tray assembly.**

3. Deflect the tab that secures the tray in the guide at the bottom of the chassis, and slide the tray out of the system.



## What Next

If you removed the disk fan tray assembly to access another subassembly, perform the appropriate procedure now.

To replace the disk fan tray assembly, complete this task:

- “How to Install the Disk Fan Tray Assembly” on page 225

---

# How to Install the Disk Fan Tray Assembly

## What to Do

1. **Align the top edge of the disk fan tray assembly in the upper guide, and the bottom edge in the lower guide on the bottom of the chassis.**

It is easier to insert the disk fan tray when you insert the upper edge of the fan tray first.

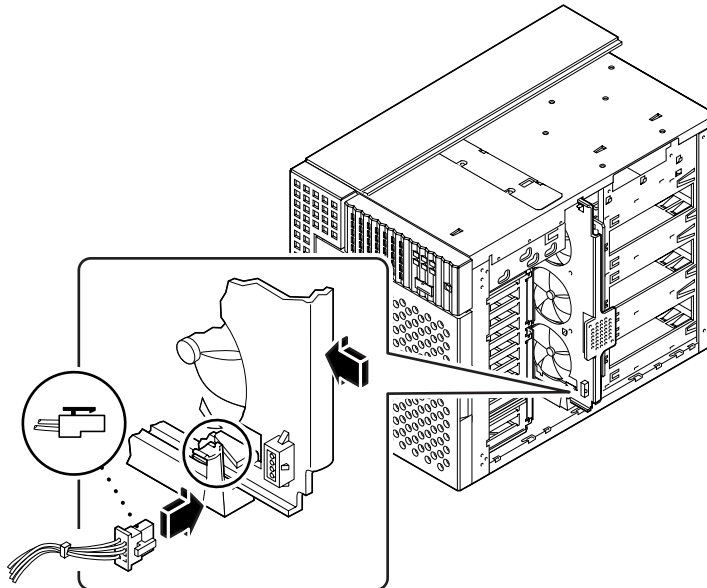
2. **Be sure that data cables are out of the way and slide the disk fan tray assembly into the chassis.**

The tab on the lower fan tray guide locks the assembly in place.

3. **Slide any 8-slot UltraSCSI data cables into the clip attached to the disk fan tray assembly.**

4. **Connect the disk fan tray/interlock cable to the disk fan tray assembly.**

Make sure that the tab on the back of the connector locks in place.



## What Next

Complete this task to reassemble the system:

- “How to Install the Right Side Panel” on page 34

---

# How to Remove the CPU Fan Tray Assembly

## Before You Begin

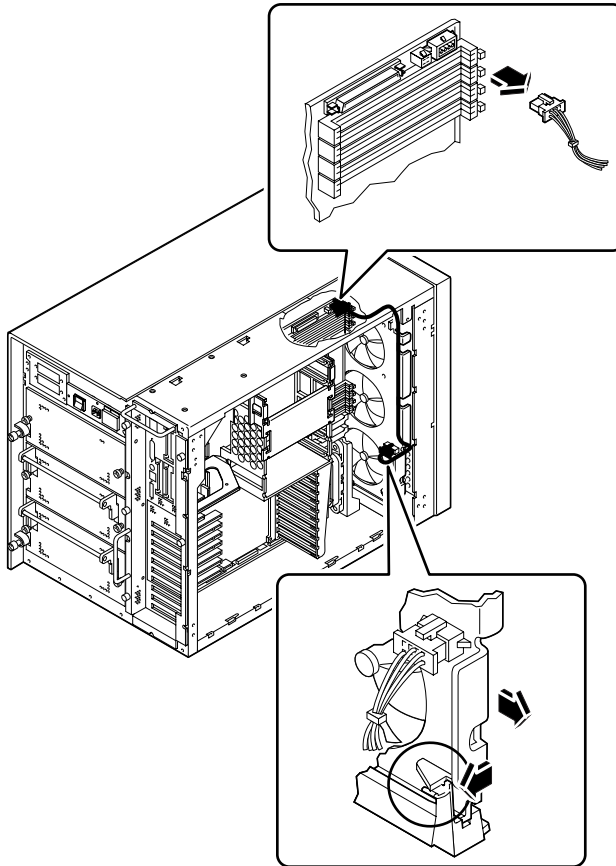
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36

## What to Do

1. **Disconnect the CPU fan tray cable from the main logic board at connector J4704.**  
Press the tab on the connector to release the cable.

2. Deflect the tab that secures the CPU fan tray in the guide on the bottom of the chassis, and slide the tray out of the chassis.



## What Next

To replace the CPU fan tray assembly, complete this task:

- “How to Install the CPU Fan Tray Assembly” on page 229



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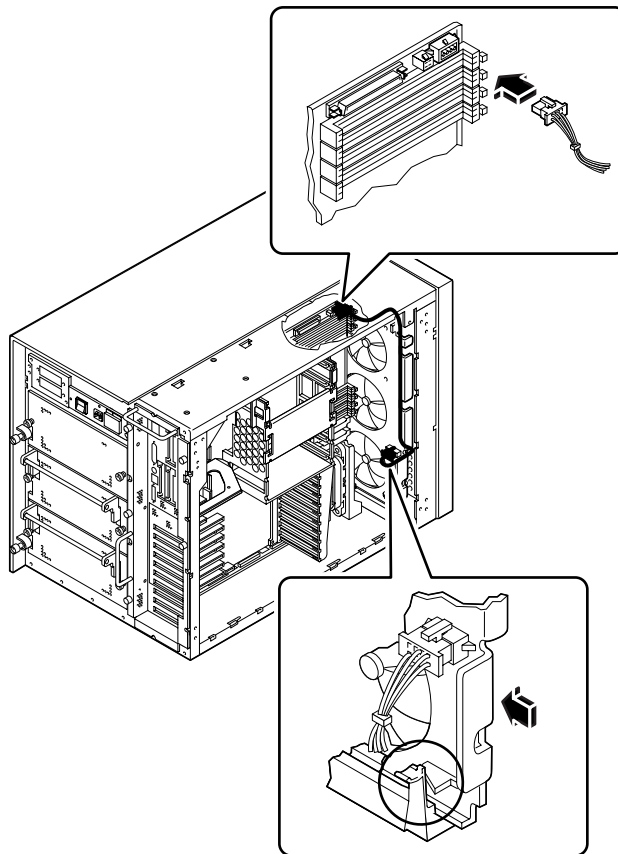
# How to Install the CPU Fan Tray Assembly

## What to Do

**1. Slide the CPU fan tray into the chassis.**

Align the CPU fan tray in the fan tray guides at the top and bottom of the chassis. Slide in the CPU fan tray until it locks into place.

**2. Connect the CPU fan tray cable to the main logic board at connector J4704.**



## What Next

Complete the following task to reassemble the system:

- “How to Install the Left Side Panel” on page 38

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# How to Remove the Upper Blower Assembly



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

---

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

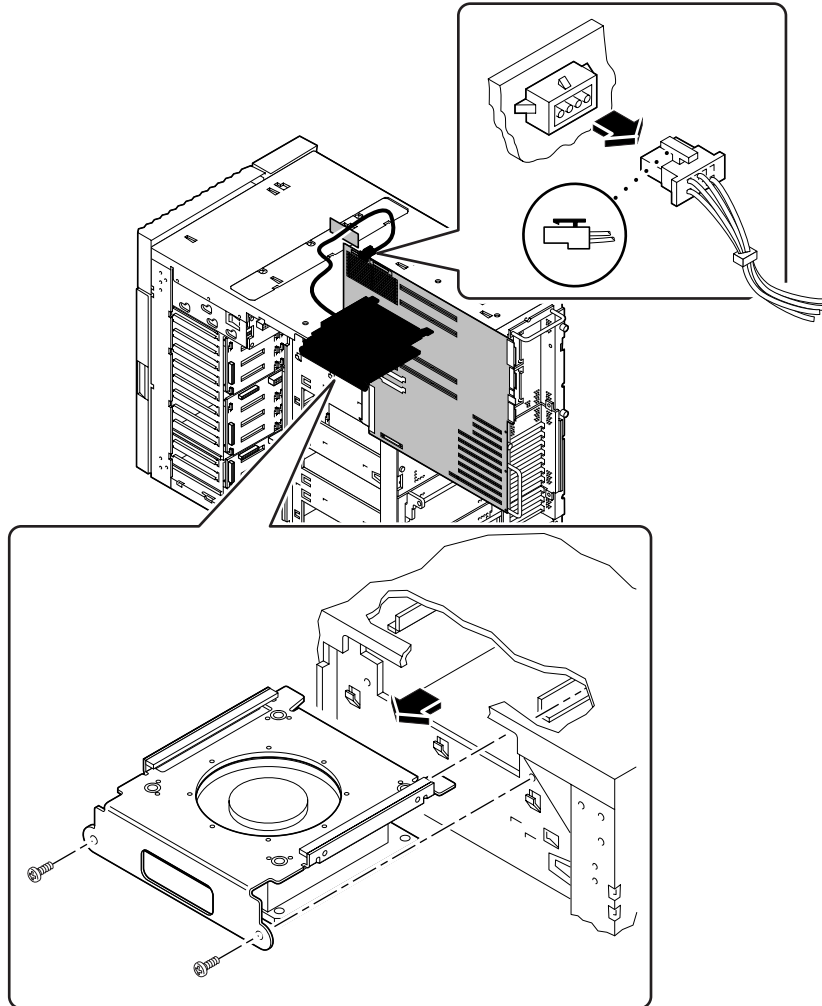
If a CPU module is installed in the upper slot, complete this task to remove it:

- “How to Remove a CPU Module” on page 139

# What to Do

1. On the left side of the system, disconnect the upper blower power cable from the top of the main logic board at connector J4705.

Press the tab on the top of the connector as you pull out the cable.



2. On the right side of the system, remove the two Phillips screws that secure the upper blower assembly to the chassis.

**3. Pull the upper blower assembly out of the chassis and set it aside.**

Carefully feed the upper blower power cable through the opening at the top of the center divider as you remove the assembly.

## What Next

To replace the upper blower assembly, complete this task:

- “How to Install the Upper Blower Assembly” on page 234

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# How to Install the Upper Blower Assembly



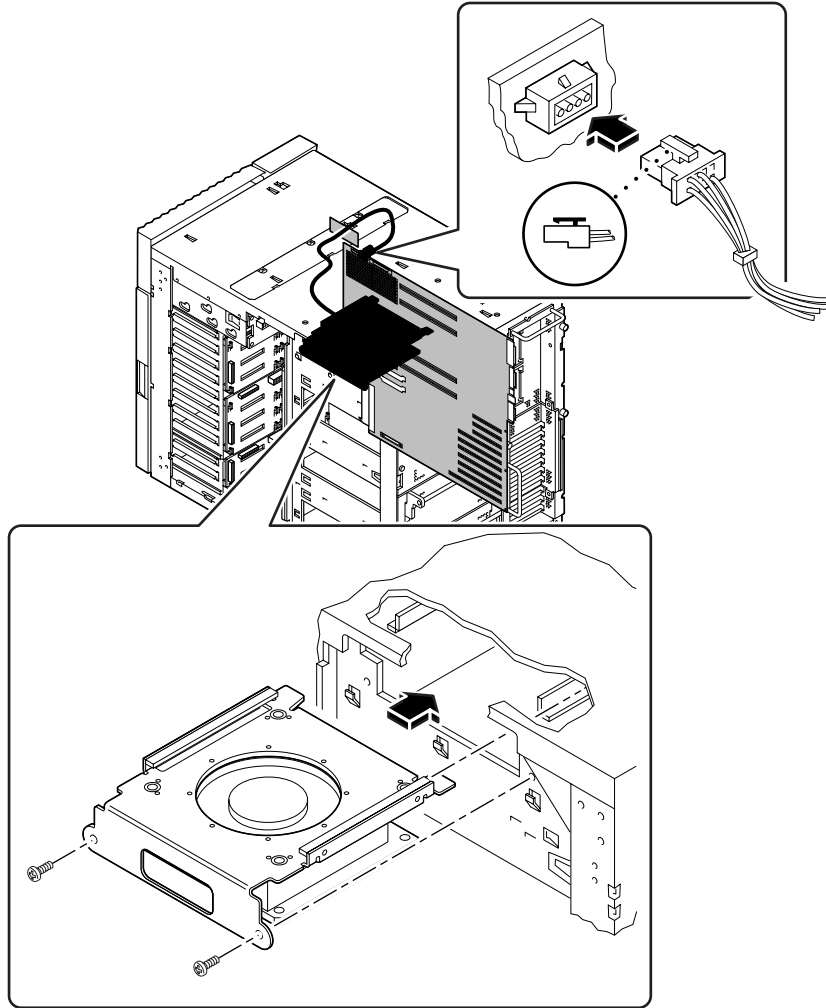
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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

1. **From the right side of the system, feed the upper blower power cable through the opening at the top of the center divider.**



- 2. Slide the upper blower assembly on to the rails in the upper blower plenum so that the two holes on the assembly line up with the two holes in the chassis.**
- 3. Attach the upper blower assembly to the chassis using the two Phillips screws.**
- 4. Connect the upper blower power cable to the top of the main logic board at connector J4705.**

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Left Side Panel” on page 38
- “How to Install the Right Side Panel” on page 34

If you removed a CPU module from the upper slot, complete this task to replace it:

- “How to Install a CPU Module” on page 141



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# How to Remove a Power Supply

## Before You Begin

It is not necessary to power off the system if you are removing a redundant power supply. For more information, see:

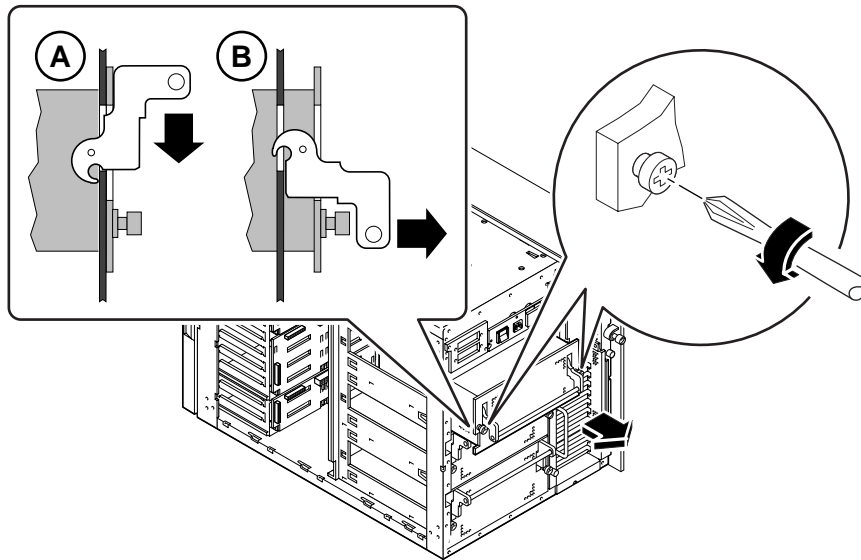
- “About Power Supplies” on page 66

If your system does not have a redundant power supply, complete this task:

- “How to Power Off the System” on page 26

## What to Do

1. Loosen the two large captive screws that secure the power supply to the chassis rear panel.



2. Push the power supply handle down to disengage the power supply from its connector.

**3. Slide the power supply out of the power supply bay.**



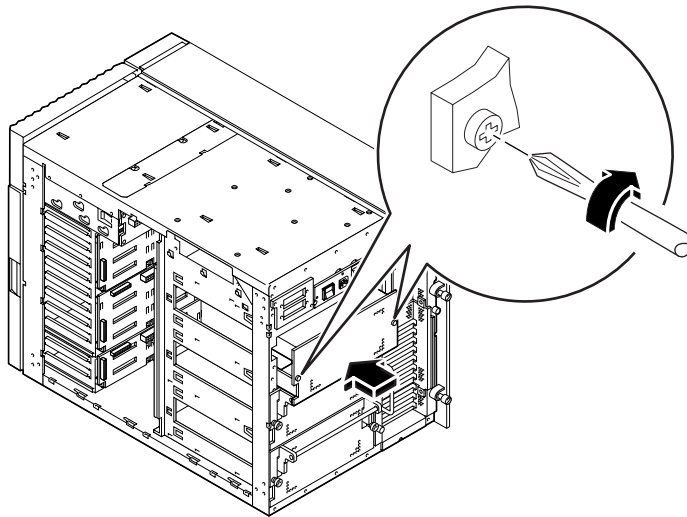
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**Caution** – The power supply is heavy, so take care when removing it from the chassis.

---

**4. If you are not replacing the power supply immediately, install a power supply filler panel:**

- a. Insert the filler panel into the bay.
- b. Fasten the two Phillips screws that secure the filler panel to the power supply bay.



## What Next

To replace the power supply, complete this task:

- “How to Install a Power Supply” on page 239

---

# How to Install a Power Supply

## Before You Begin

It is not necessary to power off the system if you are installing a redundant power supply. For more information, see:

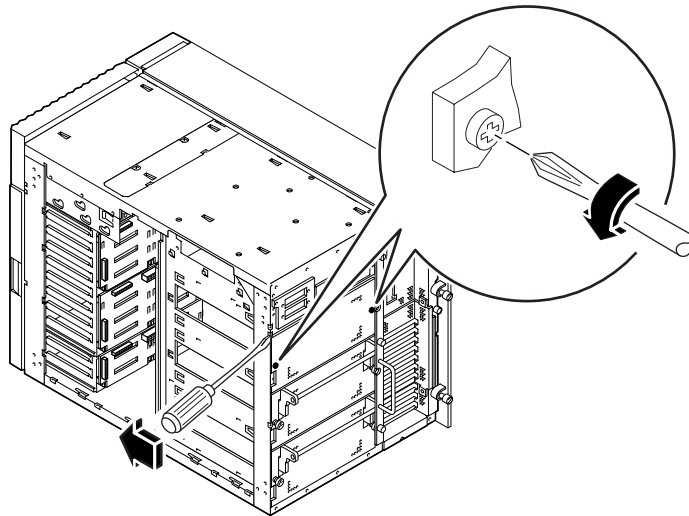
- “About Power Supplies” on page 66

If you are installing a non-redundant power supply, complete this task:

- “How to Power Off the System” on page 26

## What to Do

1. *If you are upgrading your system with an additional power supply, remove the filler panel from the desired power supply bay:*
  - a. **Remove the two Phillips screws that secure the filler panel to the power supply bay.**



- b. **Partially pry the filler panel out of the bay, using the small slot at the upper left.**

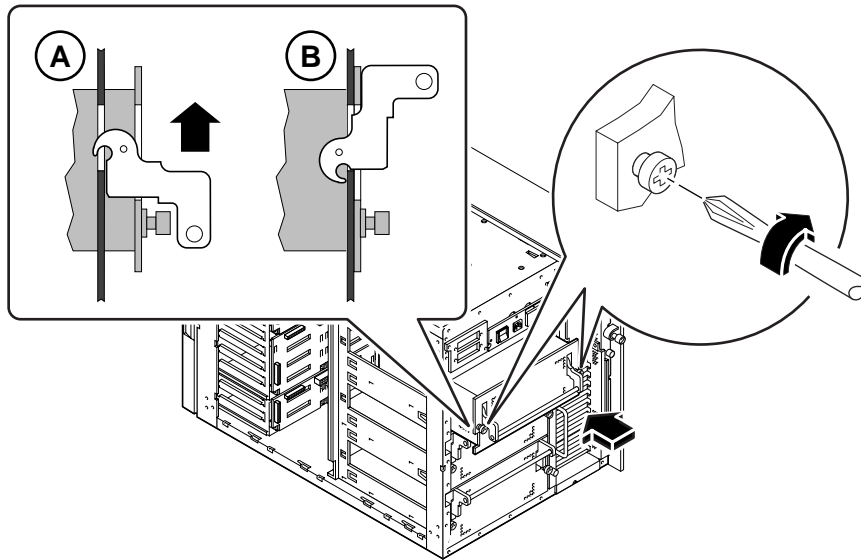
Use a flat-blade screwdriver. The filler panel is like a box, and extends into the bay.

- c. **Pull the filler panel the rest of the way out of the bay.**

2. **Keeping the handle in the down position, slide the new power supply almost all the way into the power supply bay, until the hooks on the end of the handle reach the back of the chassis.**

3. **Lift up the power supply handle to move the power supply the rest of the way into the bay.**

This also engages the power supply with its connector.



4. **Tighten the two large captive screws that secure the power supply to the chassis rear panel.**

---

# How to Remove the AC Line Filter Assembly



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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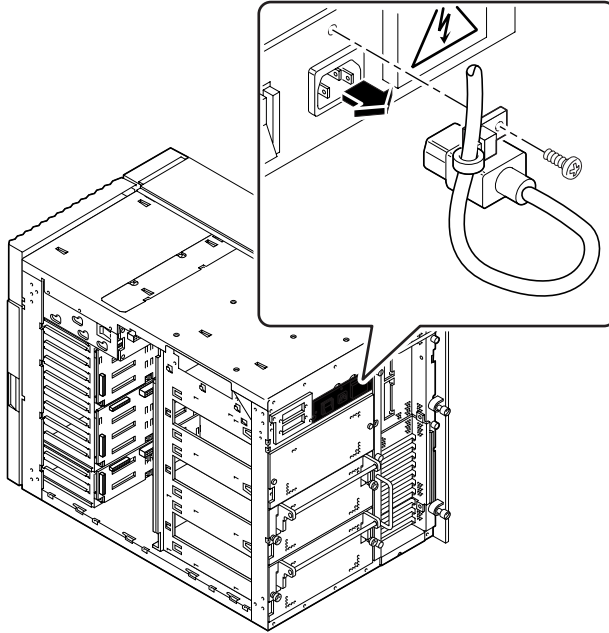
## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

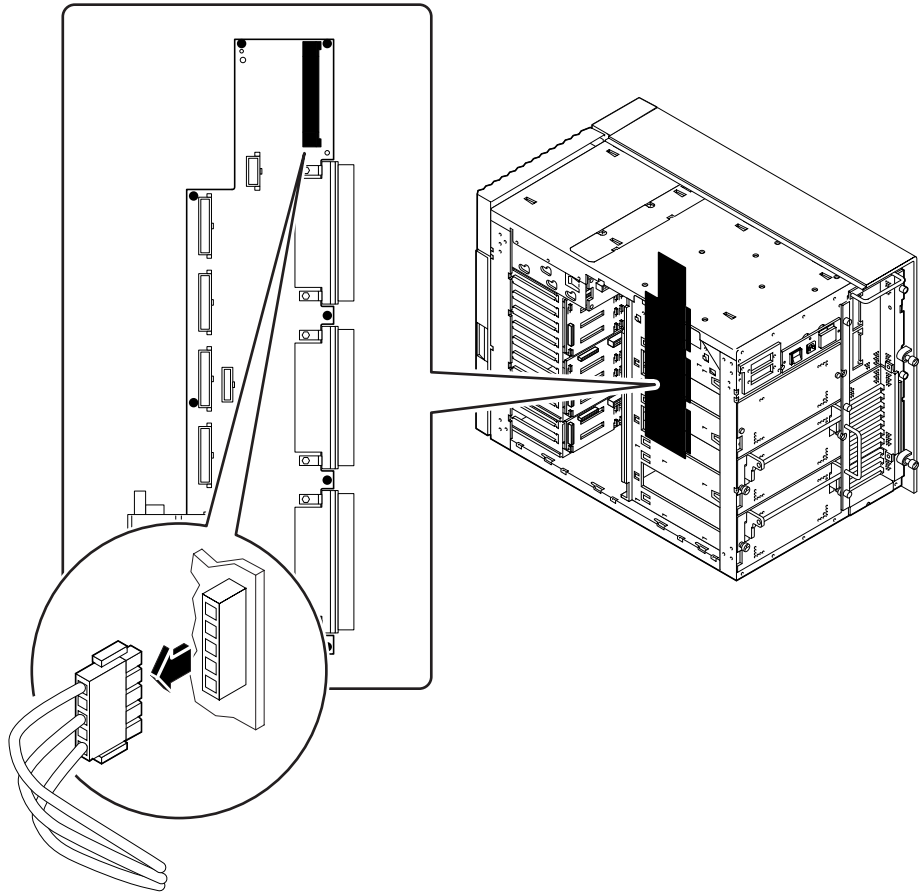
# What to Do

1. Remove the screw holding the tie-wrap that secures the AC power cord to the system, then disconnect the AC power cord from the system.

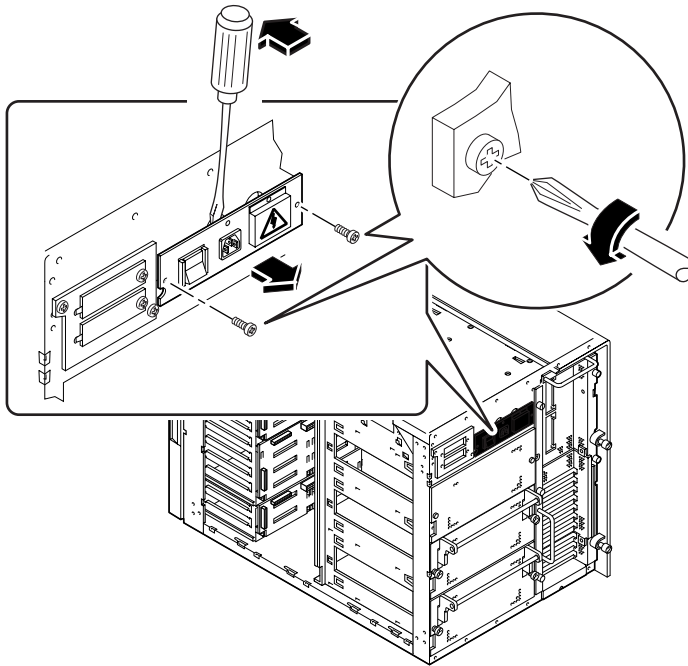


**2. Disconnect the AC line filter cable from the top of the power distribution board at connector J0308.**

Press the tabs on each side of the connector to release it.



3. Remove the two Phillips screws that secure the AC line filter assembly to the rear panel.



4. Pry the assembly part way out of the chassis using a flat-blade screwdriver.
5. Pull the assembly the rest of the way out of the chassis.  
Place the assembly on an antistatic mat.

## What Next

To replace the assembly, complete this task:

- “How to Install the AC Line Filter Assembly” on page 245



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# How to Install the AC Line Filter Assembly



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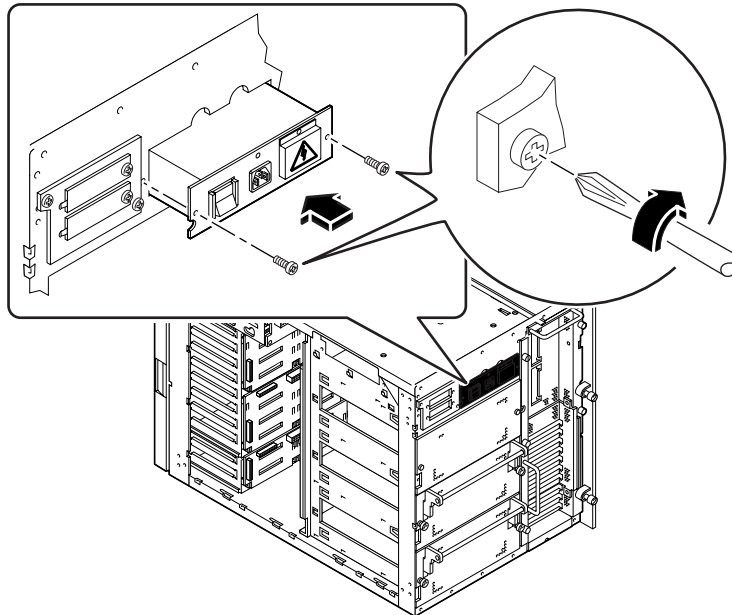
**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

1. **Slide the AC line filter assembly into the chassis, cable first.**

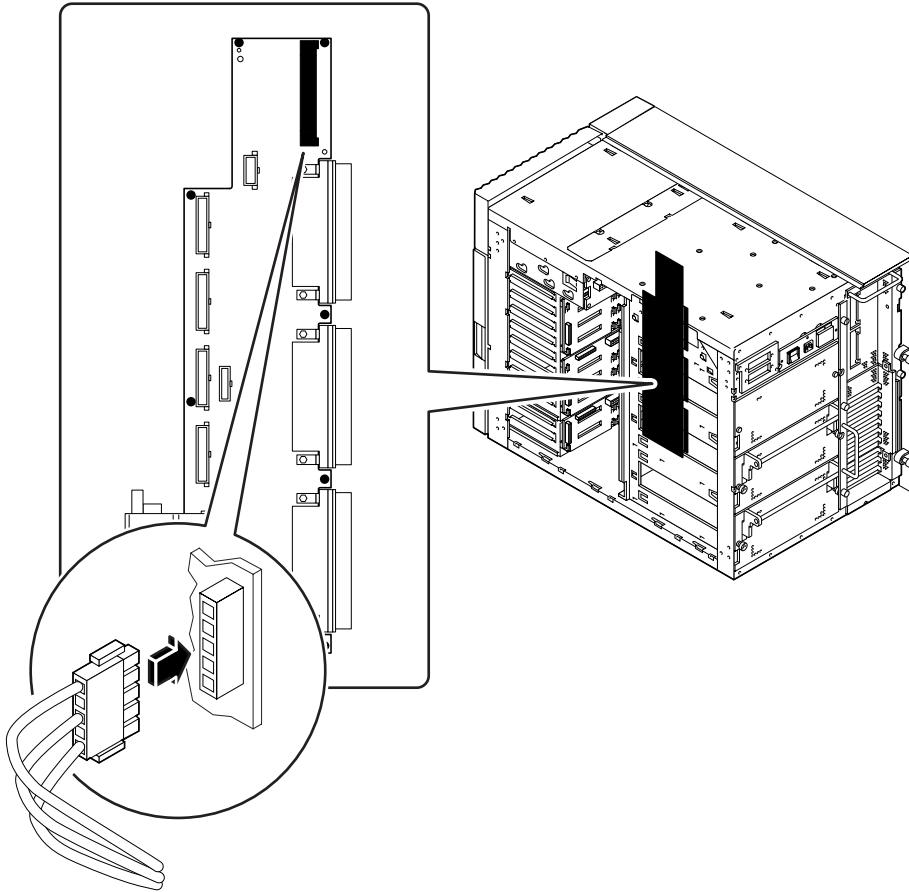
Position the assembly so that the label is on top.



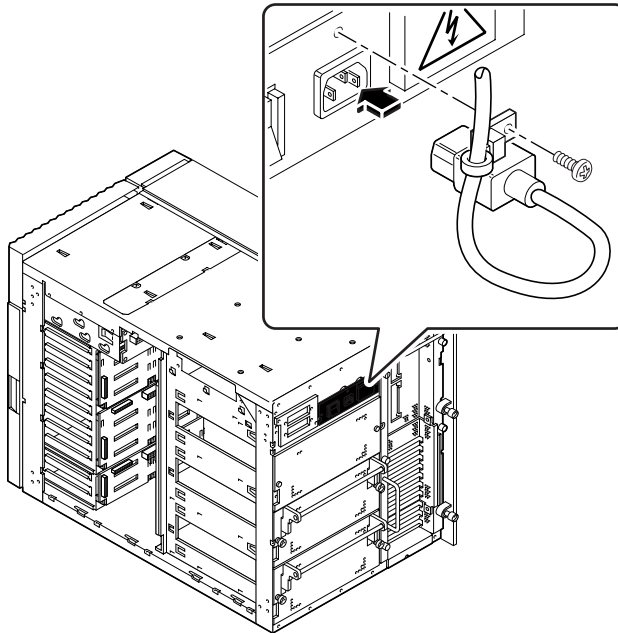
2. **Fasten the two Phillips screws that secure the AC line filter assembly to the rear panel.**

**3. Connect the AC line filter cable to the top of the power distribution board at connector J0308.**

Make sure that the tabs on the connector snap into place.



**4. Connect the AC power cord to the system.**



**5. Replace the screw that secures the power cord tie-wrap to the chassis.**

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the Speaker Assembly



---

**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

---

## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

## What to Do



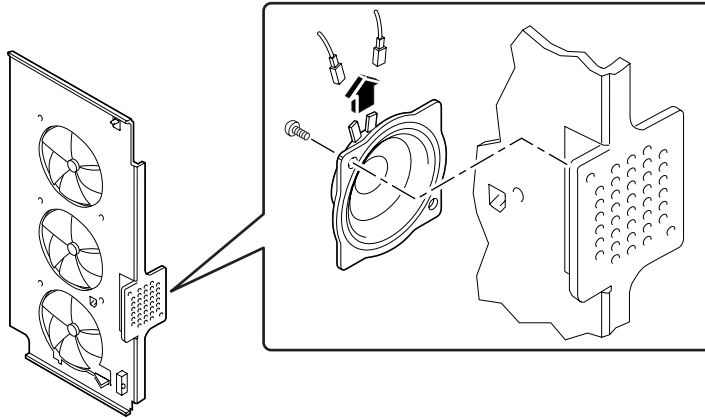
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**Caution** – Be careful when working near or handling the speaker assembly to avoid damaging the speaker surface. Do not touch the diaphragm with tools or your fingers. Grasp the speaker assembly by the metal edges only.

---

**1. Disconnect the two speaker lead connectors.**

Slide the spade connectors off the speaker lugs. If they are tightly connected, you may need to use a screwdriver or small pliers.



**2. Remove the two screws that secure the speaker assembly to the disk fan tray assembly.**

Use a small Phillips screwdriver.

**3. Remove the speaker assembly.**

## What Next

To replace the speaker, complete this task:

- “How to Install the Speaker Assembly” on page 250

---

# How to Install the Speaker Assembly



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do



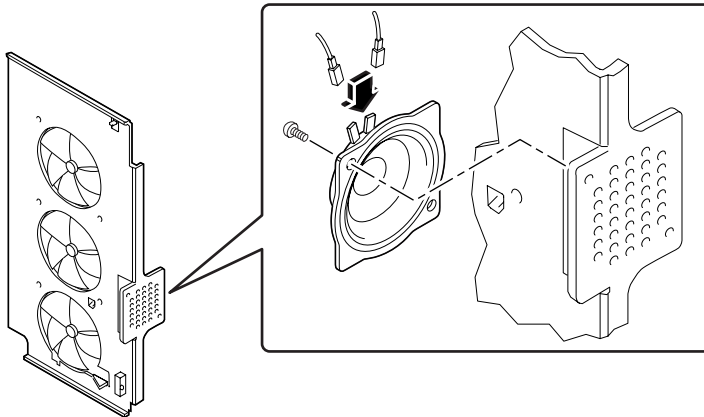
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**Caution** – Be careful when working near or handling the speaker assembly to avoid damaging the speaker surface. Do not touch the diaphragm with tools or your fingers. Grasp the speaker assembly by the metal edges only.

---

1. **Align the rounded notches on the speaker assembly with the mounting holes on the disk fan tray assembly.**
2. **Fasten the two screws that secure the speaker assembly to the disk fan tray assembly.**

Use a small Phillips screwdriver.



3. **Attach the two speaker lead connectors to the speaker assembly.**  
Slide the spade connectors onto the speaker lugs.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the LED Interface Board



---

**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

---

## Before You Begin

Complete these tasks:

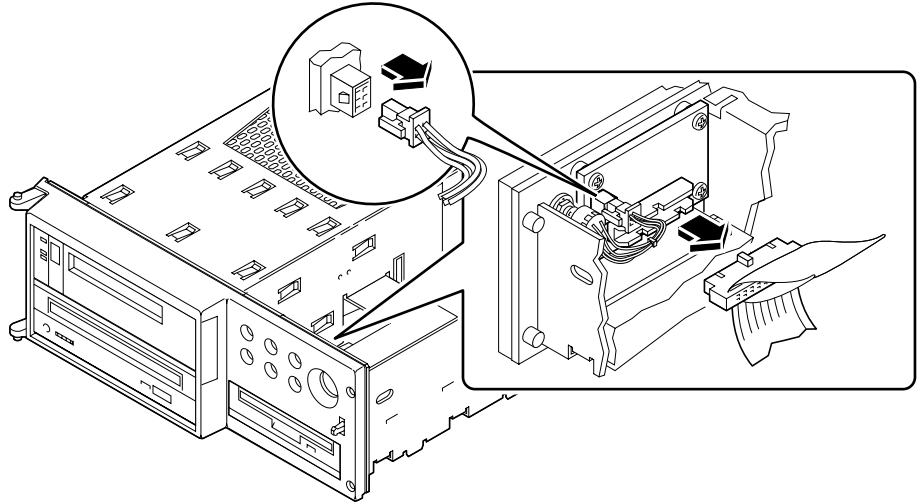
- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216



# What to Do

- 1. Disconnect the LED interface cable from the LED interface board at connector J0100.**

Pull on the white plastic pull tab to disconnect the cable.

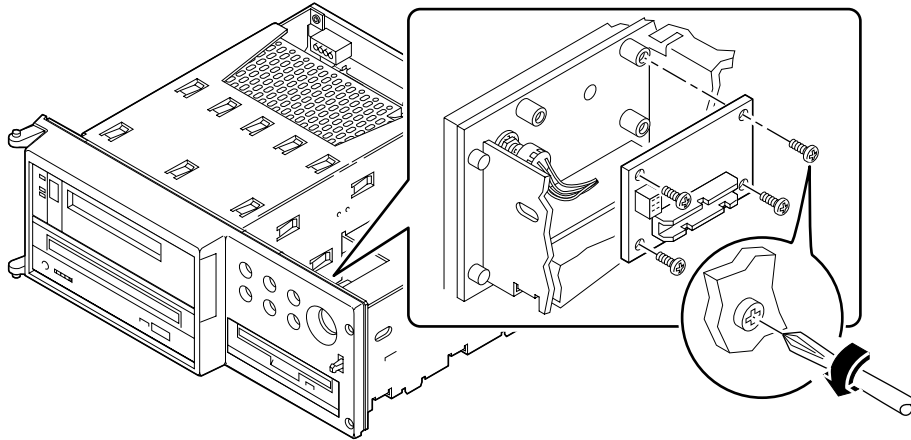


- 2. Disconnect the keyswitch cable from the LED interface board at connector J0105.**

Press the tab on the back of the connector to release the cable.

**3. Remove the four Phillips screws that secure the board to the removable media chassis.**

To make it easier to remove the screws, turn the removable media assembly upright so that it stands on its front panel.



**4. Remove the LED interface board from the removable media assembly and place it on an antistatic mat.**

## What Next

To replace the board, complete this task:

- “How to Install the LED Interface Board” on page 255

---

# How to Install the LED Interface Board



---

**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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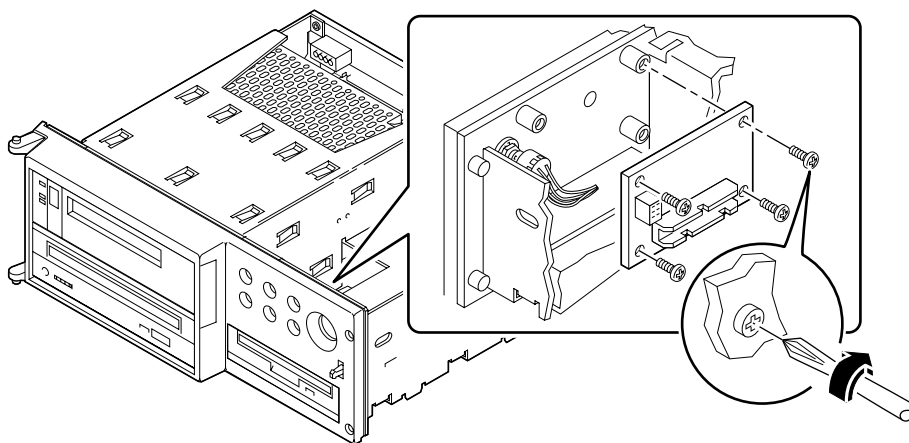
## What to Do

1. **Align the four mounting holes on the LED interface board with the corresponding stand-offs on the removable media chassis.**

Orient the board so that its LEDs are inserted into the six holes in the chassis wall.

2. **Secure the board to the chassis with the four Phillips screws you removed earlier.**

To make it easier to fasten the screws, turn the removable media assembly upright so that it stands on its front panel.

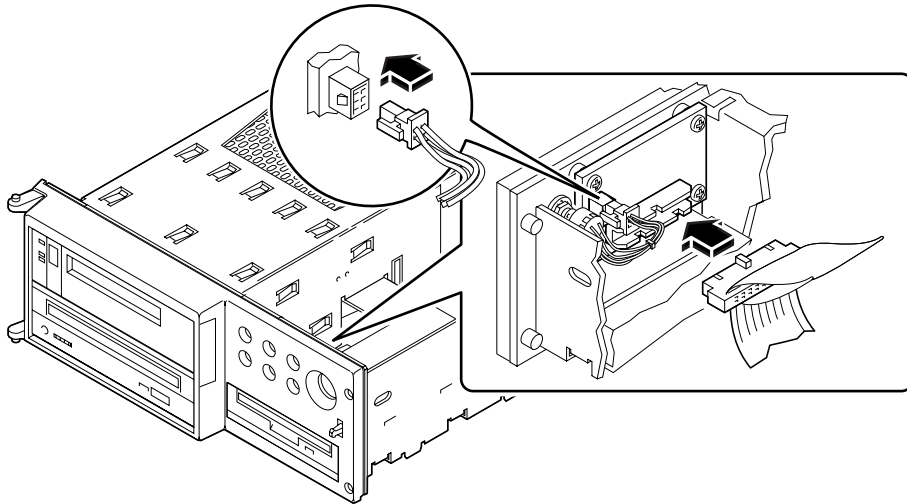


3. **Connect the free end of the keyswitch cable to the LED interface board at connector J0105.**

The connector is keyed so that it can be connected in only one way.

**4. Connect the free end of the LED interface cable to the LED interface board at connector J0100.**

The connector is keyed so it can be connected in only one way.



## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

---

# How to Remove a Rear Panel Insert

## Before You Begin

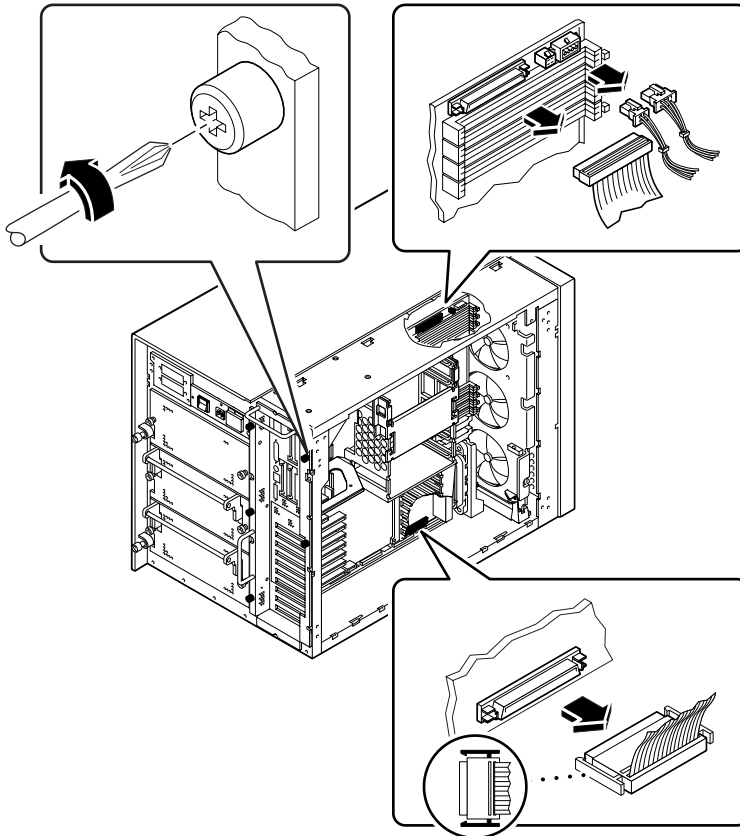
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40

## What to Do

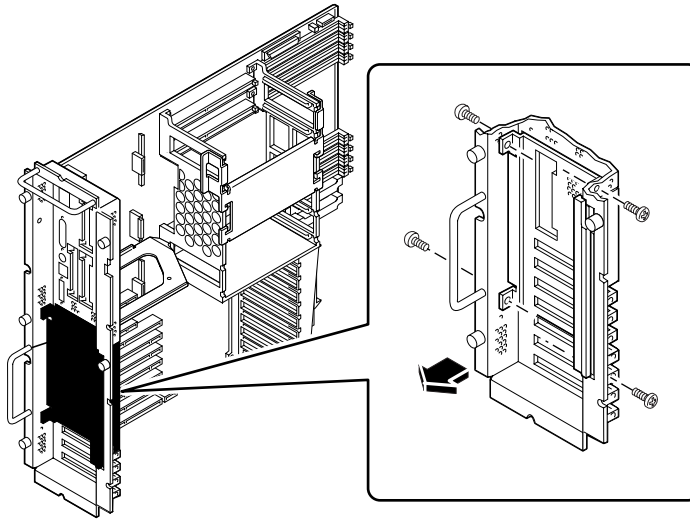
1. *If you are removing a PCI rear panel insert, remove any PCI cards in slots 3 through 10. See:*
  - “How to Remove a PCI Card” on page 147
2. *If you are removing a PCI rear panel insert, remove any PCI filler panels in slots 3 through 10. For each filler panel:*
  - a. **Remove the Phillips screw that secures the PCI filler panel to the rear panel.**
  - b. **Pull out the filler panel and keep it for future use.**
3. *If you are removing a dual graphics rear panel insert, remove the graphics card that is attached to the insert, if any. See:*
  - “How to Remove a UPA Graphics Card” on page 134
4. **Disconnect all internal cables from the main logic board:**
  - Disconnect the removable media SCSI cable, at connector J4701; press the tabs on both sides of the connector to release the cable
  - Disconnect the upper blower power cable at connector J4705
  - Disconnect the CPU fan tray power cable at connector J4704

- Disconnect the 4-slot UltraSCSI data cable, at connector J5601; press the tabs on both sides of the connector to release the cable



5. *Disconnect any 8-slot UltraSCSI data cables from their PCI cards.*  
Lay the cables across the top of the chassis, and align them in the notch provided there. Carefully note where each cable was connected.
6. **Loosen the five large captive screws that secure the main logic board to the rear of the chassis.**
7. **Carefully slide the main logic board out of the chassis about 3 inches (7.5 cm), using the handles at the rear of the board.**

**8. Remove the four Phillips screws that secure the rear panel insert to the rear panel.**



**9. From the rear of the chassis, rotate the top of the panel away from the chassis and remove it.**

It may be necessary to flex the rear panel insert slightly at the upper right corner.

## What Next

To replace a rear panel insert, complete this task:

- “How to Install a Rear Panel Insert” on page 260

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# How to Install a Rear Panel Insert

## Before You Begin

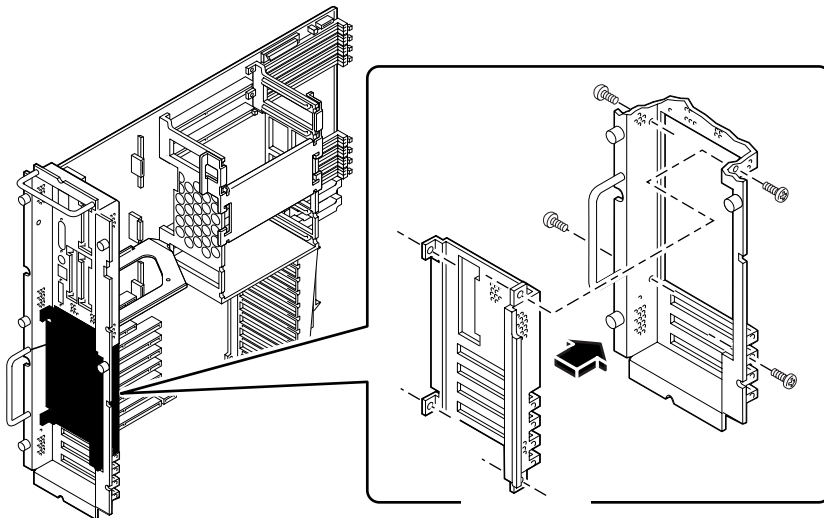
Complete this task:

- “How to Remove a Rear Panel Insert” on page 257

## What to Do

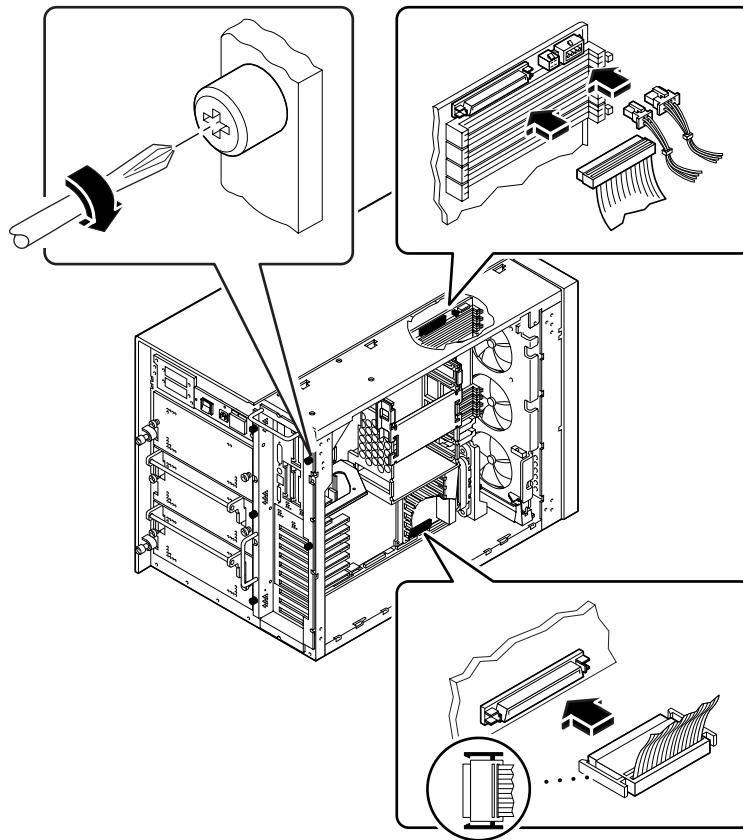
1. *If the insert is a PCI rear panel insert, remove any PCI filler panels from the insert. For each filler panel:*
  - a. **Remove the Phillips screw that secures the PCI filler panel to the rear panel.**
  - b. **Pull out the filler panel and keep it for future use.**
2. **Align the bottom of the insert under the tabs on the rear panel, then rotate the top of the insert so that it is flush with the rear panel and aligned with the mounting holes.**

It may be necessary to flex the rear panel insert slightly at the upper right corner.





3. **Attach the four Phillips screws that secure the insert to the rear panel.**  
Attach the screws through the outside edges of the rear panel.
4. **If the insert is a PCI rear panel insert, replace PCI filler panels for any PCI slots you do not intend to use immediately. For each filler panel:**
  - a. **Insert the filler panel into the opening in the rear panel insert**
  - b. **Secure the PCI filler panel to the rear panel with the Phillips screw.**
5. **Carefully push the main logic board into the chassis.**  
The connector should insert completely at the bottom right of the board.
6. **Tighten the five large captive screws that secure the main logic board to the rear of the chassis.**



7. **Connect all internal cables to the main logic board:**
  - Connect the removable media SCSI cable, at connector J4701

- Connect the upper blower power cable, at connector J4705
- Connect the CPU fan tray power cable, at connector J4704
- Connect the 4-slot UltraSCSI data cable, at connector J5601

**8. Reconnect any 8-slot UltraSCSI data cables to their respective PCI cards.**

## What Next

You may need to complete one or more of the following tasks to install optional equipment in the rear panel insert:

- “How to Install a PCI Card” on page 149
- “How to Install a UPA Graphics Card” on page 136

When you're ready to reassemble the system, complete this task:

- “How to Install the Left Side Panel” on page 38

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# Internal Cables

This section describes how to remove and install internal cables. For a list of part numbers, see “Illustrated Parts Breakdown” on page 456.

Tasks covered in this section include:

- *How to Remove the Disk Fan Tray/Interlock Cable—page 264*
- *How to Install the Disk Fan Tray/Interlock Cable—page 267*
- *How to Remove the Removable Media Power Cable—page 271*
- *How to Install the Removable Media Power Cable—page 273*
- *How to Remove the Removable Media SCSI Cable—page 275*
- *How to Install the Removable Media SCSI Cable—page 278*
- *How to Remove a SCSI Drive Power Cable—page 281*
- *How to Install a SCSI Drive Power Cable—page 284*
- *How to Remove the SCSI Drive Data Cable—page 286*
- *How to Install the SCSI Drive Data Cable—page 289*
- *How to Remove the 4-Slot UltraSCSI Power Cable—page 293*
- *How to Install the 4-Slot UltraSCSI Power Cable—page 295*
- *How to Remove the 4-Slot UltraSCSI Data Cable—page 297*
- *How to Install the 4-Slot UltraSCSI Data Cable—page 303*
- *How to Remove an 8-Slot UltraSCSI Power Cable—page 309*
- *How to Install an 8-Slot UltraSCSI Power Cable—page 311*
- *How to Remove an 8-Slot UltraSCSI Data Cable—page 313*
- *How to Install an 8-Slot UltraSCSI Data Cable—page 316*
- *How to Remove the LED Interface Cable—page 320*
- *How to Install the LED Interface Cable—page 322*
- *How to Remove the Diskette Power Cable—page 324*
- *How to Install the Diskette Power Cable—page 326*
- *How to Remove the Diskette Data Cable—page 328*
- *How to Install the Diskette Data Cable—page 330*
- *How to Remove an I<sup>2</sup>C Cable—page 332*
- *How to Install an I<sup>2</sup>C Cable—page 335*
- *How to Remove the Keypad Cable—page 337*
- *How to Install the Keypad Cable—page 339*

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# How to Remove the Disk Fan Tray/ Interlock Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

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**Note** – The interlock cable and the disk fan tray cable are tied together and are removed and installed as a single component.

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Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

If a CPU module is installed in the upper slot, complete this task to remove it:

- “How to Remove a CPU Module” on page 139

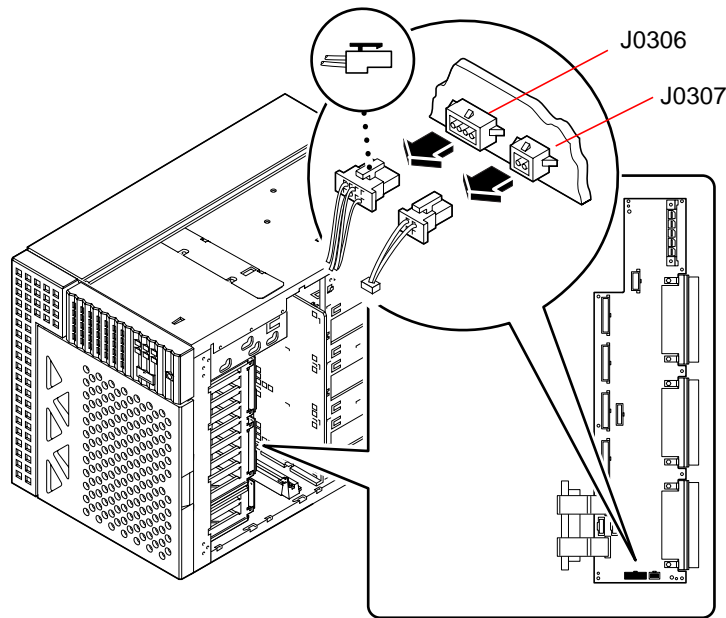
## What to Do

1. **Disconnect the interlock cable from the base of the power distribution board at connector J0307.**

Press the tab on the top of the interlock cable connector as you pull out the cable.

The disk fan tray/interlock cable consists of five ends. Two ends connect to the power distribution board; one end connects to the disk fan tray assembly; and two ends connect to switches that attach to brackets on the left and right sides of the chassis.

2. **Disconnect the disk fan tray cable from the base of the power distribution board at connector J0306.**



3. **Remove the disk fan tray/interlock cable from the plastic anchors that secure it to the chassis.**

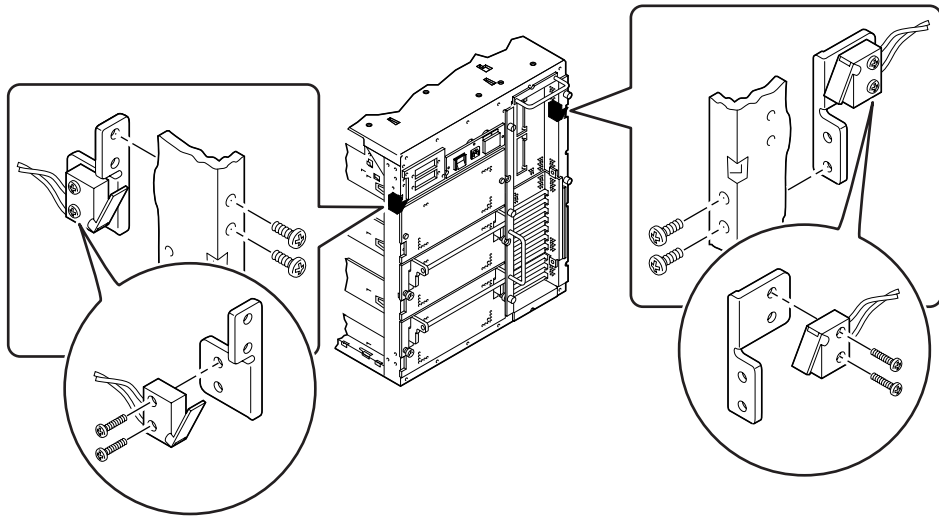
Cut the tie wrap that secures the cable to the plastic anchors on the floor and ceiling of the chassis, and on the side of the power supply cages.

4. **On the rear of the system, remove the two Phillips screws on the left and right sides of the system.**

The disk fan tray/interlock cable has a switch at two ends of the interlock cable. Each switch is attached to a small metal bracket. The brackets are attached to the left and right sides of the chassis with two Phillips screws. The screws are accessible from the back of the system.

5. **Remove the metal brackets from each end of the interlock cable by removing the two Phillips screws.**

Set the brackets aside. You will need to attach them to the switches on the new disk fan tray/interlock cable.



6. **On the left side of the system, free the cable from the metal shelf.**  
Cut the tie wraps that secure the cable.
7. **On the right side of the system, remove the disk fan tray/interlock cable from the metal guides on the side of the power supply cages.**
8. **Carefully pull the disk fan tray interlock cable through the small cutout at the top of the divider wall, and remove the cable from the system.**

## What Next

To replace the disk fan tray/interlock cable, complete this task:

- “How to Install the Disk Fan Tray/Interlock Cable” on page 267

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# How to Install the Disk Fan Tray/ Interlock Cable



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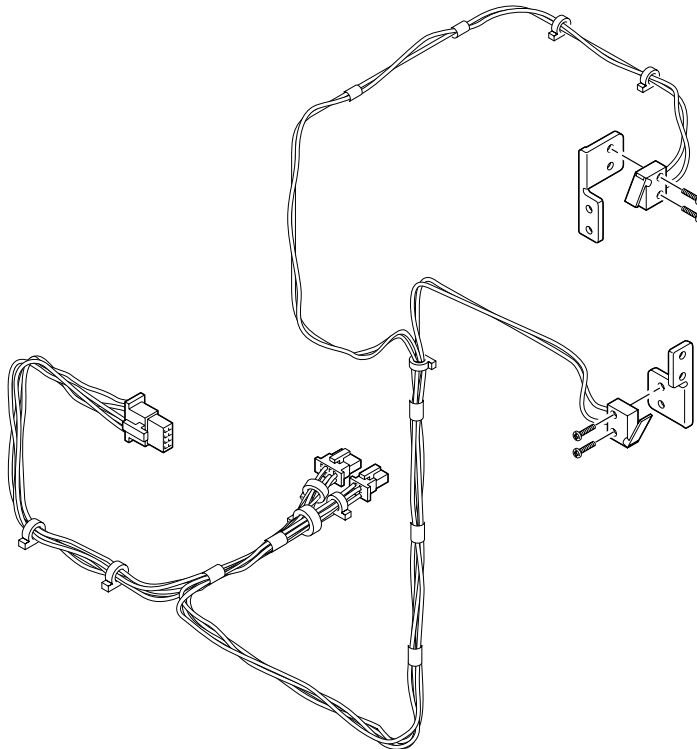
**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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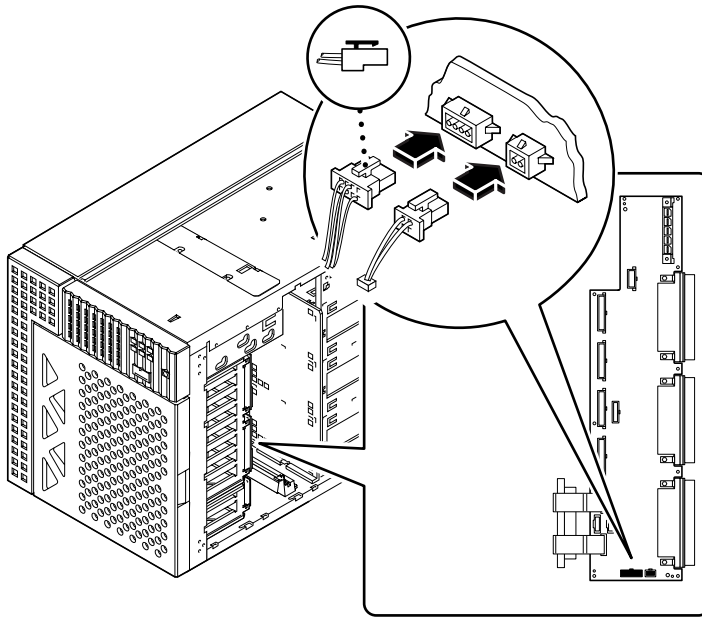
## What to Do

1. **Using the metal brackets and screws you removed earlier, attach a bracket to each switch at the ends of the new disk fan tray/interlock cable.**

The bracket screw holes for the left side should face down and the bracket screw holes for the right side should face up.



2. On the right side of the system, connect the interlock cable to the connector at the base of the power distribution board at connector J0307.
3. Connect the disk fan tray cable to the connector at the base of the power distribution board at connector J0306.



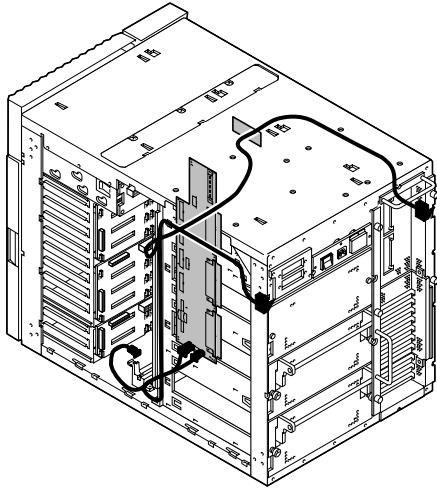
4. Tie wrap the taped portions of the cable to the plastic anchors on the floor of the chassis.

Use the tie wraps provided with the new cable. Insert a tie wrap into each anchor and around the taped portion of the cable. Join the ends of the tie wrap, and tighten it. Cut off any extra tie wrap.

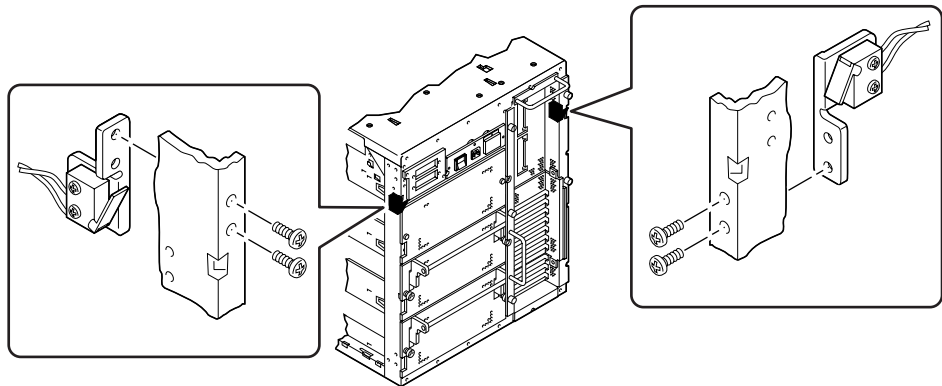
5. Hold the end of the interlock cable with the left side bracket, and feed it through the opening at the top of the center divider.



6. On the left side of the chassis, route the interlock cable over the metal shelf on the chassis ceiling just above the CPU modules.



7. Insert the interlock cable into the left side of the chassis and attach the bracket to the back of the chassis.
  - a. Align the holes on the interlock cable bracket with the holes on the left side of the chassis.
  - b. From the back of the system, secure the bracket to the chassis with the two Phillips screws.



8. Use a tie wrap to secure the taped portion of the cable to the metal shelf.

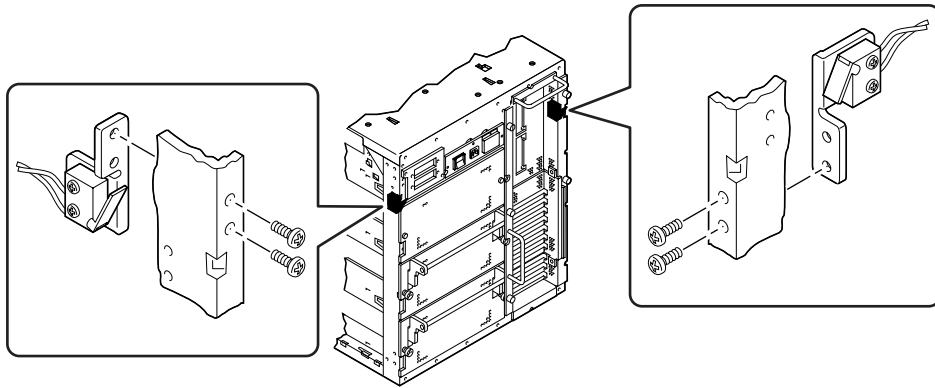
9. On the right side of the chassis, secure the interlock cable in the metal guides and plastic anchors on the sides of the power supply cages.

Use the tie wraps provided with the cable.

10. Insert the interlock cable into the right side of the chassis and attach the bracket to the back of the system.

- a. Align the holes on the interlock cable bracket with the holes on the right side of the chassis.

- b. From the back of the system, secure the bracket to the chassis with the two Phillips screws.



## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Left Side Panel” on page 38
- “How to Install the Right Side Panel” on page 34

If you removed a CPU module from the upper slot, complete this task to replace it:

- “How to Install a CPU Module” on page 141

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# How to Remove the Removable Media Power Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

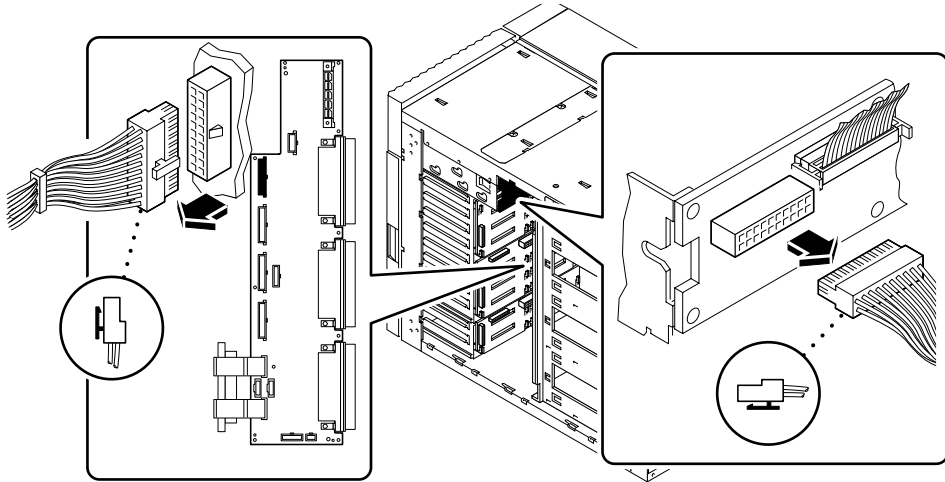
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

## What to Do

1. **Disconnect the removable media power cable from the removable media backplane at connector J0101.**

Press the tab on the bottom of the connector to release the cable.



2. **Disconnect the other end of the cable from the top of the power distribution board at connector J0302.**

Press the tab on the right side of the connector to release the cable.

3. **Carefully cut the plastic tie wrap that secures the cable to the system chassis.**

## What Next

To replace the cable, complete this task:

- “How to Install the Removable Media Power Cable” on page 273

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# How to Install the Removable Media Power Cable



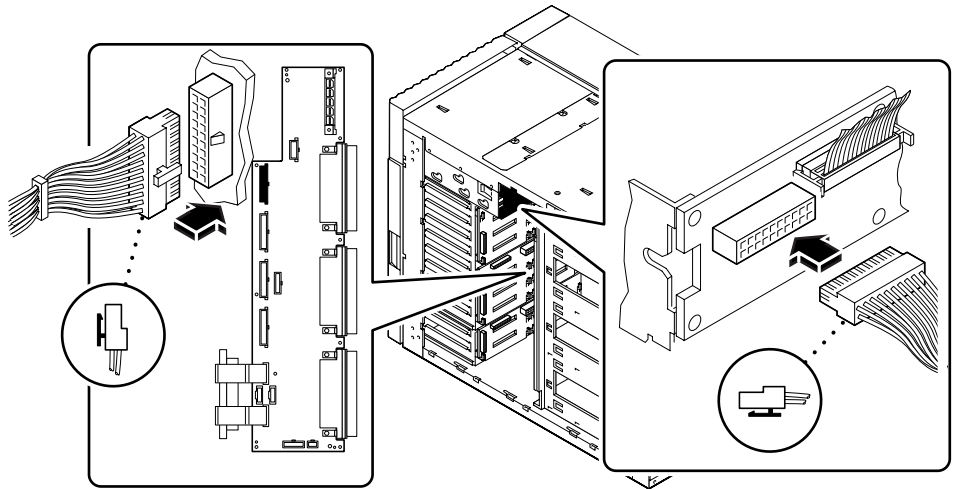
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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

1. **Connect the end of the removable media power cable labeled P2 to the removable media backplane at connector J0101.**



2. **Connect the other end of the cable, labeled P1, to the top of the power distribution board at connector J0302.**
3. **Secure the cable to the system chassis just below the removable media backplane.** Use the plastic tie wrap provided with the replacement cable.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the Removable Media SCSI Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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## Before You Begin

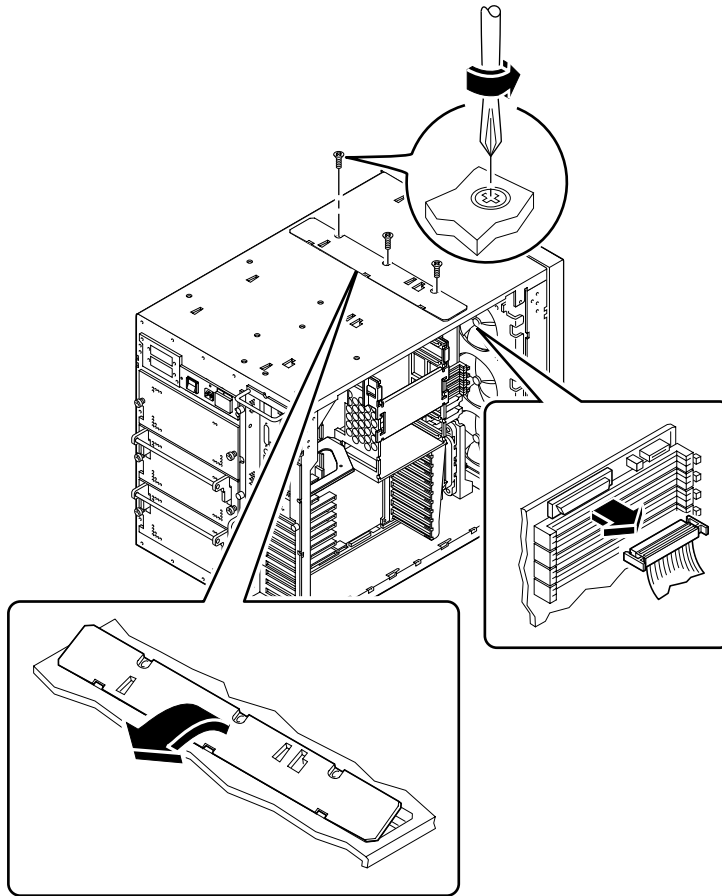
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

# What to Do

1. On the left side of the enclosure, disconnect the removable media SCSI cable from the top of the main logic board at connector J4701.

Press the tabs on both sides of the connector to release the cable.

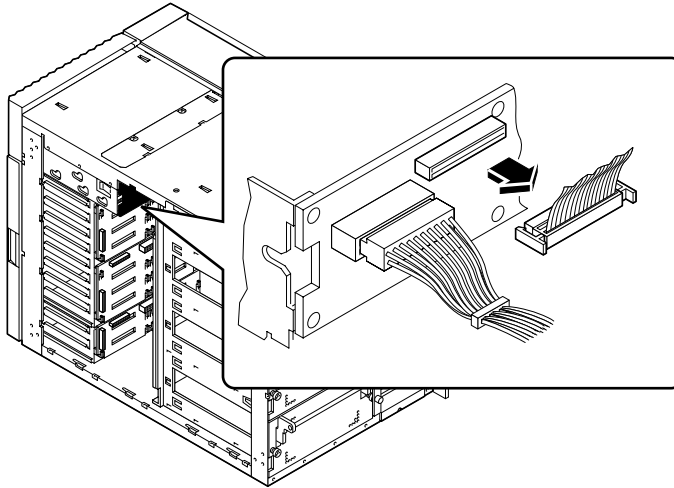


2. Remove the three small Phillips screws that secure the cable access panel to the top of the system chassis.
3. Tilt the front edge of the access panel upward and lift it free from the chassis.



4. On the right side of the enclosure, disconnect the removable media SCSI cable from the removable media backplane at connector J0103.

Press the tabs on both sides of the connector to release the cable.



5. From the top of the chassis, *carefully* pull the cable through the cable access port to remove it from the system.

If other cables are present, the removable media SCSI cable will be located beneath the others.

## What Next

To replace the cable, complete this task:

- “How to Install the Removable Media SCSI Cable” on page 278

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# How to Install the Removable Media SCSI Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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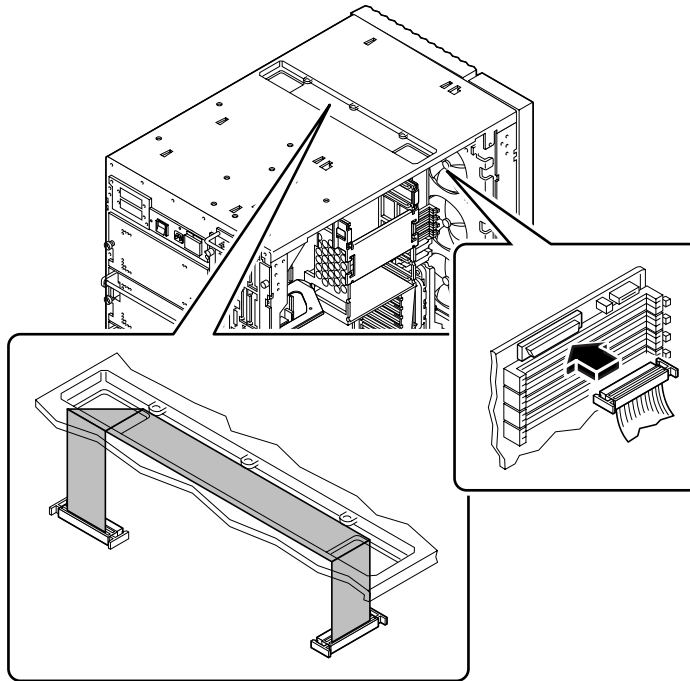
**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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# What to Do

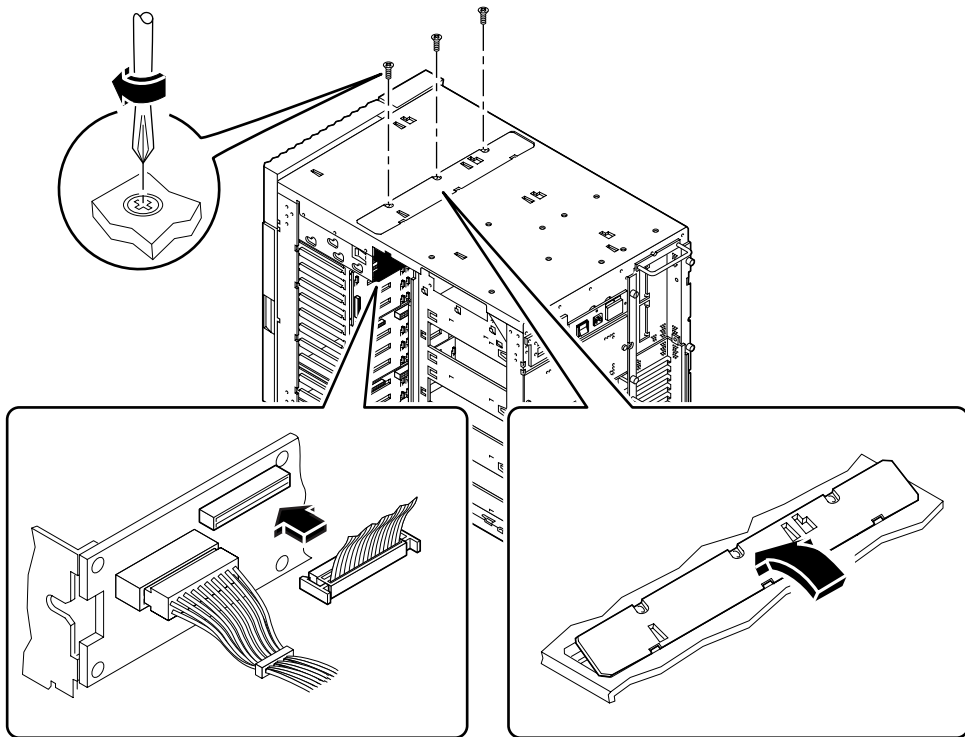
- 1. Insert the removable media SCSI cable into the cable access port on the top of the system chassis.**

Position the cable beneath any existing cables in the access port, with connector P1 toward the left side of the enclosure. Insert the right side of the cable through the irregular cutout on the right side of the cable access port.



- 2. On the left side of the enclosure, connect the end of the removable media SCSI cable labeled P1 to the top of the main logic board at connector J4701.**

3. Connect the other end of the cable, labeled P2, to the removable media backplane at connector J0103.



4. Replace the cable access panel.

Be sure that the cables are beneath the tabs in the access port. Align the three tabs on the edge of the panel with the corresponding slots in the system chassis.

5. Secure the access panel with the three Phillips screws.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Left Side Panel” on page 38
- “How to Install the Right Side Panel” on page 34

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# How to Remove a SCSI Drive Power Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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There are two SCSI drive power cables in the removable media assembly:

- One for the upper bay
- One for the lower bay

There are no locking tabs on the power cable connectors; rock them from side to side to disconnect them. Use needle-nose pliers, if necessary.

## Before You Begin

Complete these tasks:

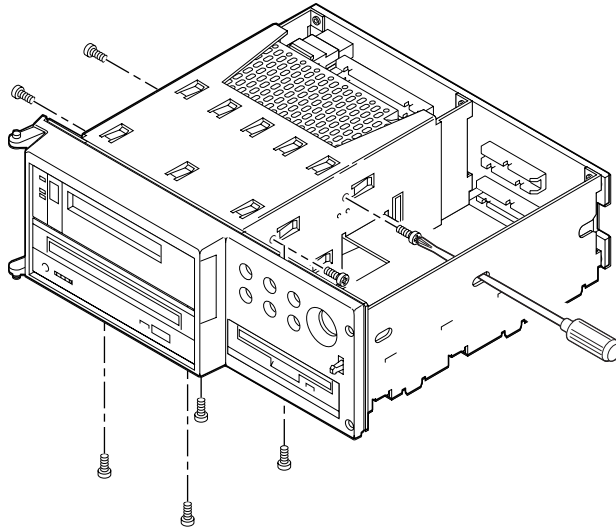
- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

## What to Do

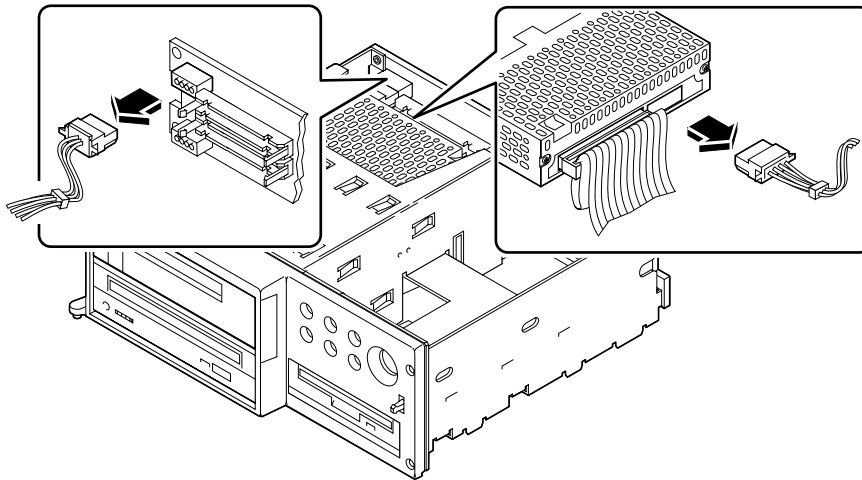
To remove the upper bay power cable, place the removable media assembly right side up on a table. To remove the lower bay power cable, place the assembly upside down on a table.

1. Remove the screws that secure the associated drive to its mounting bracket, then slide the drive part way out of the bay.

This provides easier access to the drive's power cable connector.



2. Disconnect the SCSI drive power cable from the back of the drive.



3. Disconnect the other end of the cable from the removable media backplane.

## What Next

To replace the cable, complete this task:

- “How to Install a SCSI Drive Power Cable” on page 284

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# How to Install a SCSI Drive Power Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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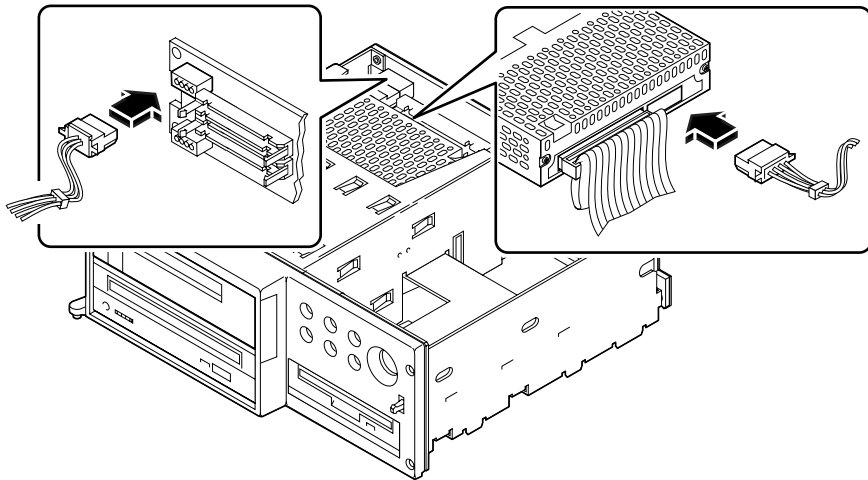
There are two SCSI drive power cables in the removable media assembly:

- One for the upper bay
- One for the lower bay

## What to Do

To install the upper bay power cable, place the removable media assembly right side up on a table. To install the lower bay power cable, place the assembly upside down on a table.

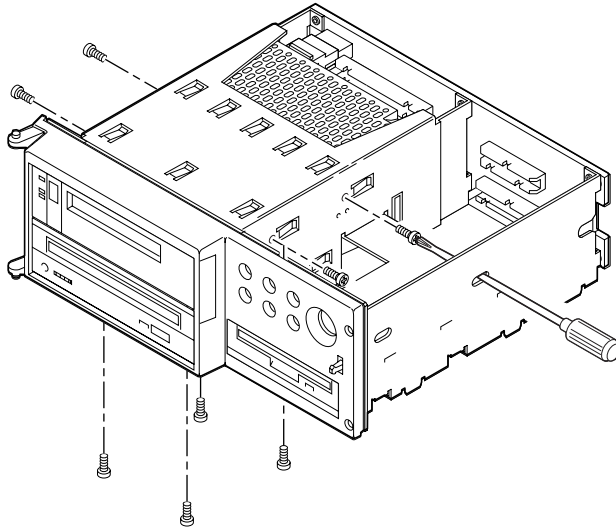
1. **Connect one end of the cable to the back of the drive.**



2. **Connect the other end of the cable to the upper or lower connector on the removable media backplane.**



**3. Align the drive and fasten the screws that secure it to the assembly.**



## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the SCSI Drive Data Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

## What to Do

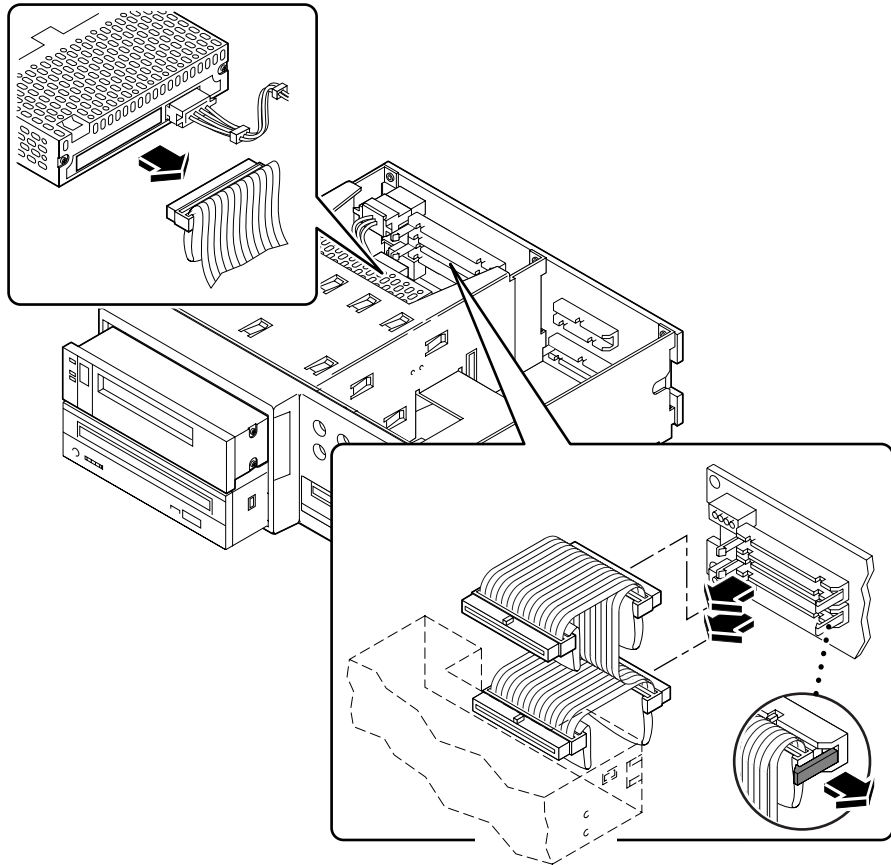
1. **Remove the screws that secure the removable media drives to their mounting brackets, then slide the drives part way out of the bay.**

This provides easier access to the SCSI cable connectors.

- For drives in the upper bay, the screws are located on the sides of the drive. (To access the screws on the divider wall, insert a screwdriver through access holes in the right side of the removable media assembly.)
- For drives in the lower bay, the screws are located beneath the drive.
- Full-height devices may use either mounting scheme.

- 2. If there is a drive in the bay closest to you, disconnect the SCSI drive data cable from the back of the drive.**

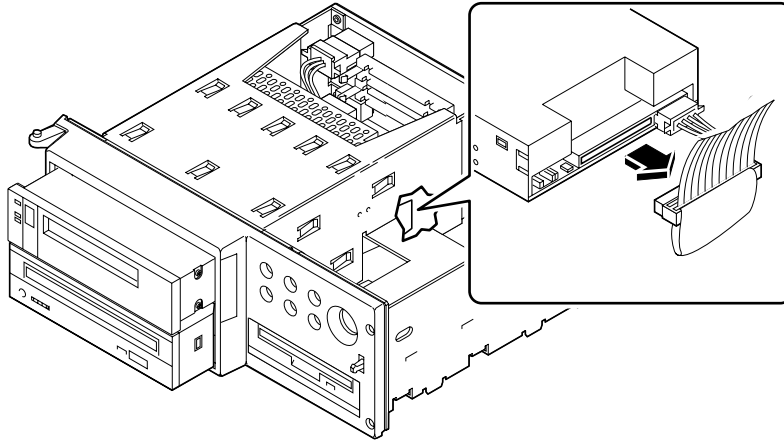
Pull on the plastic pull tab to disconnect the cable.



- 3. Press the ejection levers on the sides of the backplane connector closest to you to release the cable connector.**
- 4. Disconnect the cable connector from the connector on the backplane.**  
Pull on the plastic pull tab to disconnect the cable.
- 5. Press the ejection levers on the sides of the other backplane connector to release the cable connector.**
- 6. Disconnect the cable connector from the connector on the backplane.**  
Pull on the plastic pull tab to disconnect the cable.

7. If there is a drive in the bay farthest away from you, disconnect the SCSI drive data cable from the back of the drive.

Pull on the plastic pull tab attached to the cable connector.



## What Next

To replace the cable, complete this task:

- “How to Install the SCSI Drive Data Cable” on page 289

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# How to Install the SCSI Drive Data Cable



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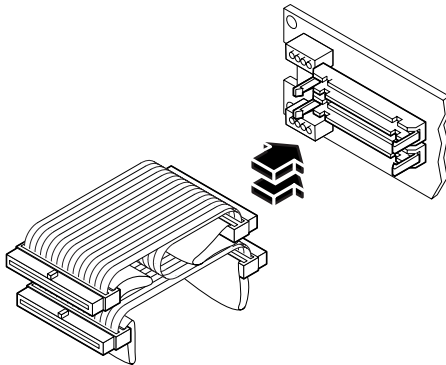
**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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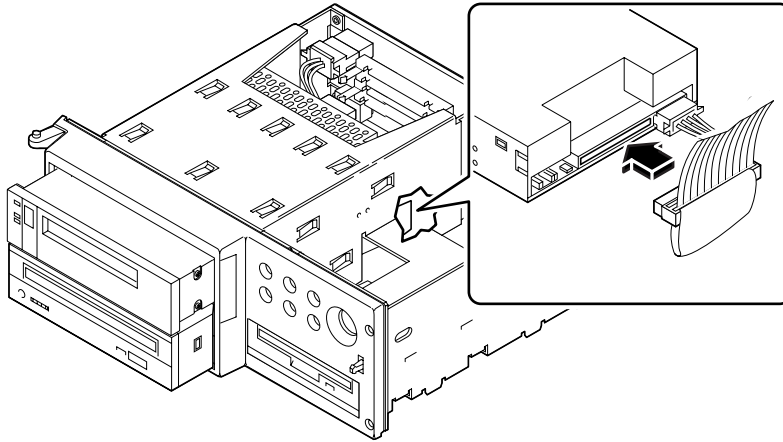
## What to Do

### 1. Position the removable media assembly right-side up.

Position the cable and assembly as shown in the following figure, with the pull tabs facing down. Push the lower half of the cable into the assembly opening.

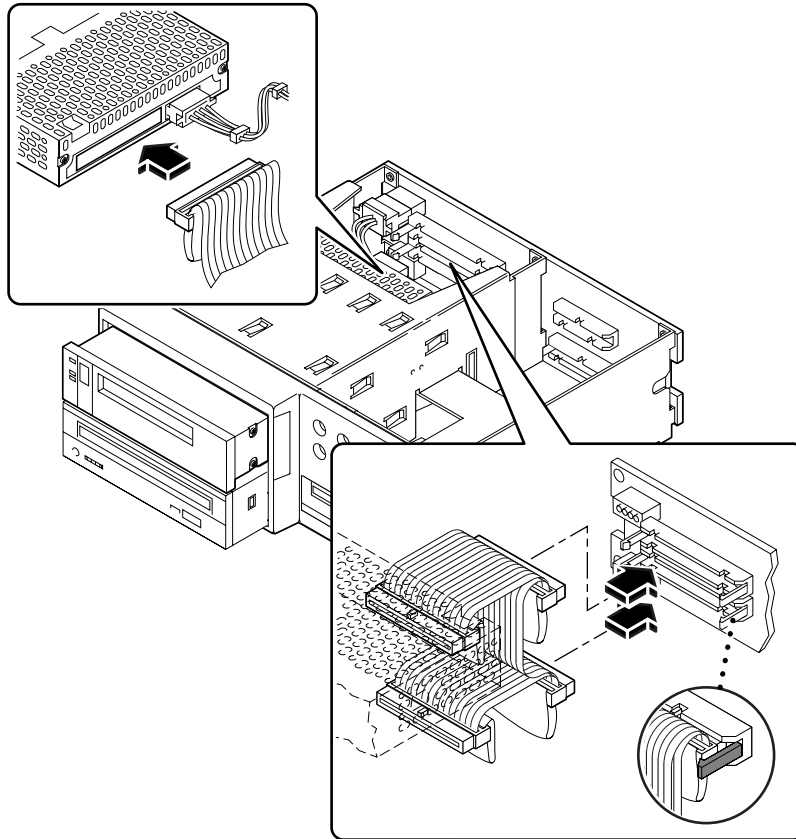


2. If there is a drive installed in the bay closest to you, connect the upper-left end of the SCSI drive data cable to the back of the drive.



3. **Connect the upper-right connector on the cable to the upper connector on the inside of the backplane.**

The levers on the sides of the backplane connector should lock the cable connector in place.



4. **Turn the assembly upside down.**
5. **Connect the cable to the other data connector on the inside of the backplane.**  
The levers on the sides of the backplane connector should lock the cable connector in place.
6. **If there is a drive installed in the bay closest to you, connect the remaining cable connector to the back of the drive.**

**7. Align the drives and fasten the screws that secure them to the removable media assembly.**

- For drives in the upper bay, the screws are located on the sides of the drive. (To access the screws on the divider wall, insert a screwdriver through access holes in the right side of the removable media assembly.)
- For drives in the lower bay, the screws are located beneath the drive.
- Full-height devices may use either mounting scheme.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34



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# How to Remove the 4-Slot UltraSCSI Power Cable

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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

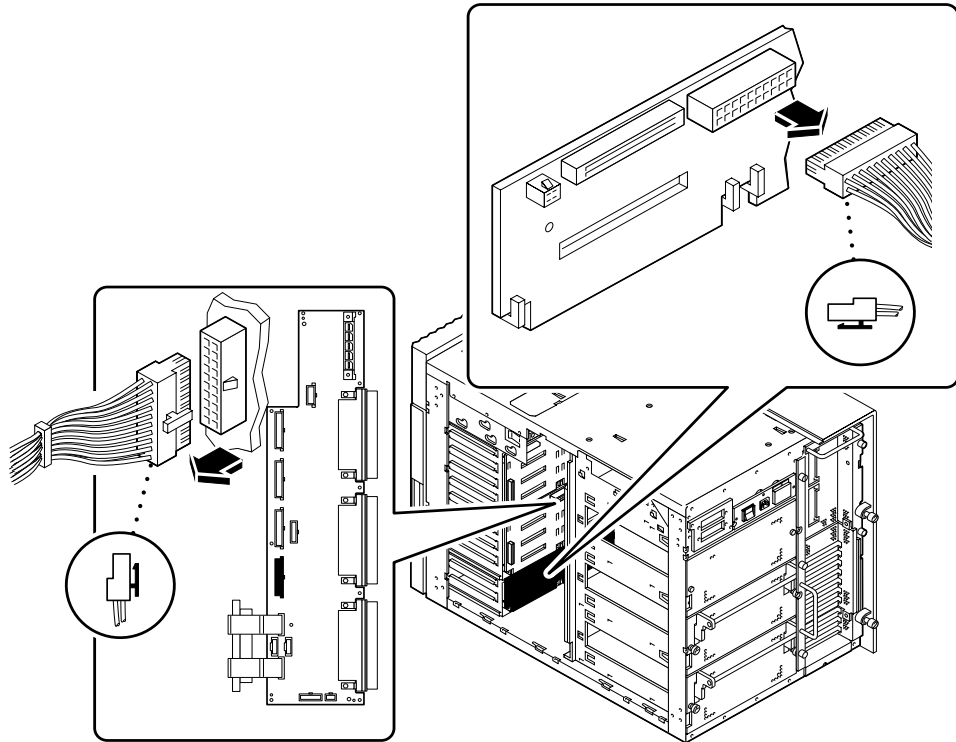
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

## What to Do

1. **Disconnect the 4-slot UltraSCSI power cable from the 4-slot UltraSCSI backplane at connector J0101.**

Press the tab on the bottom of the connector to release the cable.



2. **Disconnect the other end of the cable from the power distribution board at connector J0305.**

Press the tab on the right side of the connector to release the cable.

## What Next

To replace the cable, complete this task:

- “How to Install the 4-Slot UltraSCSI Power Cable” on page 295

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# How to Install the 4-Slot UltraSCSI Power Cable



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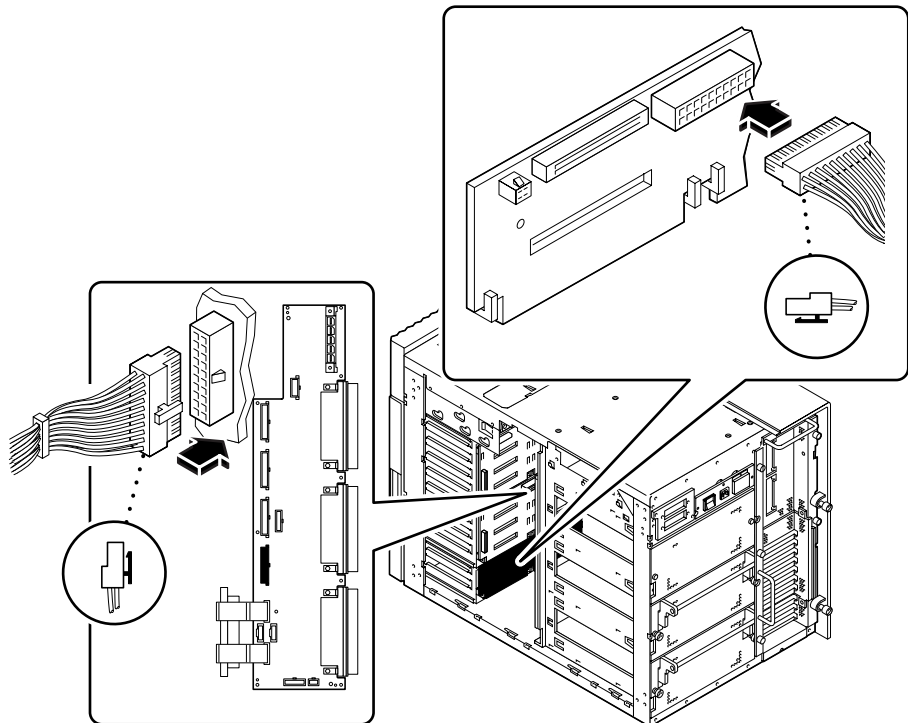
**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

1. **Connect the end of the 4-slot UltraSCSI power cable labeled P2 to the power distribution board at connector J0305.**

Be sure that the tab on the right side of the connector snaps into place.



- 2. Connect the other end of the cable, labeled P1, to the 4-slot UltraSCSI backplane at connector J0101.**

Be sure that the tab on the bottom of the connector snaps into place.

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the 4-Slot UltraSCSI Data Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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## Before You Begin

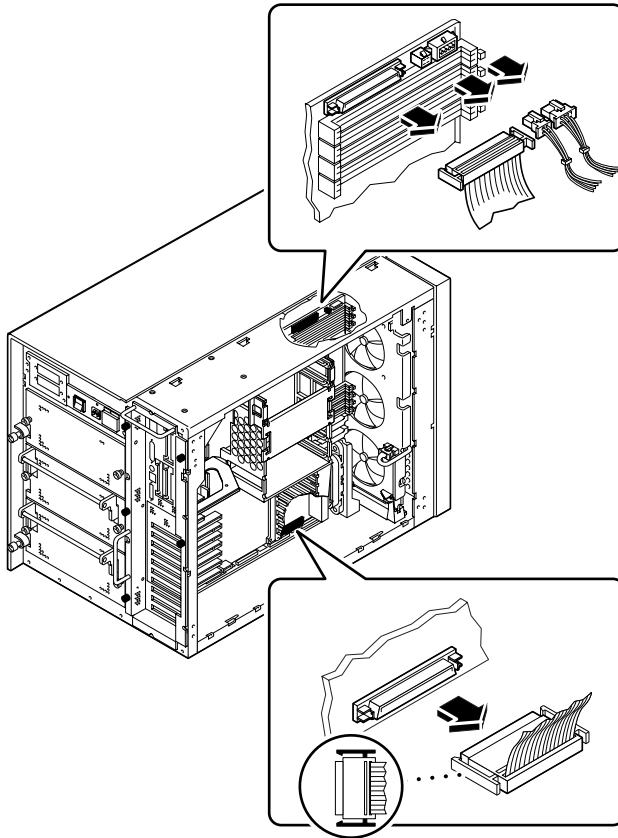
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the CPU Fan Tray Assembly” on page 227
- “How to Remove the Disk Fan Tray Assembly” on page 223

# What to Do

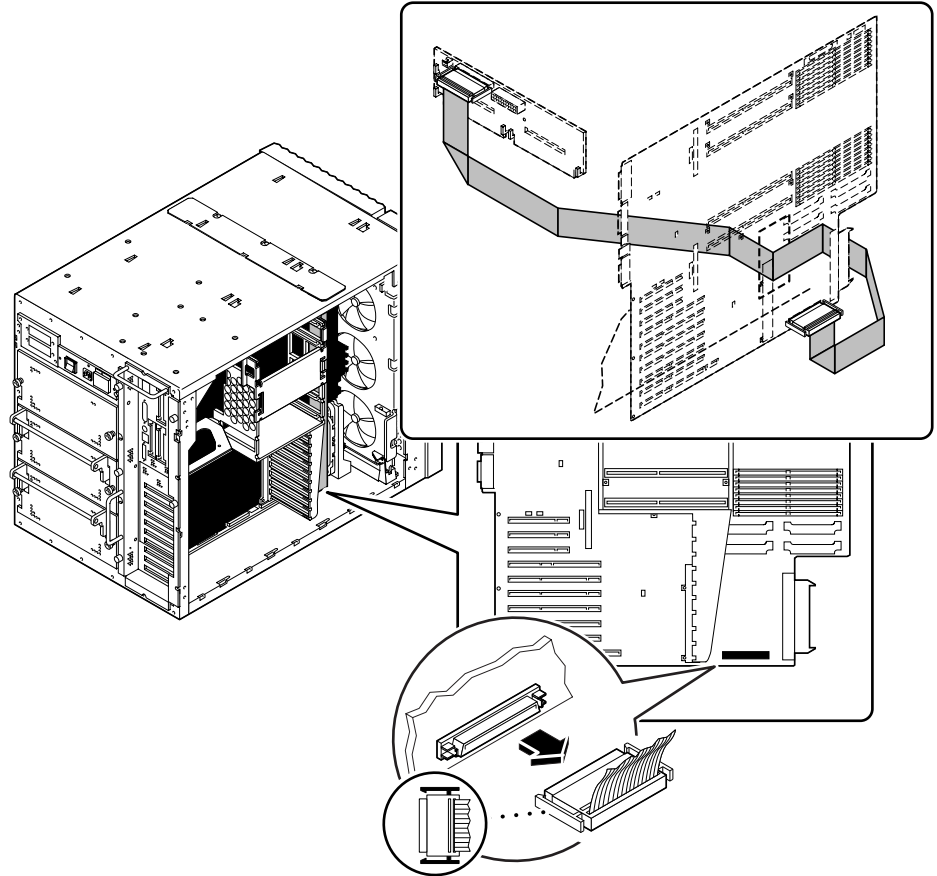
## 1. Disconnect the cables from the main logic board.

Press the tabs on both sides of the connector to release the cable.



- a. Disconnect the CPU fan tray power cable, at connector J4704.
- b. Disconnect the removable media SCSI cable, at connector J4701.
- c. Disconnect the upper blower power cable, at connector J4705.

**d. Disconnect the 4-slot UltraSCSI data cable, at connector J5601.**



**e. Disconnect any internal PCI cables.**

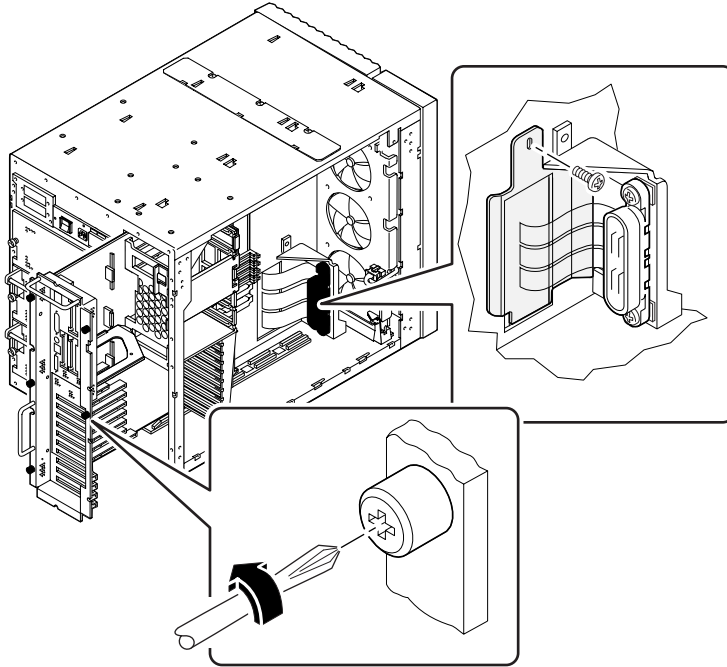
**2. Pull the main logic board approximately 6 inches (15 cm) out of the system.**

**a. Loosen the five screws on the rear panel.**

**b. Carefully slide the main logic board part way out of the chassis using the handles at the rear of the board.**

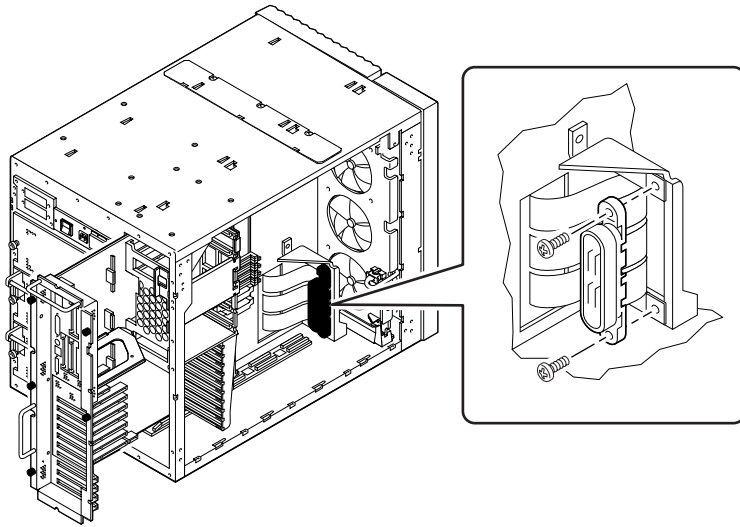
3. Remove the screw that secures the plastic shield to the opening in the chassis wall, and remove the shield from the system.

The plastic shield covers the cables that are routed through the opening, and provides a protective barrier between the cables and the main logic board.





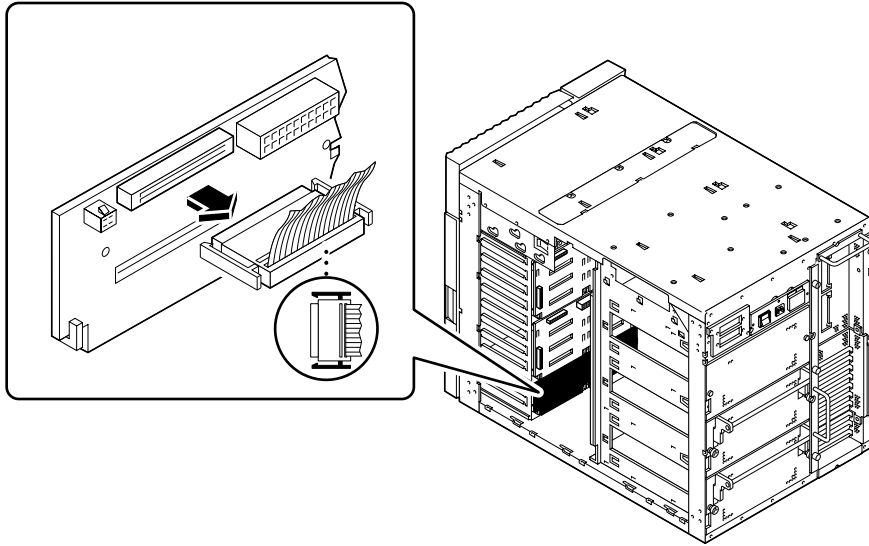
4. On the left side of the system, remove the two large slotted screws that secure the large main logic board connector to its mounting bracket.



5. Feed the 4-slot data cable around the main logic board connector and through the opening in the chassis wall.

6. On the right side of the system, disconnect the 4-slot UltraSCSI data cable from the 4-slot UltraSCSI backplane at connector J0102.

Press the tabs on the sides of the connector to release the cable.



7. Carefully pull the cable out from between the divider wall and the disk cage, and remove it from the system.

## What Next

To replace the 4-slot SCSI cable, complete this task:

- “How to Install the 4-Slot UltraSCSI Data Cable” on page 303

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# How to Install the 4-Slot UltraSCSI Data Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

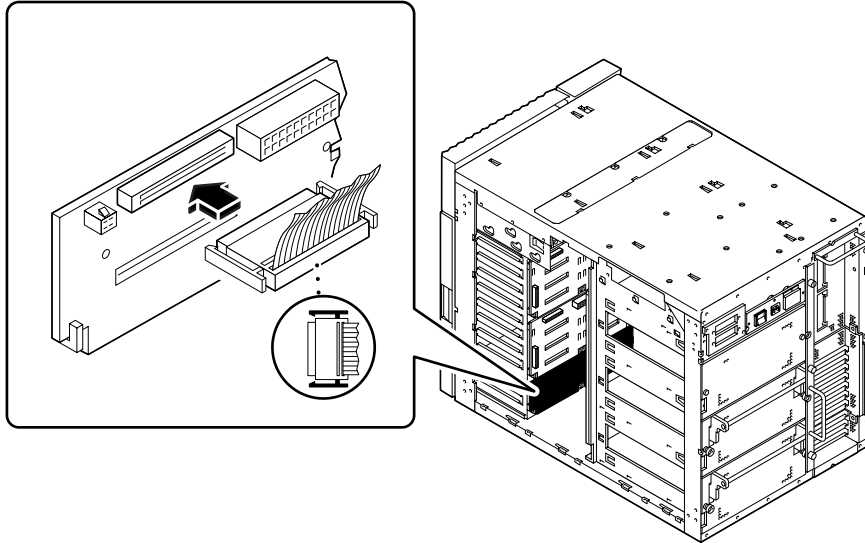
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## What to Do

1. **From the left side of the system, feed the cable through the opening in the center divider wall of the chassis.**

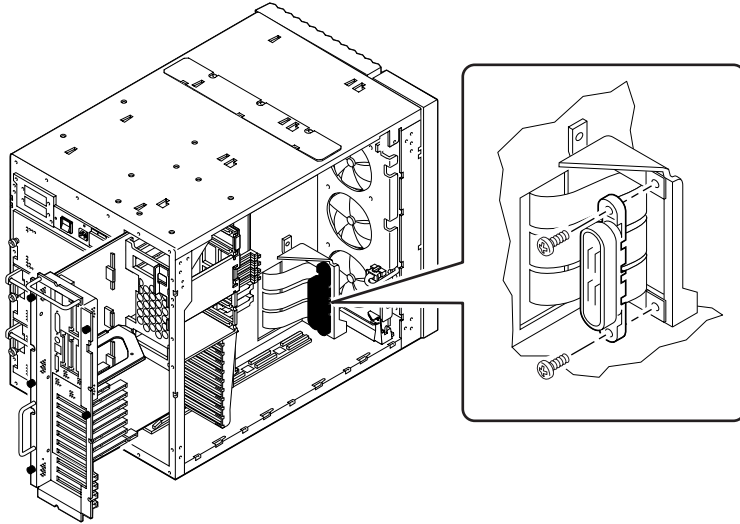
2. On the right side of the system, connect the 4-slot UltraSCSI data cable to the 4-slot UltraSCSI backplane at connector J0102.

Carefully pull the cable out from between the divider wall and the disk cage and connect it to the 4-slot UltraSCSI backplane.



- 3. On the left side of the system, attach the main logic board connector to its mounting bracket on the chassis center divider wall.**

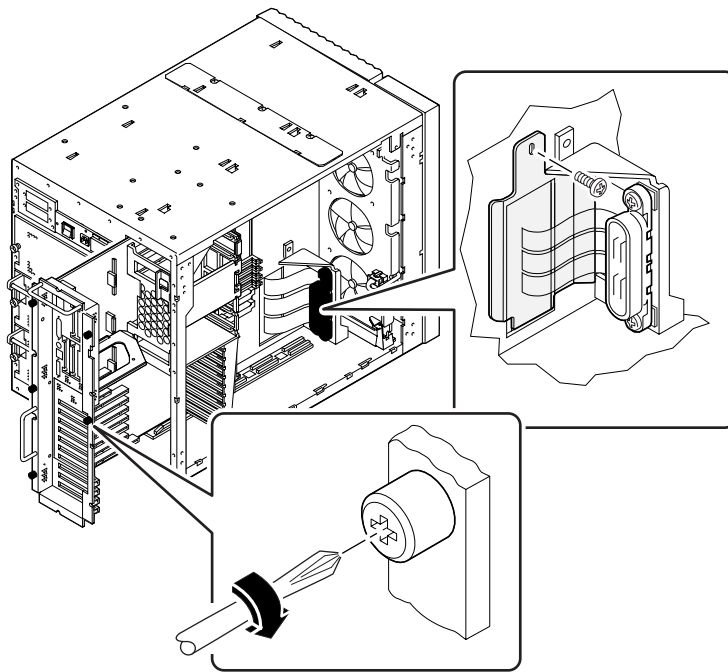
Make sure the 4-slot UltraSCSI data cable is routed behind the power distribution cables feeding the main logic board. Align the connector with the bracket and loosely tighten each screw before completely tightening both screws.



- 4. Secure the plastic shield over the opening in the chassis wall.**

The shield covers the cables that are routed through the opening.

- a. Position the shield so that the screw hole is at the top and the bottom flange bends away from you.**
- b. Insert the bottom of the shield into the opening in the chassis wall.**
- c. Align the hole on the top of the shield with the hole over the chassis opening, and secure the shield to the chassis with the Phillips screw.**

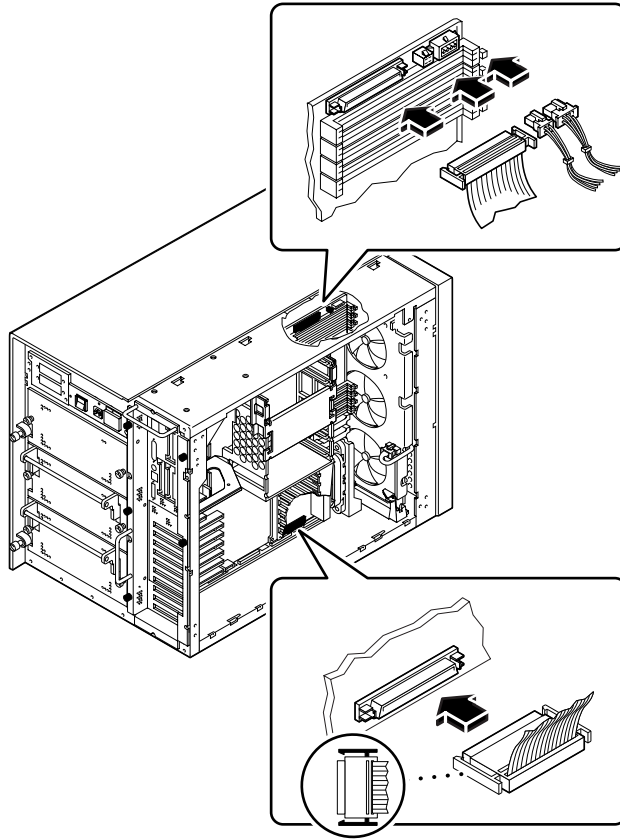


**5. Push the main logic board back into the system chassis.**

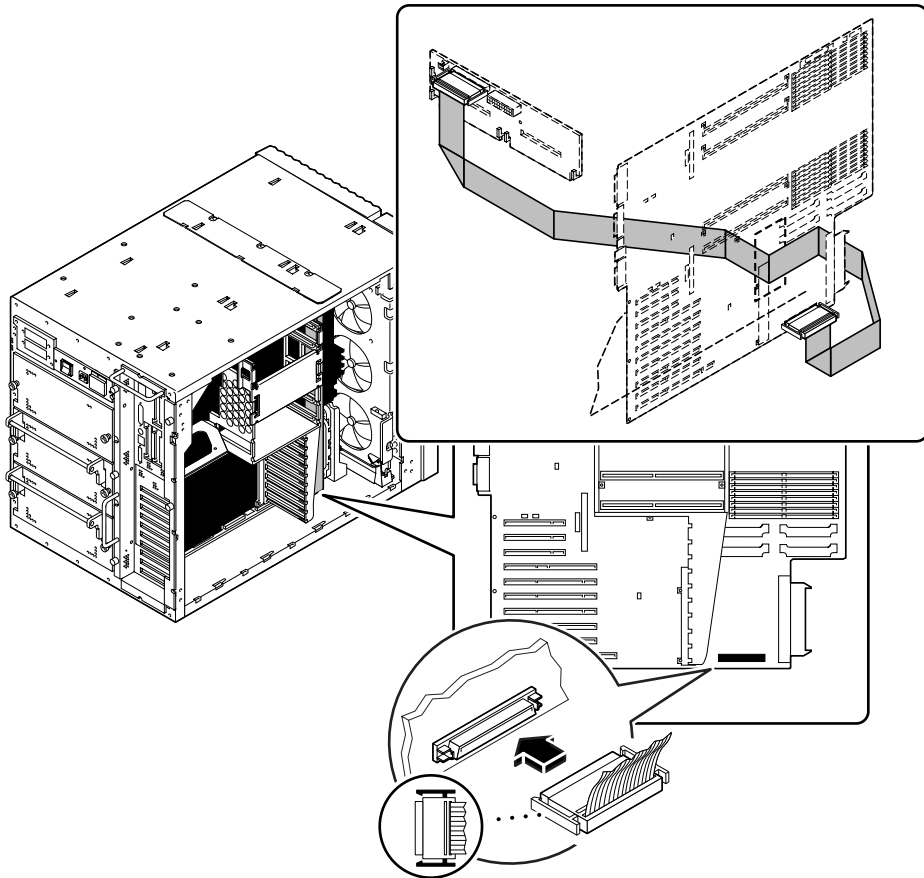
**6. Tighten the five screws on the rear panel.**

**7. Reconnect the cables to the main logic board:**

- a. Connect the removable media SCSI cable, at connector J4701.**
- b. Connect the CPU fan tray power cable, at connector J4704.**
- c. Connect the upper blower power cable, at connector J4705.**



d. Connect the 4-slot UltraSCSI data cable, at connector J5601.



## What Next

Complete the following tasks to reassemble the system:

- “How to Install the CPU Fan Tray Assembly” on page 229
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Left Side Panel” on page 38
- “How to Install the Right Side Panel” on page 34



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# How to Remove an 8-Slot UltraSCSI Power Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

---

## Before You Begin

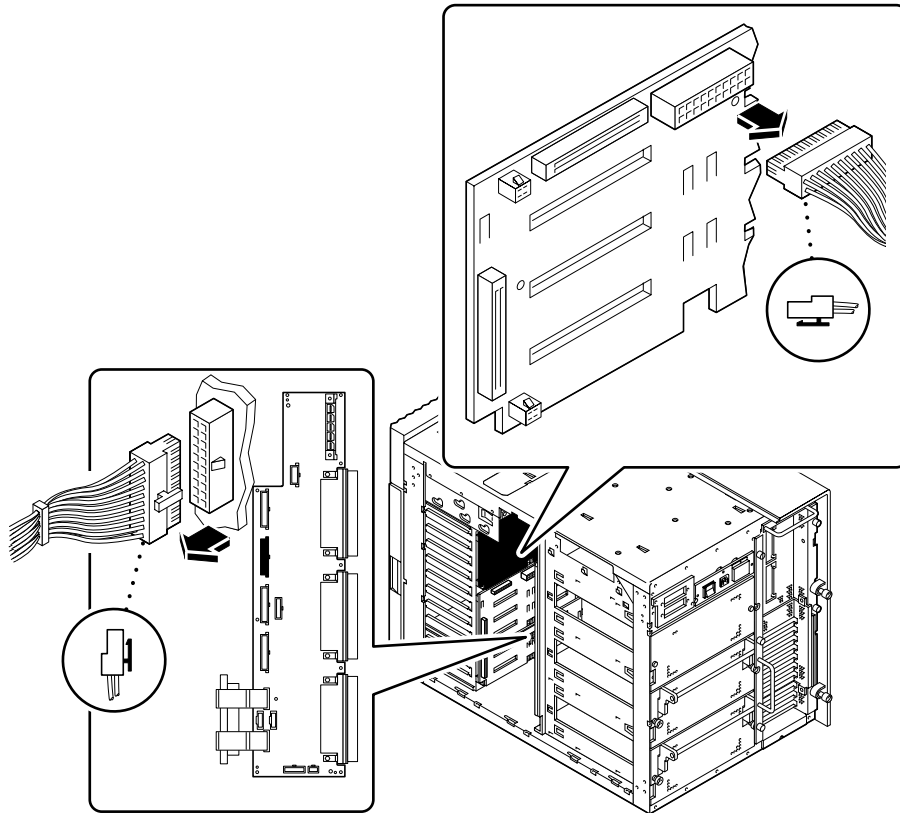
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

## What to Do

1. **Disconnect the 8-slot UltraSCSI power cable from the 8-slot UltraSCSI backplane at connector J0101.**

Press the tab on the bottom of the connector to release the cable.



2. **Disconnect the other end of the cable from the power distribution board at connector J0303 or J0304.**

Press the tab on the right side of the connector to release the cable.

## What Next

To replace the cable, complete this task:

- “How to Install an 8-Slot UltraSCSI Power Cable” on page 311

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# How to Install an 8-Slot UltraSCSI Power Cable



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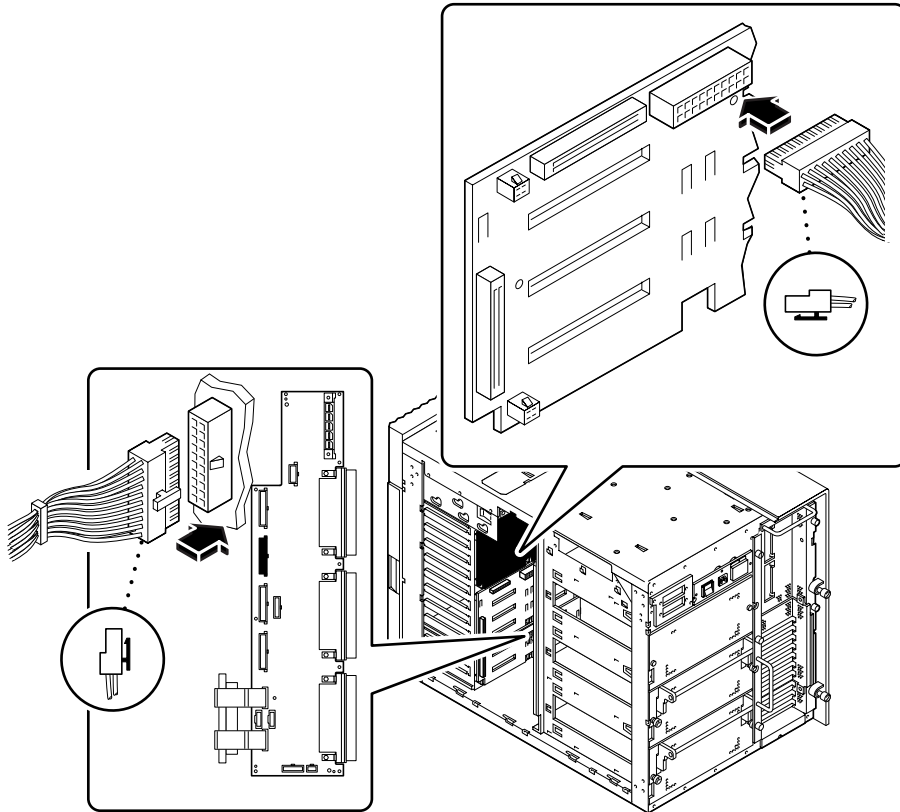
**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

1. **Connect the end of the 8-slot UltraSCSI power cable labeled P1 to the power distribution board at connector J0303 or J0304.**

Be sure that the tab on the right side of the connector snaps into place.



2. **Connect the other end of the cable, labeled P2, to the 8-slot UltraSCSI backplane at connector J0101.**

Be sure that the tab on the bottom of the connector snaps into place.

## What Next

Complete this task to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove an 8-Slot UltraSCSI Data Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223

## What to Do

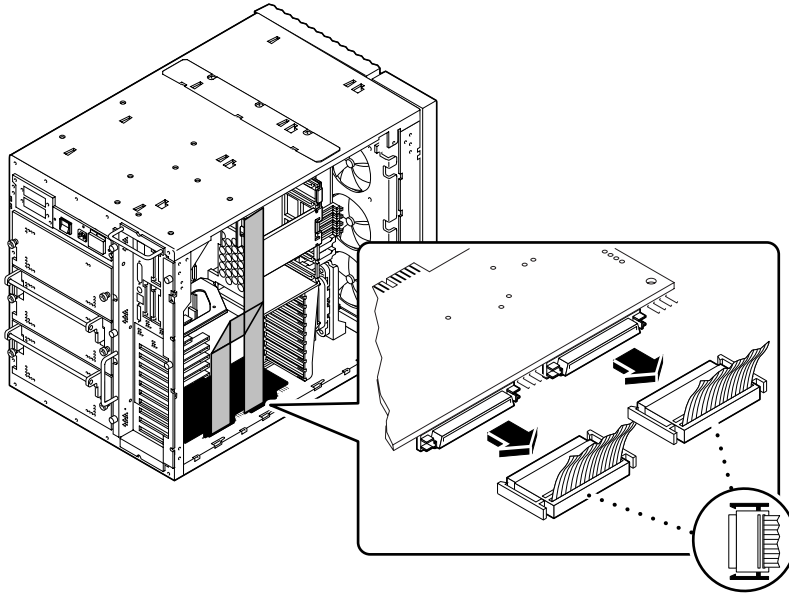
1. If your system has two 8-slot backplanes installed, determine which of the two 8-slot UltraSCSI data cables needs to be replaced, and which UltraSCSI controller PCI card is connected to the faulty cable.
2. Free the faulty cable from any cable clips securing it to the CPU card cage or disk fan tray assembly.
3. Disconnect any cables that limit access to the PCI card connectors for the 8-slot data cable you are replacing.

Be sure that the cables are labeled.

4. **On the left side of the enclosure, disconnect the two 8-slot UltraSCSI data cable connectors from the associated UltraSCSI controller PCI card.**

Press the tabs on both sides of each connector to release it.

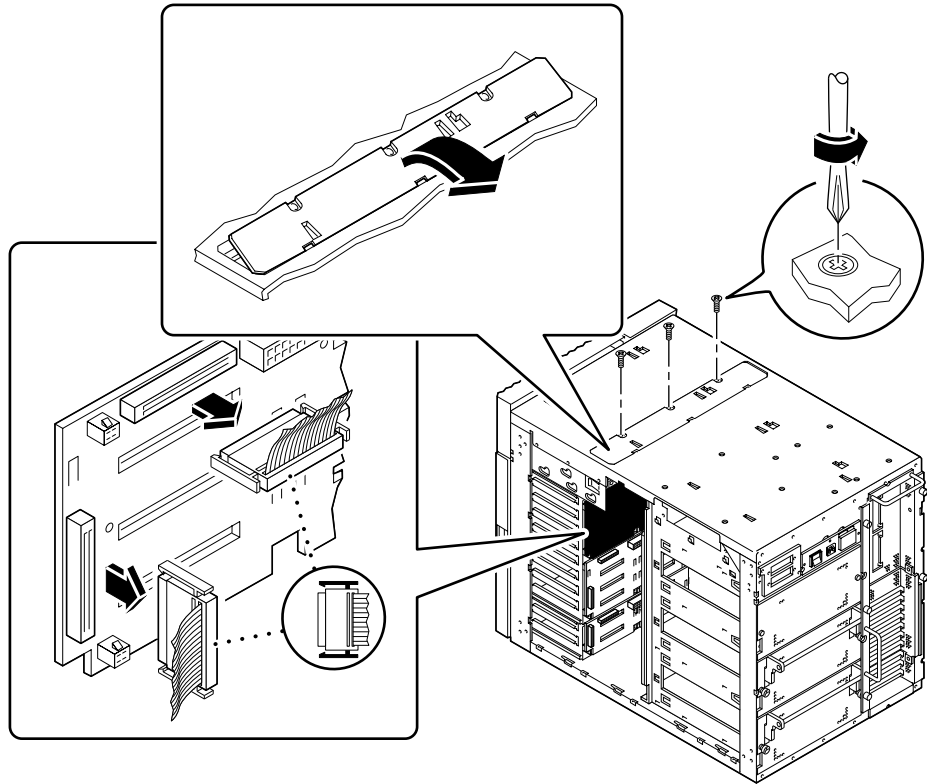
The cable connectors are labeled P1-A and P1-B. Take note of where each connector attaches to the PCI card.



5. **On the left side of the enclosure, slide the cable forward and out of the shelf at the top of the chassis.**

6. On the right side of the enclosure, disconnect the two connectors at the other end of the cable from the 8-slot backplane at connectors J0102 and J0402.

Press the tabs on both sides of each connector to release the cable.



7. Remove the three small Phillips screws that secure the cable access panel to the top of the system chassis.
8. Tilt the front edge of the access panel upward and lift it free from the chassis.
9. From the top of the chassis, *carefully* lift the cable out of the cable access port to remove it from the system.

Lift gently on one end of the cable to identify which one to remove.

## What Next

To replace the cable, complete this task:

- “How to Install an 8-Slot UltraSCSI Data Cable” on page 316

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# How to Install an 8-Slot UltraSCSI Data Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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**Caution** – UltraSCSI data cables are fragile and should be handled with care.

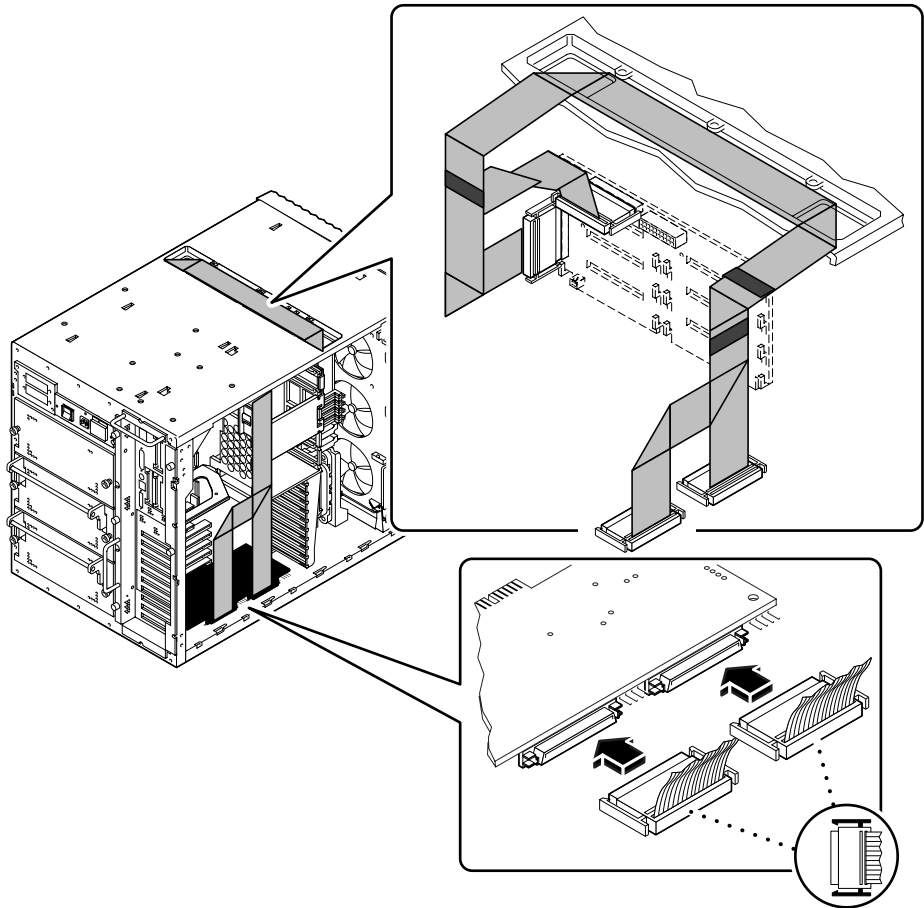
---

## What to Do

1. **Copy information from the four labels on the old cable to the corresponding labels on the new cable.**
2. **Insert the 8-slot UltraSCSI data cable into the cable access port on the top of the system chassis.**

Position the cable in the access port with connectors P1-A and P1-B toward the left side of the enclosure. If there are two 8-slot backplanes installed, you must position the cable for the lower backplane on top.

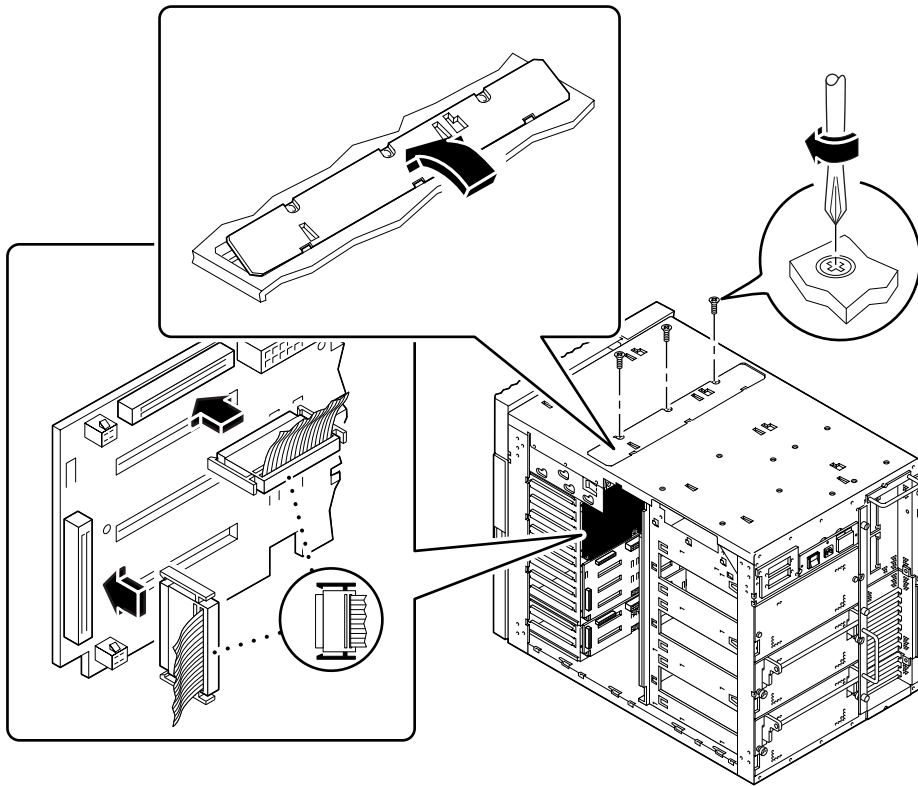




3. **On the left side of the enclosure, carefully route the cable so that it rests on top of the shelf located directly above the top CPU module.**  
Take care to avoid damaging the cable on any sharp sheet metal edges.
4. **On the left side of the enclosure, connect the cable connectors to the associated UltraSCSI controller PCI card.**  
Connect P1-A to the connector closest to the rear panel, and P1-B to the connector closest to the front of the card.
5. **If the UltraSCSI data cable has excess slack, carefully fold the cable and secure the fold using the cable clip attached to the CPU card cage.**  
Do not crease the cable when you fold it.
6. **Reconnect any cables you disconnected to access the PCI controller card.**

**7. Connect the other end of the cable to the 8-slot backplane.**

Connect P2-A to the lower connector, J0102, and P2-B to the upper connector, J0402.



**8. If the 8-slot UltraSCSI data cable has excess slack, carefully fold the cable and secure the fold using the cable clip attached to the disk fan tray assembly.**

Do not crease the cable when you fold it.

**9. Replace the cable access panel.**

Be sure that the cables are beneath the tabs in the cable access port. Align the three tabs on the edge of the panel with the corresponding slots in the system chassis.

**10. Secure the access panel with the three Phillips screws.**

## What Next

Complete these tasks to reassemble the system:

- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Left Side Panel” on page 38
- “How to Install the Right Side Panel” on page 34

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# How to Remove the LED Interface Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

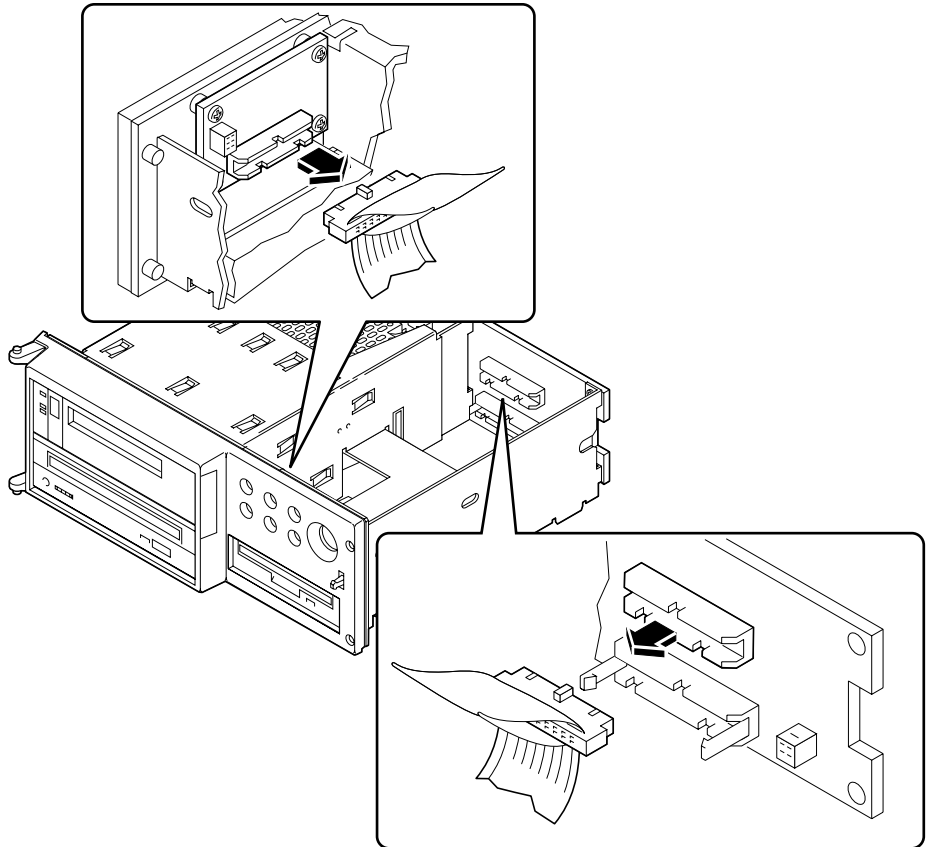
## What to Do

1. **Disconnect the LED interface cable from the removable media assembly backplane at connector J0104.**

Pull on the white plastic pull tab to disconnect the cable.

**2. Disconnect the other end of the cable from the LED interface board at connector J0100.**

Pull on the white plastic pull tab to disconnect the cable.



## What Next

To replace the cable, complete this task:

- “How to Install the LED Interface Cable” on page 322

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# How to Install the LED Interface Cable



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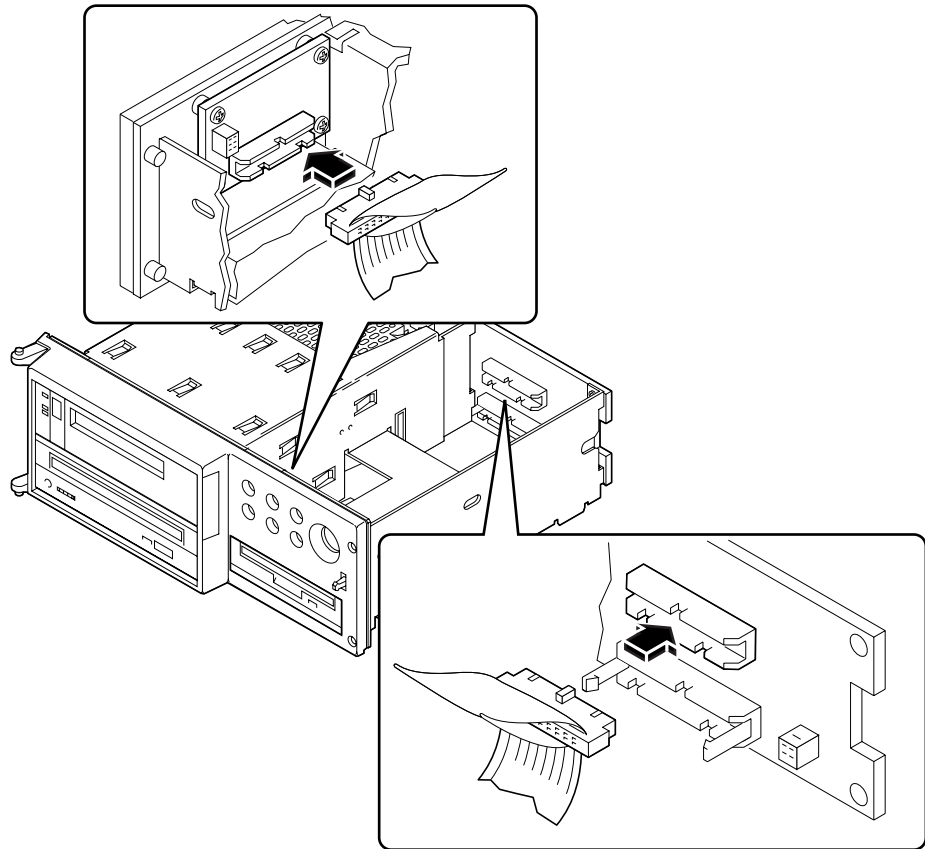
**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

- 1. Connect the LED interface cable to the LED interface board at connector J0100.**  
The two ends of the cable are identical. Both ends are keyed so that they can be connected in only one way.

2. Connect the other end of the cable to the removable media backplane at connector J0104.



## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the Diskette Power Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

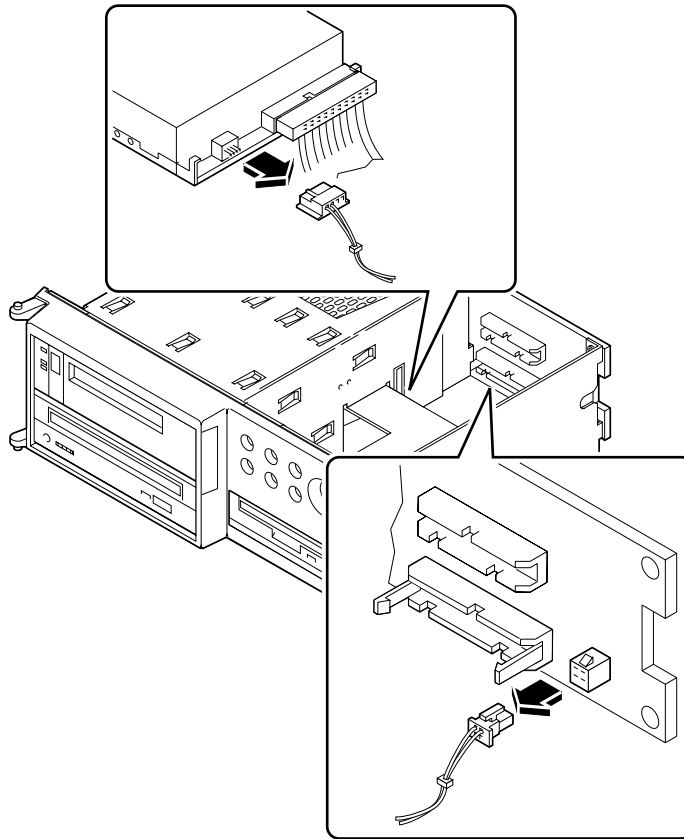
## What to Do

1. **Disconnect the diskette power cable from the rear of the diskette drive.**



**2. Disconnect the diskette power cable from the removable media backplane at connector P0101.**

Press the tab on the top of the connector to release the cable.



**3. Remove the diskette power cable from the removable media assembly.**

## What Next

To replace the diskette power cable, complete this task:

- “How to Install the Diskette Power Cable” on page 326

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# How to Install the Diskette Power Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

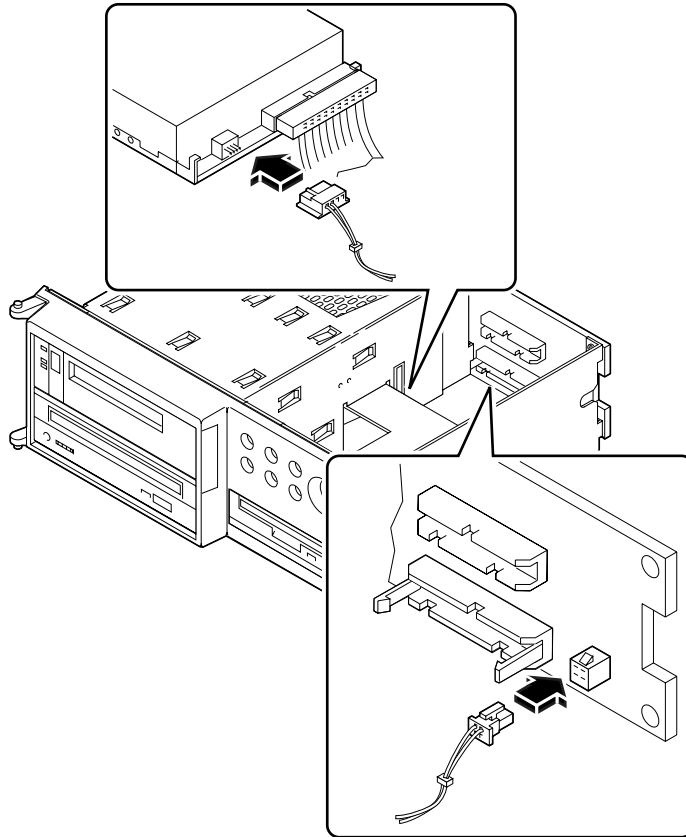
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## What to Do

1. **Connect the diskette power cable to the rear of the diskette drive.**

**2. Connect the diskette power cable to the removable media backplane at connector P0101.**

The locking tab on the connector snaps into place.



## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34

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# How to Remove the Diskette Data Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

## What to Do

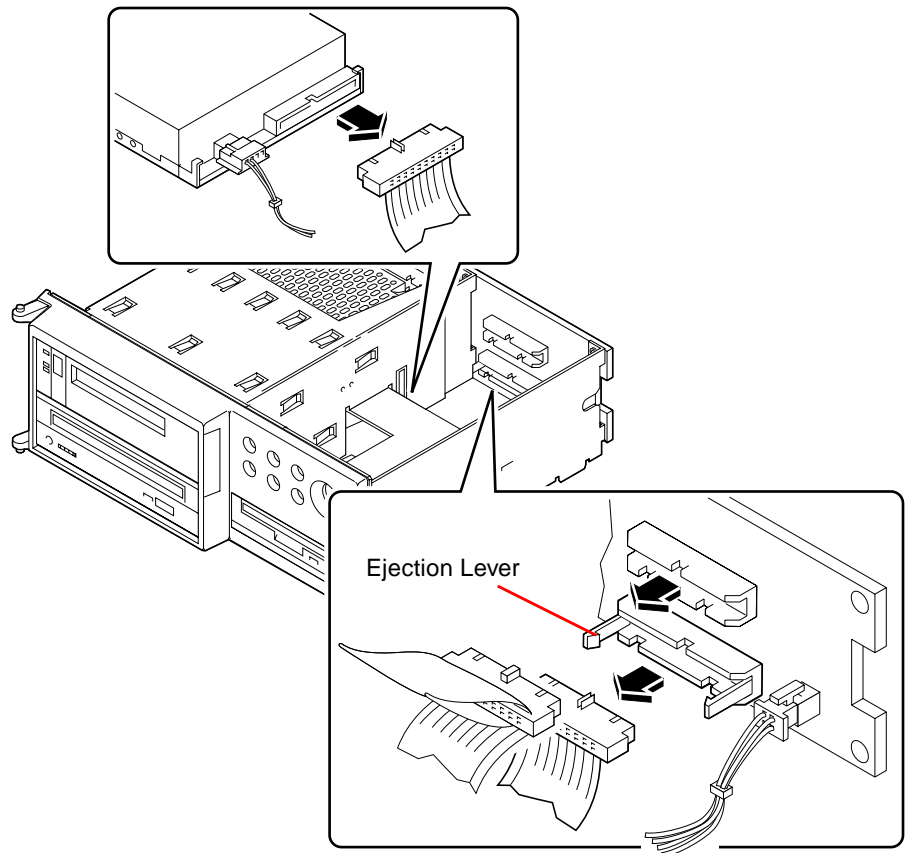
1. **Disconnect the LED interface cable from the removable media backplane at connector J0104.**

Pull on the plastic pull tab to disconnect the cable.

2. **Disconnect the diskette data cable from the removable media backplane at connector J0102.**

Press back the ejection levers to release the data cable from its connector.

3. Disconnect the diskette data cable from the rear of the diskette drive, and remove the cable from the removable media assembly.



4. If you are not replacing the diskette data cable right away, reconnect the LED interface cable to the removable media backplane at connector J0104.

## What Next

To replace the diskette data cable, complete this task:

- “How to Install the Diskette Data Cable” on page 330

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# How to Install the Diskette Data Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

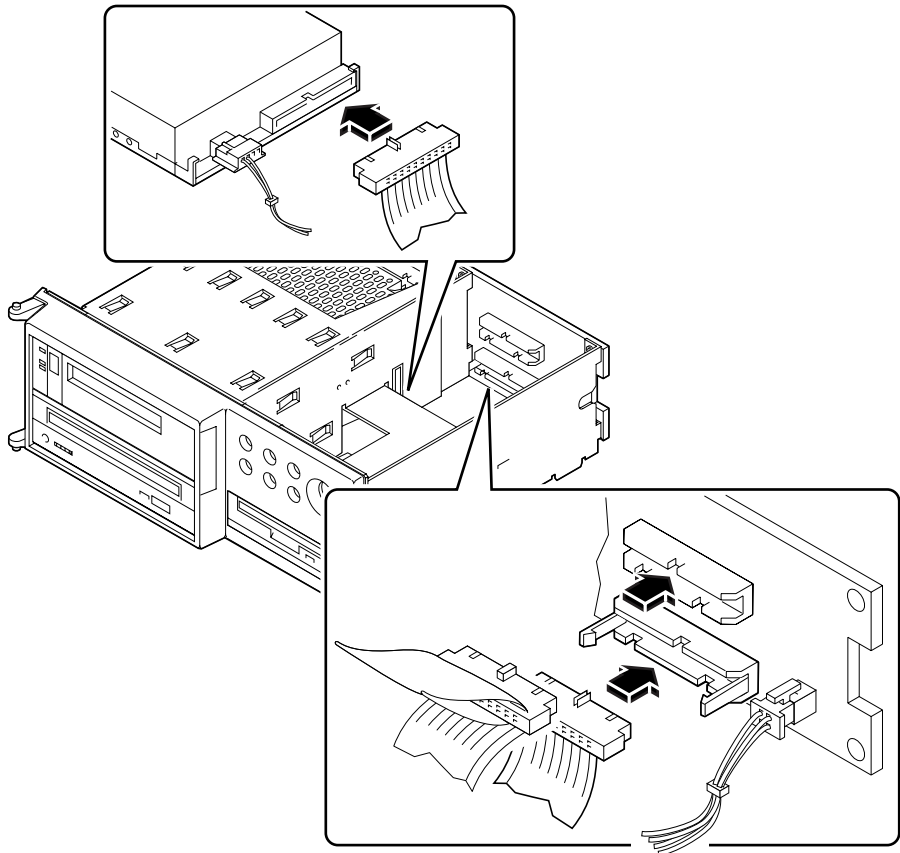
---

## What to Do

1. **Connect the diskette data cable to the rear of the diskette drive.**
2. **Connect the diskette data cable to the removable media backplane at connector J0102.**

Firmly push the diskette data cable into the backplane. The levers on the cable connector will automatically lock in place to secure the cable.

**3. Reconnect the LED interface cable to the removable media backplane at connector J0104.**



## What Next

Complete the following tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225”
- “How to Install the Right Side Panel” on page 34

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# How to Remove an I<sup>2</sup>C Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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There may be one or two I<sup>2</sup>C cables in your system, depending upon whether you have one or two 8-slot UltraSCSI backplanes installed.

## Before You Begin

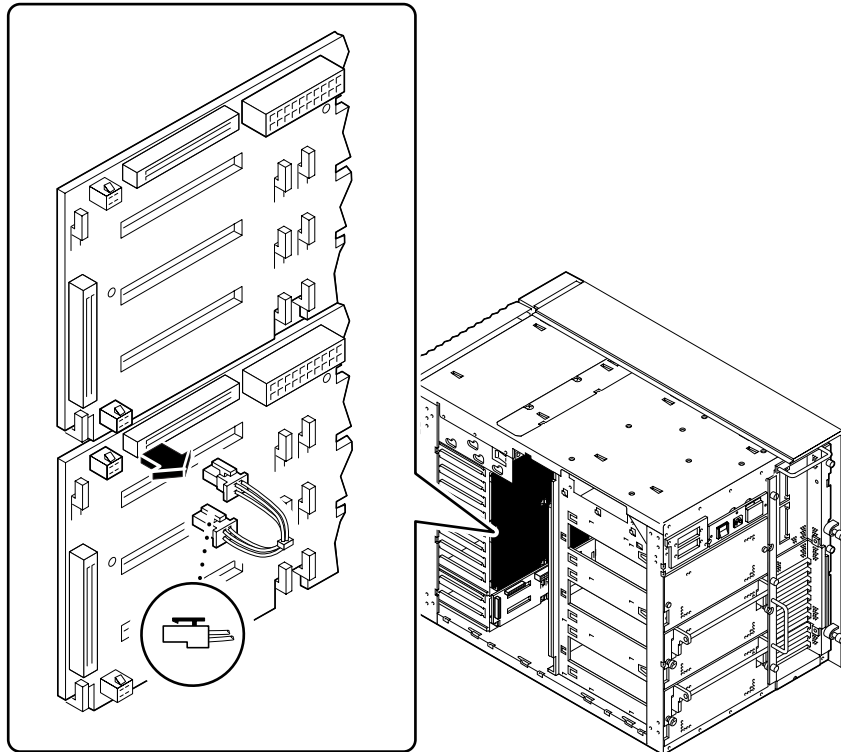
Complete these tasks:

- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Remove the Left Side Panel” on page 36
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223



# What to Do

1. *If you are removing the I<sup>2</sup>C cable for the upper 8-slot UltraSCSI backplane:*
  - a. **Disconnect the cable from the upper 8-slot backplane at connector P0600.**  
Press the tab on the top of the connector to release the cable.

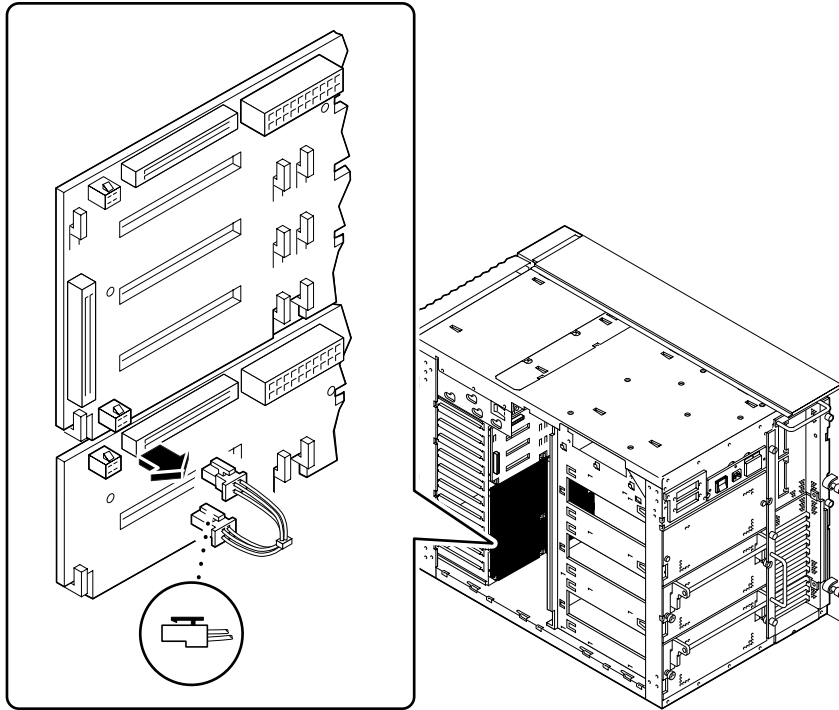


- b. **Disconnect the other end of the cable from the lower 8-slot backplane at connector P0601.**  
Press the tab on the top of the connector to release the cable.

2. If you are removing the I<sup>2</sup>C cable for the lower 8-slot UltraSCSI backplane:

a. **Disconnect the cable from the lower 8-slot backplane at connector P0600.**

Press the tab on the top of the connector to release the cable.



b. **Disconnect the other end of the cable from the 4-slot backplane at connector P0500.**

Press the tab on the top of the connector to release the cable.

## What Next

To replace the cable, complete this task:

- “How to Install an I<sup>2</sup>C Cable” on page 335

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# How to Install an I<sup>2</sup>C Cable



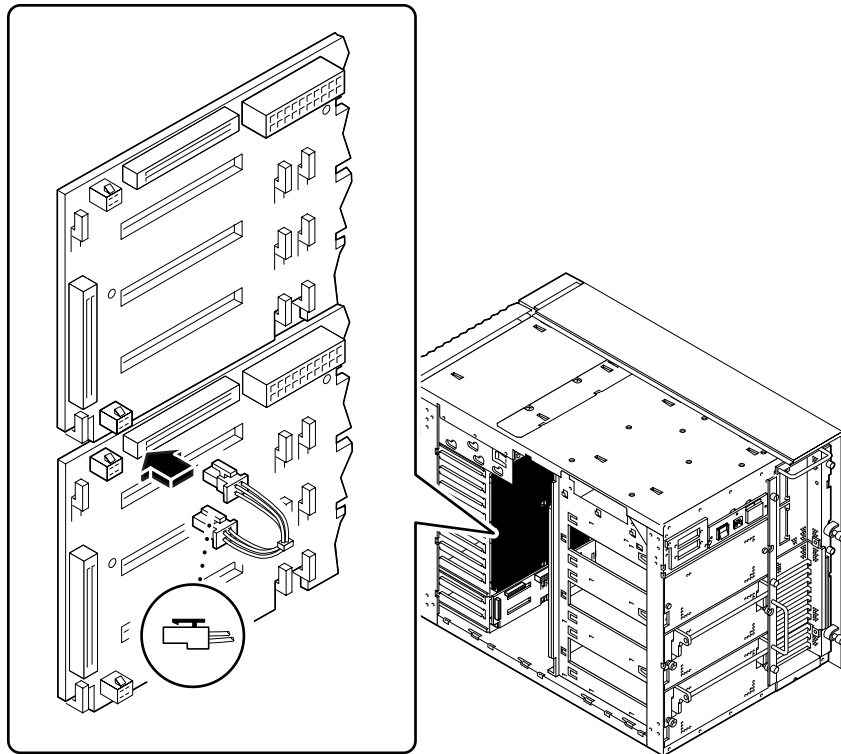
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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

1. *If you are installing the I<sup>2</sup>C cable for the upper 8-slot UltraSCSI backplane:*
  - a. **Connect the cable to the lower 8-slot backplane at connector P0601.**  
Make sure that the tab on the top of the connector locks in place.





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# How to Remove the Keyswitch Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## Before You Begin

Complete these tasks:

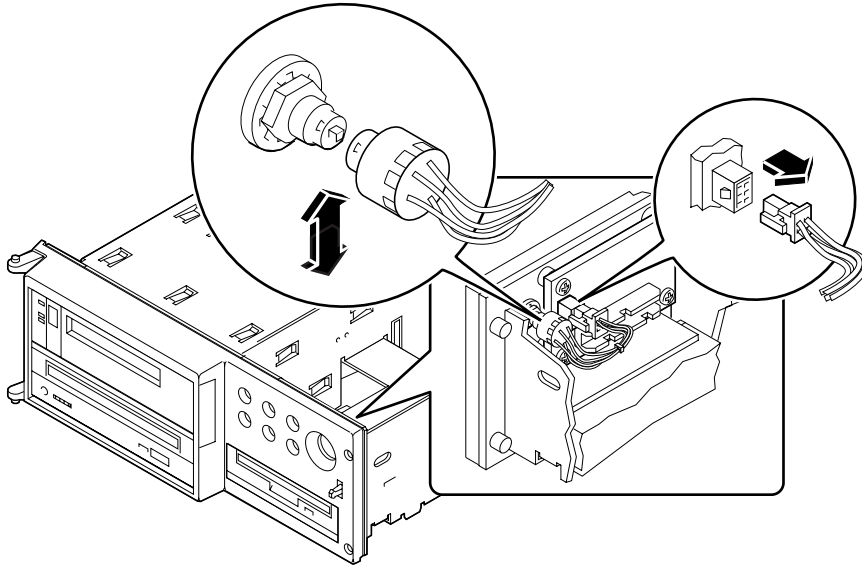
- “How to Power Off the System” on page 26
- “How to Remove the Right Side Panel” on page 32
- “How to Avoid Electrostatic Discharge” on page 40
- “How to Remove the Disk Fan Tray Assembly” on page 223
- “How to Remove the Removable Media Assembly” on page 216

## What to Do

1. **Disconnect the keyswitch cable from the LED interface board at connector J0105.**  
Press the tab on the back of the connector to release the cable.
2. **Make sure that the keyswitch is turned counter-clockwise as far as it will go (⏻ position).**

**3. Disconnect the other end of the cable from the keyswitch assembly.**

Carefully press up or down on the end the cable and pull it away from the keyswitch assembly. If necessary, insert an extra small flat-blade screwdriver into the small slit to pry the connector loose.



## What Next

To replace the cable, complete this task:

- “How to Install the Keyswitch Cable” on page 339

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# How to Install the Keyswitch Cable



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**Caution** – This procedure must be performed by a qualified service-trained maintenance provider. Persons who remove any of the outer panels to access this equipment must observe all safety precautions and comply with skill level requirements, certification, and all applicable local and national laws.

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## What to Do

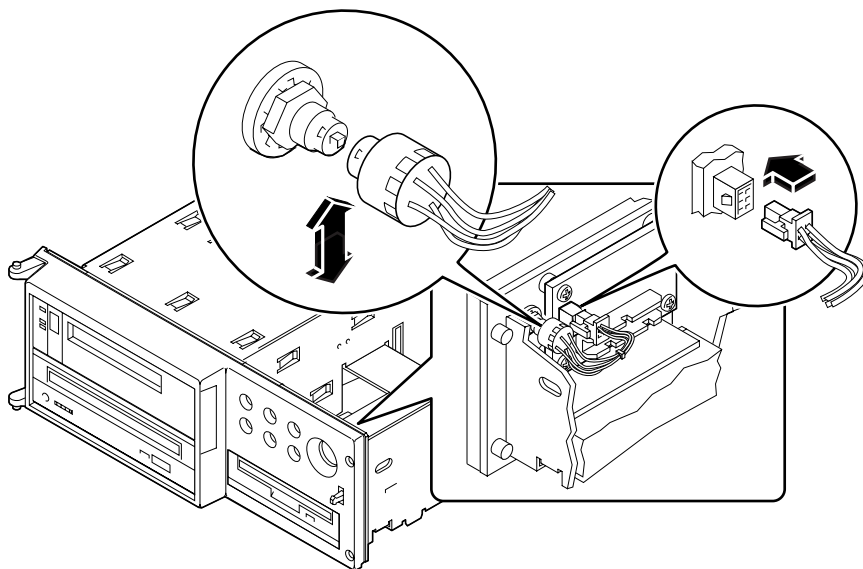
1. **Connect the 6-pin connector of the keyswitch cable to the LED interface board at connector J0105.**

The connector is keyed so that you can connect it in only one way.

2. **Make sure that the keyswitch is turned counter-clockwise as far as it will go (⏻ position).**

3. **Connect the other end of the cable to the keyswitch assembly.**

Align the three rectangular slots on the cable connector with the corresponding tabs on the keyswitch assembly.



## What Next

Complete these tasks to reassemble the system:

- “How to Install the Removable Media Assembly” on page 220
- “How to Install the Disk Fan Tray Assembly” on page 225
- “How to Install the Right Side Panel” on page 34



# Administration and Networking

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This chapter focuses on administrative tasks associated with Ethernet interfaces and the disk array.

*Tasks covered in this chapter include:*

- *How to Configure the Standard Ethernet Interface—page 343*
- *How to Add an Ethernet Interface—page 345*
- *How to Attach a Twisted-Pair Ethernet (TPE) Cable—page 348*
- *How to Attach an MII Ethernet Transceiver—page 350*
- *How to Boot the System Using the Standard Ethernet Interface—page 353*
- *How to Boot the System Using a PCI-Based Ethernet Interface—page 355*
- *How to Select the Boot Device—page 357*

*Other information covered in this chapter includes:*

- *About Network Interface Options—page 342*
- *About Disk Array Configurations and Concepts—page 359*

---

# About Network Interface Options

The system's main logic board provides an auto-sensing, switchable 10BASE-T/100BASE-TX Ethernet interface conforming to the IEEE 802.3u Ethernet standard. The interface configures itself automatically for either 10-Mbps or 100-Mbps operation, depending on network characteristics.

Two rear panel connectors provide access to the Ethernet interface:

- One RJ-45 connector for connecting a twisted-pair Ethernet (TPE) cable
- One Media Independent Interface (MII) connector for connecting an external MII transceiver

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**Note** – You can use only one of the main logic board Ethernet connectors; you cannot connect to the TPE and MII connectors at the same time.

---

The Media Independent Interface lets you connect the system to a variety of external 100BASE-TX (Fast) Ethernet transceivers, providing compatibility with different Ethernet wiring types. When an external transceiver is connected to the MII, the system automatically activates the MII port and disables the TPE port.

Sun Microsystems offers an MII-to-AUI transceiver as a separately orderable option (order number X467A). A number of third-party MII transceivers are also available for connecting to TX, T4, FX, and AUI-type Ethernet networks.

For instructions on configuring the main logic board Ethernet interface, see “How to Configure the Standard Ethernet Interface” on page 343. For information about operating characteristics and configuration parameters for the `hme` Fast Ethernet device driver, please see *Platform Notes: The Fast Ethernet Device Driver*. This document is available on *Solaris on Sun Hardware AnswerBook*, which is provided on the SMCC Updates CD for the Solaris release you are running.

Additional network interfaces are available through PCI cards, providing connection to Ethernet, token ring, FDDI, and other network types. For more information, see “How to Add an Ethernet Interface” on page 345 and the documentation supplied with the PCI network interface card.

---

# How to Configure the Standard Ethernet Interface

## Before You Begin

You must perform the following tasks:

- Complete the prerequisite steps in “How to Install the Sun Ultra 450 Workstation” on page 15.
- Determine which of the two Ethernet ports you want to use; see “About Network Interface Options” on page 342.
- Attach a cable to the appropriate Ethernet port; see “How to Attach a Twisted-Pair Ethernet (TPE) Cable” on page 348 or “How to Attach an MII Ethernet Transceiver” on page 350.

---

**Note** – You can configure only one Ethernet interface during installation of the operating system. To configure additional interfaces, see “How to Add an Ethernet Interface” on page 345.

---

## What to Do

### 1. Assign a host name to the machine.

The host name must be unique within the network. It can be made up of characters and numbers. Do not use a dot in the host name. Do not begin the name with a number or a special character.

### 2. Determine the IP address for the interface.

An IP address must be assigned by your network administrator. Each network device or interface must have a unique IP address.

### 3. Resume the installation of the system.

See “How to Install the Sun Ultra 450 Workstation” on page 15. When installing the operating system, you may be prompted to enter the host name and IP address of the machine.

---

**Note** – If you have installed a PCI card as a second Ethernet interface, the operating system asks you to select a primary network interface and then prompts you for its host name and IP address. You must configure the second interface separately, after the operating system is installed. See “How to Add an Ethernet Interface” on page 345.

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**Note** – This system conforms to the Ethernet 10/100BASE-T standard, which states that the Ethernet 10BASE-T link integrity test function should always be enabled on both the host system and the Ethernet hub. If you have problems verifying connection between this system and your hub, verify that the Ethernet hub also has the link test function enabled. See “Network Communications Failure” on page 418 and refer to the manual provided with your hub for more information about the link integrity test function.

---

## What Next

After completing this procedure, the Ethernet interface is ready for operation. However, in order for other network devices to communicate with the system, the system’s IP address and host name must be entered into the namespace on the network name server. For information about setting up a network name service, consult the *Solaris System Administrator AnswerBook* for your specific Solaris release.

The the `hme` Fast Ethernet device driver for the system’s standard Ethernet interface is automatically installed with the Solaris release. For information about operating characteristics and configuration parameters for the `hme` driver, please see *Platform Notes: The hme Fast Ethernet Device Driver*. This document is available on *Solaris on Sun Hardware AnswerBook*, which is provided on the SMCC Updates CD for the Solaris release you are running.

If you want to add an additional network interface by means of a PCI card, you must configure it separately, after installing the operating system. see:

- “How to Add an Ethernet Interface” on page 345.

---

# How to Add an Ethernet Interface

## Before You Begin

Follow this procedure to add a PCI card that provides an additional Ethernet interface.

You must perform the following tasks:

- Install the system; see “How to Install the Sun Ultra 450 Workstation” on page 15.
- Install any additional PCI Ethernet interface cards that you wish to configure; see “How to Install a PCI Card” on page 149.
- Attach a cable to the new Ethernet port and to the network; see “How to Attach a Twisted-Pair Ethernet (TPE) Cable” on page 348 or “How to Attach an MII Ethernet Transceiver” on page 350.

## What to Do

### 1. Assign a network host name to the interface.

- The host name must be unique within the network. It can be made up of characters and numbers. Do not use a dot in the host name. Do not begin the name with a number or a special character.
- Usually an interface host name is based on the machine host name. For example, if the machine is assigned the host name `zardo`, then the additional Ethernet interface could be named `zardo-1`. The machine’s host name is assigned when operating system software is installed. For more information, see the installation instructions accompanying the Solaris software.

### 2. Determine the IP address for the interface.

An IP address must be assigned by your network administrator. Each interface on a network must have a unique IP address.

### 3. Boot the operating system and log on to the system as superuser.

Enter the following command at the system prompt, and the superuser password:

```
zardo # su
Password:
```

#### 4. Create an appropriate `/etc/hostname` file for the new interface.

The name of the file you create should be of the form `/etc/hostname.typenum`, where *type* is the Ethernet type identifier (some common types are `hme`, `le`, `nf`, and `ie`) and *num* is the logical number of the interface according to the order in which it was installed in the system.

For example, the standard interface provided on the system's main logic board is `hme0` (*type* = `hme`, *num* = 0). If you add a SunSwift PCI Ethernet adapter card as a second `hme` interface, the file name should be `hostname.hme1`.

---

**Note** – The documentation accompanying the Ethernet interface should identify its type. Alternatively, you can enter the `show-devs` command from the `ok` prompt to obtain a list of all installed devices.

---

The host name has an associated IP address that you enter in the `/etc/hosts` file. See Step 6.

#### 5. Enter the host name, assigned in Step 1, to the `/etc/hostname` file for the new interface.

Following is an example of the `/etc/hostname` files required for a machine called `zardoz`, which has two Ethernet interfaces—the standard on-board Ethernet interface (`hme0`) and a second interface provided by a PCI Ethernet adapter card (`hme1`). The host name will be `zardoz` to a network connected to the standard `hme0` interface, and `zardoz-1` to a network connected to the `hme1` interface.

```
zardoz # cat /etc/hostname.hme0
zardoz
zardoz # cat /etc/hostname.hme1
zardoz-1
```

#### 6. Create an entry in the `/etc/hosts` file for each active Ethernet interface.

An entry consists of the IP address and the host name for each interface.

The following example shows the entries in the `/etc/hosts` file for the interfaces identified in the `/etc/hostname` file created in Step 4 and Step 5.

```
zardoz # cat /etc/hosts
...
127.0.0.1    localhost
129.144.10.57 zardoz    loghost
129.144.11.83 zardoz-1
```

## 7. Reboot the system; enter:

```
zardoz # reboot -- -r
```

This command rebuilds the device trees so the system will recognize the newly installed PCI Ethernet adapter card.

## What Next

After completing this procedure, the Ethernet interface is ready for operation. However, in order for other network devices to communicate with the system through this interface, the interface information (its IP address and host name) must be entered into the namespace on the network name server. For information about setting up a network name service, consult the *Solaris System Administrator AnswerBook* for your specific Solaris release.

---

# How to Attach a Twisted-Pair Ethernet (TPE) Cable

## Before You Begin

If you are attaching a twisted-pair Ethernet (TPE) cable to the system's standard Ethernet interface, you must perform the following task:

- Complete prerequisite steps in “How to Install the Sun Ultra 450 Workstation” on page 15.

If you are installing an additional Ethernet interface, you must perform the following tasks:

- Install the system; see “How to Install the Sun Ultra 450 Workstation” on page 15.
- Install a PCI Ethernet interface card; see “How to Install a PCI Card” on page 149.

## What to Do

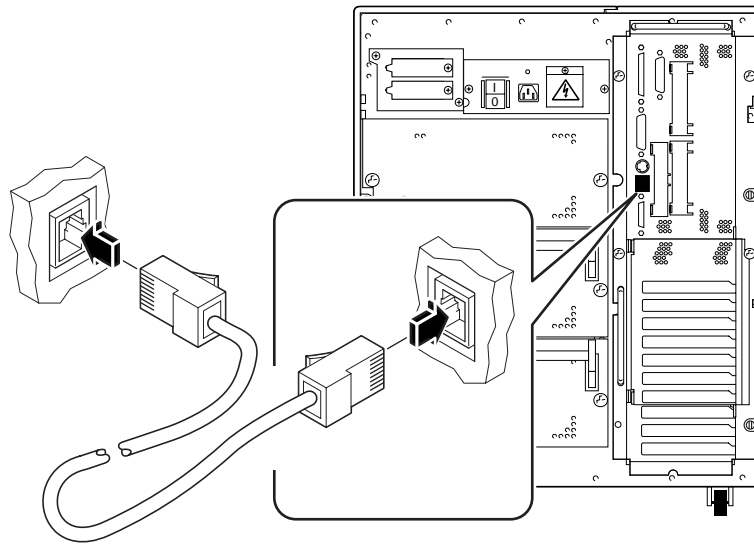
- 1. Locate the RJ-45 connector for the appropriate Ethernet interface.**

The system comes with one TPE connector on the rear panel. A PCI card could also be used to provide a TPE connection to an additional Ethernet interface.



**2. Plug in the TPE cable to the appropriate RJ-45 connector.**

You should hear the connector tab click into place.



**3. Plug the other end of the cable into the TPE outlet in the wall or the floor.**

You should hear the connector tab click into place.

See your network administrator if you need more information about how to connect to your network.

---

**Note** – You can use only one of the main logic board Ethernet ports. You cannot connect to the main logic board’s TPE and MII ports at the same time. For information about connecting to the MII port, see “How to Attach an MII Ethernet Transceiver” on page 350.

---

## What Next

If you are installing your system, complete the installation procedure. Return to:

- “How to Install the Sun Ultra 450 Workstation” on page 15

If you are adding additional interfaces to the system, then you need to configure those interfaces; see:

- “How to Add an Ethernet Interface” on page 345

---

# How to Attach an MII Ethernet Transceiver

The Media Independent Interface (MII) lets you connect the system to a variety of external Fast Ethernet transceivers, providing compatibility with different Ethernet wiring types.

You can order an MII-to-AUI transceiver from Sun Microsystems as a separate option (order number X467A). A number of third-party MII transceivers are also available for connecting to TX, T4, FX, and AUI-type Ethernet networks.

The procedure below assumes you are connecting the Sun MII-to-AUI transceiver. For third-party transceivers, see the documentation supplied with the transceiver.

## Before You Begin

If you are attaching an Ethernet Media Independent Interface (MII) transceiver to the system's standard Ethernet interface, you must have already performed the following task:

- Completed prerequisite steps in "How to Install the Sun Ultra 450 Workstation" on page 15

If you are adding an Ethernet interface, you must have already performed the following tasks:

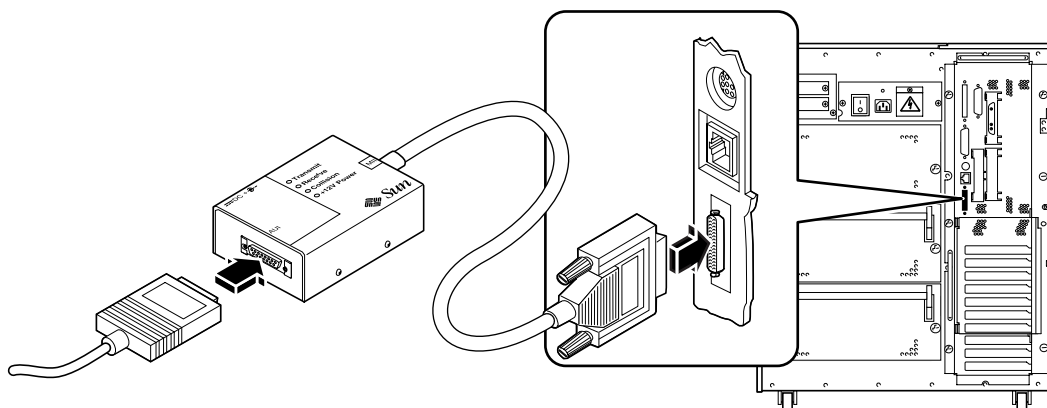
- Installed the system; see "How to Install the Sun Ultra 450 Workstation" on page 15
- Installed a PCI Ethernet interface card; see "How to Install a PCI Card" on page 149

## What to Do

### 1. Locate the appropriate MII Ethernet connector.

The system comes with one MII Ethernet connector on the rear panel. A PCI card could also be used to provide an MII connection to an additional Ethernet interface.

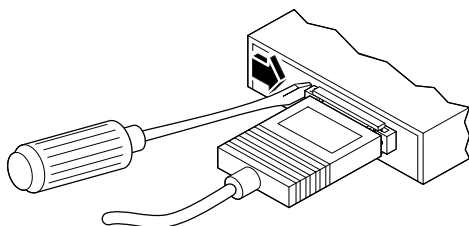
2. Plug the MII Ethernet transceiver into the MII Ethernet connector on the system rear panel.



3. Attach the network AUI cable to the AUI connector on the MII-to-AUI transceiver.

4. Lock the AUI connector.

As viewed from the top, slide the latch to the right to lock the AUI cable to the MII-to-AUI transceiver. Use a flat-blade screwdriver, if necessary.



5. Connect the other end of the cable to the appropriate network device.

There are a variety of connector and cabling options available for the AUI connection. See your network administrator if you need more information about how to connect to your network.

---

**Note** – You can use only one of the main logic board Ethernet ports. You cannot connect to the main logic board’s TPE and MII ports at the same time. For information about connecting to the TPE port, see “How to Attach a Twisted-Pair Ethernet (TPE) Cable” on page 348.

---

## What Next

If you are installing your system, then complete the installation procedure.  
Return to:

- “How to Install the Sun Ultra 450 Workstation” on page 15

If you are adding an additional interface to your system, then you need to configure that interface; see:

- “How to Add an Ethernet Interface” on page 345.

---

# How to Boot the System Using the Standard Ethernet Interface

## Before You Begin

Before you can boot the system over a network interface, you must complete the installation procedure; see:

- “How to Install the Sun Ultra 450 Workstation” on page 15

Specifically, you must perform the following tasks:

- Configure the Ethernet port; see “How to Configure the Standard Ethernet Interface” on page 343
- Attach the Ethernet port to a network; see “How to Attach a Twisted-Pair Ethernet (TPE) Cable” on page 348 or “How to Attach an MII Ethernet Transceiver” on page 350
- Power up the system; see “How to Power On the System” on page 28

---

**Note** – To boot the system over an Ethernet network, it is necessary that there be a bootable image for Sun4u architecture somewhere on the network. For details, see the installation instructions accompanying your Solaris software.

---

## What to Do

- At the `ok` prompt,
  - a. To load the operating system into the server’s volatile memory, enter:

```
ok boot net
```

---

**Note** – Because the operating system is only in volatile memory, it is not retained across power cycles.

---

**b. To install the operating system onto the server's internal system disk, enter:**

```
ok boot net - install
```

Both commands boot the system, and the system console displays the system prompt.

## What Next

If you want to use the main logic board Ethernet interface as the default boot device, you must change the value of certain OpenBoot parameters. For more information, see *OpenBoot 3.x Command Reference Manual* in the *Solaris System Administrator AnswerBook* for your specific Solaris release.

---

# How to Boot the System Using a PCI-Based Ethernet Interface

## Before You Begin

Before you can boot the system over a network interface, you must complete the installation procedure; see:

- “How to Install the Sun Ultra 450 Workstation” on page 15

Specifically, you must perform the following tasks:

- Configure the PCI-based Ethernet port; see “How to Add an Ethernet Interface” on page 345
- Attach the Ethernet port to a network; see “How to Attach a Twisted-Pair Ethernet (TPE) Cable” on page 348 or “How to Attach an MII Ethernet Transceiver” on page 350
- Power up the system; see “How to Power On the System” on page 28

---

**Note** – To boot the system over an Ethernet network, it is necessary that there be a bootable image for Sun4u architecture somewhere on the network. For details, see the installation instructions accompanying your Solaris software.

---

## What to Do

1. At the `ok` prompt, enter:

```
ok show-devs
```

The `show-devs` command lists the system devices. It displays the full path name of the `hme` device, similar to the example below:

```
/pci@6,2000/pci@1/SUNW,hme@1,1
```

## 2. Change the default net device.

At the ok prompt, enter:

```
ok nvalias net hme_path
ok nvstore
```

where *hme\_path* is the full path name of the hme device—in this example, `/pci@6,2000/pci@1/SUNW,hme@1,1`.

## 3. Load and boot the operating system over the network interface.

a. To load the operating system into the server's volatile memory, enter:

```
ok boot net
```

---

**Note** – Because the operating system is only in volatile memory, it is not retained across power cycles.

---

b. To install the operating system onto the server's internal system hard drive, enter:

```
ok boot net - install
```

Both commands boot the system, and the system console displays the system prompt.

## What Next

If you want to use this Ethernet interface as the default boot device, you must permanently change the value of the `boot-device` parameter. For more information, see:

- “How to Select the Boot Device” on page 357
- *OpenBoot 3.x Command Reference Manual* in the *Solaris System Administrator AnswerBook* for your specific Solaris release



---

# How to Select the Boot Device

## Before You Begin

Before you can select a boot device, you must complete the installation procedure; see:

- “How to Install the Sun Ultra 450 Workstation” on page 15

Specifically, you must perform the following tasks:

- Power up the system; see “How to Power On the System” on page 28

If you want to boot across a network interface, then you must also perform the following tasks:

- Configure the Ethernet port; see “How to Configure the Standard Ethernet Interface” on page 343
- Attach the Ethernet port to a network; see “How to Attach a Twisted-Pair Ethernet (TPE) Cable” on page 348 or “How to Attach an MII Ethernet Transceiver” on page 350

The device that is used to boot the system is determined by the setting of an OpenBoot firmware configuration parameter called `boot-device`. The default setting of this parameter is `disk net`. Because of this setting, the firmware first attempts to boot from the system hard drive, and if that fails, then from the main logic board Ethernet interface.

This procedure assumes that you are familiar with the OpenBoot firmware and that you know how to enter the OpenBoot environment. For more information about the OpenBoot firmware, see *OpenBoot 3.x Command Reference Manual* in the *Solaris System Administrator AnswerBook* for your specific Solaris release.

## What to Do

1. At the `ok` prompt, enter:

```
ok setenv boot-device device-specifier
```

where the *device-specifier* is one of the following:

- `cdrom` – Selects the CD-ROM drive

- `disk` – Selects the hard disk
- `floppy` – Select the 3.5-inch diskette drive
- `tape` – Selects the SCSI tape drive
- `net` – Selects the Ethernet interface on the main logic board
- *full path name* – Selects the Ethernet interface specified by the path name

---

**Note** – You can also specify the name of the program to be booted as well as the way the boot program operates. For more information, see *OpenBoot 3.x Command Reference Manual* in the *Solaris System Administrator AnswerBook* for your specific Solaris release.

---

If you want to select a network interface other than the system board Ethernet interface as the default boot device, you can determine the full path name of each interface, by entering:

```
ok show-devs
```

The `show-devs` command lists the system devices. It displays the full path name of each PCI device. An example of a path name is shown below:

```
/pci@6,2000/pci@1/SUNW,hme@0,1
```

## 2. To cause parameter changes to take effect, enter:

```
ok reset
```

---

**Note** – You can also power cycle the system using the front panel keyswitch to store parameter changes.

---

## What Next

For more information about using the OpenBoot firmware, see *OpenBoot 3.x Command Reference Manual* in the *Solaris System Administrator AnswerBook* for your specific Solaris release.

---

# About Disk Array Configurations and Concepts

The Solstice™ DiskSuite™ software designed for use with the system lets you configure the machine's internal disks in several configurations called *disk arrays* that improve performance, capacity, and availability.

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**Note** – Solstice DiskSuite and other software must be ordered separately.

---

This section describes some of the most popular and useful of those configurations, including:

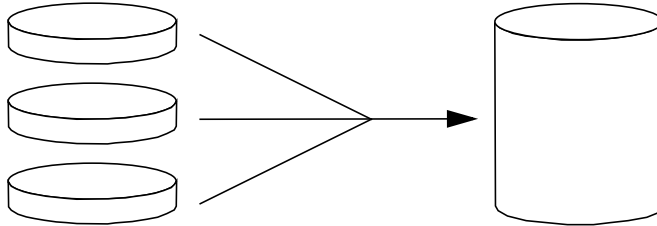
- Disk concatenation
- Disk mirroring (RAID 1)
- Disk striping (RAID 0)
- Disk striping with parity (RAID-5)
- Hot spares
- Hot plug

The DiskSuite software creates *metadevices*—logical disk devices consisting of one or more physical disks or partitions from several disks. Once you use Solstice DiskSuite to create a metadevice, the operating system uses and maintains the metadevice as if it were a single device.

For instance, you can combine the three disks `c1t2d0s2`, `c1t3d0s2`, and `c1t4d0s2` into the metadevice `/dev/md/rdisk/d0`.

## Disk Concatenation

Disk concatenation is a method for increasing logical volume size beyond the capacity of one disk drive by creating one large metadvice from two or more smaller drives. This lets you create arbitrarily large partitions.



Using this method, the concatenated disks are filled with data sequentially, with the second disk being written to when no space remains on the first, the third when no room remains on the second, and so on.

## RAID 1: Disk Mirroring

Disk mirroring is a technique that uses data redundancy—two complete copies of all data stored on two separate disks—to protect against loss of data due to disk failure. One metadvice is created from two disks.

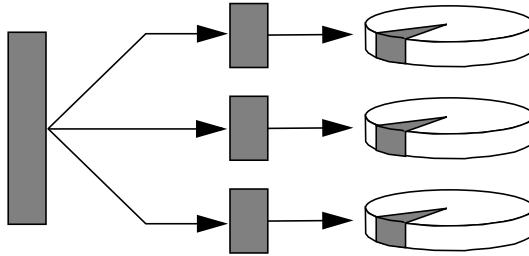


Whenever the operating system needs to write to the mirrored metadvice, both disks are updated. The disks are maintained at all times with exactly the same information. When the operating system needs to read from the mirrored metadvice, it reads from whichever disk is more readily accessible at the moment. The scheme is sometimes called *RAID-1*, where RAID stands for *Redundant Arrays of Inexpensive Disks*.

RAID 1 offers the highest level of data protection, but storage costs are high, since all data is stored twice.

## RAID 0: Disk Striping

Disk striping (sometimes called *RAID-0*) is a technique for increasing system throughput by using several disk drives in parallel. Whereas in non-striped disks the operating system writes a single block to a single disk, in a striped arrangement each block is divided and portions of the data are written to different disks.



System performance using RAID 0 will be better than using RAID 1 or 5, but the possibility of data loss is greater because there is no way to retrieve or reconstruct data stored on a failed drive.

## RAID 5: Disk Striping with Parity

RAID Level 5 is an implementation of disk striping in which parity information is included with each disk write. The advantage of the technique is that if any one disk in a RAID-5 array fails, all the information on the failed drive can be reconstructed from the data and parity on the remaining disks.

System performance using RAID 5 will fall between that of RAID 0 and RAID 1, and all data loss is fully protected.

## Hot Spares

In a hot spares arrangement, one or more disk drives are installed in the system but are unused during normal operation. Should one of the active drives fail, disk write operations are automatically redirected to a hot spare disk and the failed disk drive is retired from operation.

## Hot Plug

The system's disk bays are designed to permit disk drive removal and insertion while the system is powered on. Hot-plug technology significantly increases the system's serviceability and availability, by providing the ability to:

- Add additional hardware dynamically to enable the system to handle an increasingly larger workload, perform load balancing, and improve performance of a running system.
- Remove/replace faulty hardware with minimal system service disruption.

For more information about hot-pluggable disk drives, see "About Internal Disk Drives" on page 63.

## For More Information

See the documentation supplied with the Solstice DiskSuite software.

## Storage Devices

---

Your system accommodates one internally mounted diskette drive and up to two internal CD-ROM or tape drives. This chapter contains basic information about how to use these devices.

*Tasks covered in this chapter include:*

- *How to Prevent Overwriting of a Diskette—page 364*
- *How to Allow Writing to a Diskette—page 365*
- *How to Insert a Diskette Into Its Drive—page 366*
- *How to Remove a Diskette From Its Drive—page 367*
- *How to Use `fdformat` to Format a New Diskette—page 368*
- *How to Use `fdformat` to Reformat a Used Diskette—page 369*
- *How to Copy Files To and From a Diskette—page 370*
- *How to Insert a Compact Disc Into the Drive—page 371*
- *How to Eject a Compact Disc With Software Commands—page 373*
- *How to Eject a Compact Disc Manually—page 375*
- *How to Eject a Compact Disc in an Emergency—page 377*
- *How to Remove a Tape Cartridge—page 381*
- *How to Control the Tape Drive—page 382*
- *How to Clean the Tape Drive—page 383*

*Other information covered in this chapter includes:*

- *About the Tape Drive and Tape Cartridges—page 379*
- *What If Your CD Drive Can't Read a CD?—page 384*

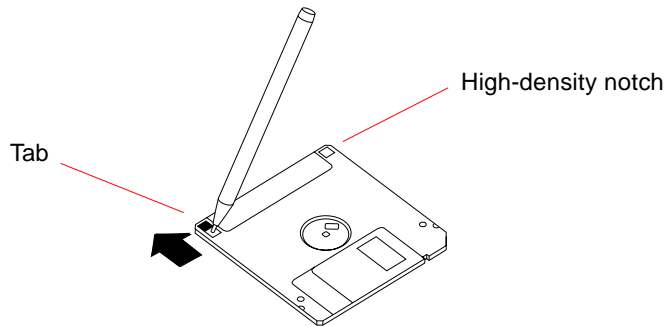
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# How to Prevent Overwriting of a Diskette

You can physically protect a diskette (write-protect it) so that data cannot be erased or overwritten. Once you have write-protected a diskette, additional information cannot be saved on it. When you no longer want to protect the information on a diskette, you can change it back to write-enable status and once again write and store information on it.

## What to Do

1. Turn the diskette upside-down and find the write-protect tab.
2. Move the tab toward the diskette's edge until you can see through the notch.  
Use a ballpoint pen or other implement. When you can see through the notch, the diskette is write-protected.



## What Next

If you want to change the diskette to write-enable status, see:

- “How to Allow Writing to a Diskette” on page 365



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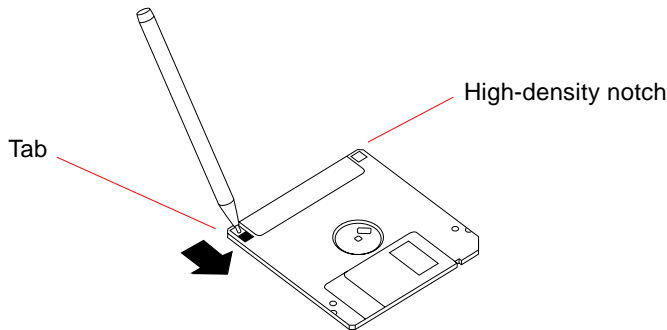
# How to Allow Writing to a Diskette

You can physically protect a diskette (write-protect it) so that data cannot be erased or overwritten. Once you have write-protected a diskette, additional information cannot be saved on it. When you no longer want to protect the information on a diskette, you can change it back to write-enabled status and once again write and store information on it.

## What to Do

1. Turn the diskette upside-down and find the write-protect tab.
2. Push the tab away from the diskette's edge as far as it will go.

Use a ballpoint pen or other implement. When the notch is covered, the diskette is write-enabled.



## What Next

You can now write to the diskette. If the diskette hasn't been formatted, see:

- “How to Use `fdformat` to Format a New Diskette” on page 368

If you want to change the diskette to write-protect status, see:

- “How to Prevent Overwriting of a Diskette” on page 364

---

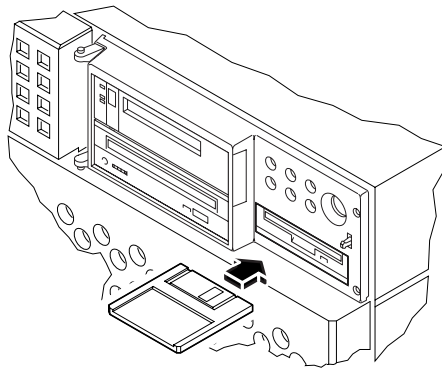
# How to Insert a Diskette Into Its Drive

## Before You Begin

To access the drive, you must open the top door on the front of the system.

## What to Do

1. **Insert the diskette, with the label side up, into the drive.**
2. **Push firmly until you feel the diskette click into position.**



## What Next

For instructions on removing a diskette from the drive, see:

- “How to Remove a Diskette From Its Drive” on page 367.

---

# How to Remove a Diskette From Its Drive

## Before You Begin

To access the drive, you must open the top door on the front of the system.

## What to Do

1. **From the console device, type `eject`**

The operating system unmounts the file system on the diskette.

2. **Press the Eject button on the front of the diskette drive.**

The diskette unseats itself and pops halfway out of the drive. Pull it from the diskette drive.

## What Next

If you are finished using the diskette drive, close the top door on the front of the chassis.

---

# How to Use `fdformat` to Format a New Diskette

## Before You Begin

You must format new diskettes before you use them. The simplest way to format, list the contents of, read, copy, or eject a diskette is to use the File Manager tool. Refer to *Solaris User's Guide* for information about File Manager.

If the diskette is write-protected, you have to remove the write protection; see:

- “How to Allow Writing to a Diskette” on page 365

To access the drive, you must open the top door on the front of the chassis.

## What to Do

1. **Insert the diskette into the diskette drive.**
2. **From the console device, enter the `fdformat` command.**

Type the appropriate command, as listed for your diskette. It takes a minute or two for the system to format the diskette.

Diskette Density	Storage Capacity (Formatted)	Command
High Density (HD)	1.44 Mbytes	<code>fdformat</code>
Medium Density (MD)	1.2 Mbytes	<code>fdformat -m</code>
Low Density (2DD)	720 Kbytes	<code>fdformat -l</code>

## What Next

You can now write to and read from the diskette.

---

# How to Use `fdformat` to Reformat a Used Diskette

## Before You Begin

The simplest way to format, list the contents of, read, copy, or eject a diskette is to use the File Manager tool. Refer to *Solaris User's Guide* for information about File Manager.



---

**Caution** – Formatting erases everything on a diskette. Do not format a used diskette unless you want to erase its contents.

---

If the diskette is write-protected, you have to remove the write protection; see:

- “How to Allow Writing to a Diskette” on page 365

To access the drive, you must open the top door on the front of the system.

## What to Do

1. **Insert a diskette into the diskette drive.**
2. **From the console device, enter the `fdformat` command.**

Type the appropriate command, as listed for your diskette. It takes a minute or two for the system to format the diskette.

---

Diskette Density	Storage Capacity (Formatted)	Command
High Density (HD)	1.44 Mbytes	<code>fdformat -U</code>
Medium Density (MD)	1.2 Mbytes	<code>fdformat -mU</code>
Low Density (2DD)	720 Kbytes	<code>fdformat -lU</code>

---

## What Next

You can now write to and read from the diskette.

---

# How to Copy Files To and From a Diskette

## What to Do

For instructions on how to copy files and file systems to and from a diskette, see *Solaris 2.x Handbook for SMCC Peripherals* and *Solaris User's Guide*.

---

# How to Insert a Compact Disc Into the Drive

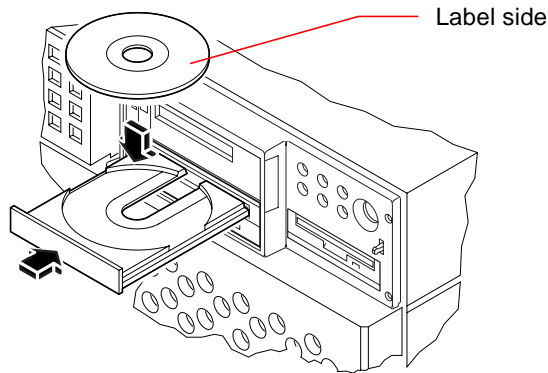
## Before You Begin

To access the drive, you must open the top door on the front of the chassis.

## What to Do

1. **Push the Eject button on the CD-ROM drive to release the drive tray.**
2. **Place a CD into the drive tray, label side up.**

A compact disc is a single-sided storage medium. Place it into the tray with the label side up, as shown.



3. **Gently push the tray back into the drive.**

The CD drive has an automated closing mechanism that retracts the tray into the drive.

## What Next

You can eject a compact disc from the drive by using one of three methods:

- With software commands; see “How to Eject a Compact Disc With Software Commands” on page 373
- Manually; see “How to Eject a Compact Disc Manually” on page 375
- Using an emergency procedure; see “How to Eject a Compact Disc in an Emergency” on page 377



---

# How to Eject a Compact Disc With Software Commands

## Before You Begin

To access the drive, you must open the top door on the front of the chassis.



---

**Caution** – The CD-ROM drive is located behind a hinged door in the front top panel. If you eject a CD remotely using software commands, *be sure that the front panel door is open or removed*. Otherwise, the CD will not eject.

---

## What to Do

### 1. Kill processes accessing the CD-ROM drive, if necessary.

The disc will not eject while the drive is in use. To kill any processes accessing the CD-ROM drive, become superuser and type the following:

```
% su
Password:
# fuser -k /cdrom/cdrom0
```

---

**Note** – You should warn users before abruptly halting processes. The command `fuser -u /cdrom/cdrom0` helps you identify who's accessing the CD-ROM drive. Refer to the *Solaris 2.x System Administrator's Guide* for more information about the `fuser` command.

---

### 2. From the console device, enter:

```
% eject cdrom0
```

The CD-ROM disc should eject.

## What Next

You can also eject a compact disc by using one of these methods:

- Manually; see “How to Eject a Compact Disc Manually” on page 375
- Using an emergency procedure; see “How to Eject a Compact Disc in an Emergency” on page 377

---

# How to Eject a Compact Disc Manually

## Before You Begin

To access the drive, you must open the top door on the front of the chassis.

## What to Do

### 1. Kill processes accessing the CD-ROM drive, if necessary.

The front panel Eject button will not eject a disc while the disc is in use. To kill any processes accessing the CD-ROM drive, become superuser and type the following:

```
% su
Password:
# fuser -k /cdrom/cdrom0
```

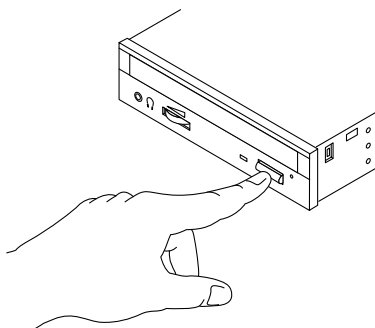
---

**Note** – You should warn users before abruptly halting processes. The command `fuser -u /cdrom/cdrom0` helps you identify who's accessing the CD-ROM drive. Refer to the *Solaris 2.x System Administrator's Guide* for more information about the `fuser` command.

---

### 2. Press the Eject button on the front panel.

The drive ejects the CD tray and you can remove the disc.



## What Next

You can also eject a compact disc by using one of these methods:

- With software commands; see “How to Eject a Compact Disc With Software Commands” on page 373
- Using an emergency procedure; see “How to Eject a Compact Disc in an Emergency” on page 377

---

# How to Eject a Compact Disc in an Emergency

## Before You Begin

Use the emergency ejection procedure *only in emergency situations*, for instance, if you unmounted the disc and the Eject button does not function.

To access the drive, you must open the top door on the front of the chassis.

## What to Do

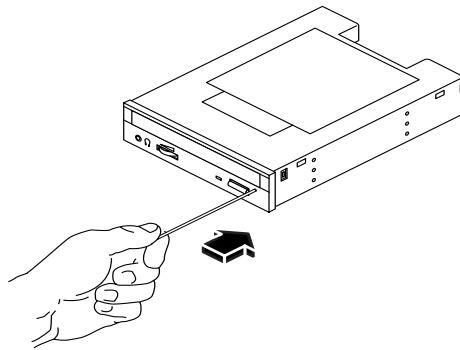


---

**Caution** – If this procedure is used while a disc is mounted, you can degrade or destroy data in your system.

---

- 1. Turn off the power to your system.**  
See “How to Power Off the System” on page 26.
- 2. Unfold and straighten one end of a large wire paper clip.**
- 3. Insert the straightened end of the clip (at least 0.5 inch or 12 millimeters length) into the emergency eject hole and press firmly.**  
Pull the tray from the drive after the clip is inserted into the hole.



## What Next

You can also eject a compact disc by using one of these methods:

- With software commands; see “How to Eject a Compact Disc With Software Commands” on page 373
- Manually; see “How to Eject a Compact Disc Manually” on page 375

---

# About the Tape Drive and Tape Cartridges

There are a number of different tape drives offered by Sun Microsystems for your system. Each tape drive is shipped with a specification sheet that contains the following information:

- Type of cartridges that can be used with the drive
- Cartridge storage capacity
- Handling and storage information
- Physical characteristics
- Power requirements
- Cleaning instructions
- Description of controls, indicators, and jumper setting

## Handling and Storing Tape Cartridges

The following general handling and storage information applies to cartridges for any of the tape drives offered for your system:

- Keep cartridges away from anything magnetic.
- Store cartridges in a dust-free environment.
- Keep cartridges away from direct sunlight and sources of heat, cold, or humidity. Constant room temperature and 50% humidity is recommended.
- Do not touch the surface of the tape.

## Thermal Conditioning

To ensure proper thermal conditioning, keep the tape cartridge at the same temperature as the drive for 24 hours. (This applies to cartridges for any of the tape drives offered for your system.)

---

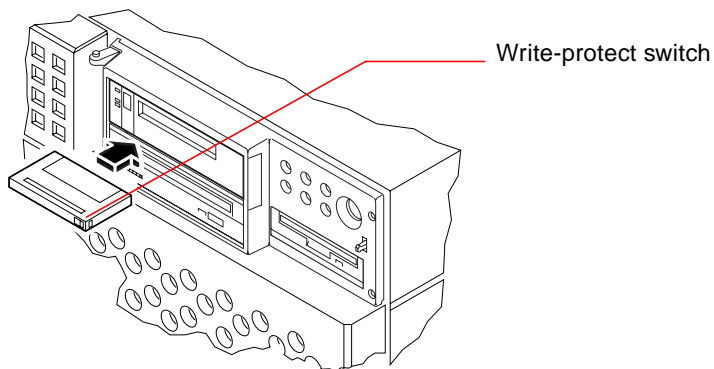
# How to Insert a Tape Cartridge

## Before You Begin

To access the drive, you must open the top door on the front of the chassis.

## What to Do

1. **Verify that the tape cartridge write-protect switch is set correctly.**  
If the lock window is open, the tape is write-protected.



2. **Insert the cartridge into the drive label side up.**
3. **Push gently on the cartridge until it is pulled into the drive.**

## What Next

To remove a tape cartridge from the drive, see:

- “How to Remove a Tape Cartridge” on page 381.



---

# How to Remove a Tape Cartridge

## Before You Begin

To access the drive, you must open the top door on the front of the chassis.

---

**Note** – The information in this section applies to a DDS-3 tape drive. If you have a different type of tape drive installed, see the specifications shipped with the drive for information.

---

## What to Do

### 1. Check that there is no drive activity.

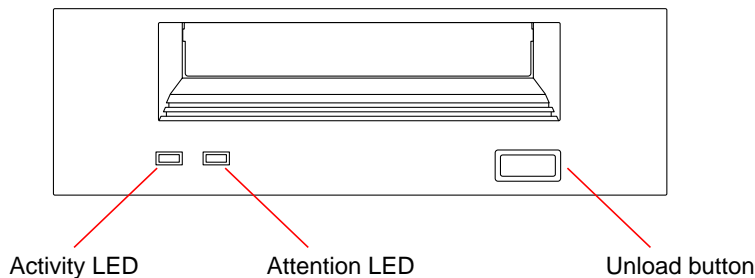
The green LED activity LED should be unlit. A flashing LED indicates drive activity.



---

**Caution** – Do not eject the tape cartridge when the drive is active, or you may incur data loss or equipment damage.

---



### 2. Push the Eject button and remove the tape cartridge.

## What Next

To insert a cartridge into the drive, see:

- “How to Insert a Tape Cartridge” on page 380.

---

# How to Control the Tape Drive

## What to Do

For information about software commands needed to read and write data with your tape drive, refer to *Solaris 2.x Handbook for SMCC Peripherals*, the *Solaris User's Guide*, or AnswerBook documentation.

---

# How to Clean the Tape Drive

## Before You Begin

Observe these rules about *when* to clean a tape drive:

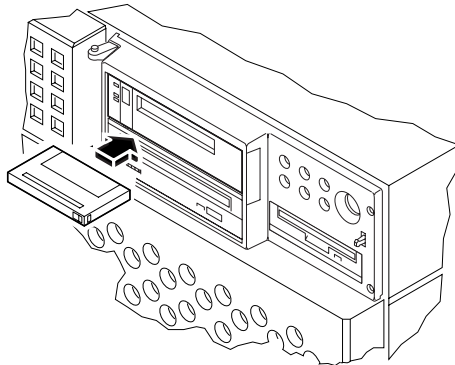
1. Clean the drive after the first four hours of use with a new 4-mm tape.
2. After that, clean the tape drive after every 25 hours of use to maintain reliable operation.
3. Clean the drive twice as often if you use it in a dusty environment or operate it infrequently.

To access the drive, you must open the top door on the front of the chassis.

## What to Do

- **Insert a cleaning cartridge into the drive.**

The tape should play for a short while, and then eject automatically.



Do not use any cartridges other than a DDS-approved cleaning tape cartridge to clean your tape drive.

---

# What If Your CD Drive Can't Read a CD?

## Before You Begin

Open the top door on the front of the chassis. Eject the compact disc and remove it from the tray; see “How to Eject a Compact Disc With Software Commands” on page 373.

---

**Note** – If the drive cannot read a disc, you may have a dusty or dirty disc.

---

## What to Do

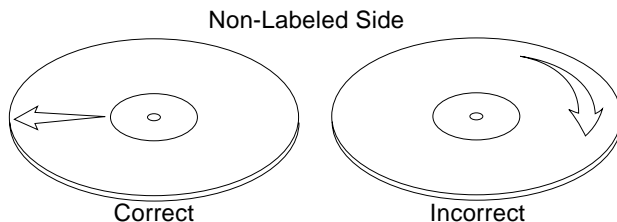
### 1. Clean the disc with compressed air.

Compressed air can remove most accumulations of dust and large dirt particles.

### 2. If spraying with compressed air *fails* to remove the dirt on a disc, wipe the disc using a soft, clean, lint-free, *dry* cloth.

- Wipe the non-labeled side of the disc *radially* from the center to the outside.
- Do *not* wipe in a circular motion.
- Wipe only the affected areas of the disc.

The figure below shows the correct and incorrect ways to clean a compact disc.



## What Next

To insert the compact disc into the drive, see:

- “How to Insert a Compact Disc Into the Drive” on page 371.

# Diagnostics and Troubleshooting

---

This chapter instructs you in the use of diagnostic tools available for the system, and how to use these tools, as well as error indications and software commands to determine what component of the system needs to be replaced.

*Tasks covered in this chapter include:*

- *How to Use POST Diagnostics—page 389*
- *How to Use OpenBoot Diagnostics (OBdiag)—page 399*
- *How to Set the Diagnostic Level for POST and OBdiag—page 402*
- *How to Check Whether SunVTS Software Is Installed—page 405*
- *How to Use SunVTS Software—page 406*

*Other information covered in this chapter includes:*

- *About Diagnostic Tools—page 386*
- *About Power-On Self-Test (POST) Diagnostics—page 388*
- *About OpenBoot Diagnostics (OBdiag)—page 391*
- *About SunVTS Software—page 403*
- *About Troubleshooting Your System—page 408*
- *About Diagnosing Specific Problems—page 418*

---

# About Diagnostic Tools

The system provides both firmware-based and software-based diagnostic tools to help you identify and isolate hardware problems. These tools include:

- Power-on self test (POST) diagnostics
- OpenBoot diagnostics (OBDiag)
- SunVTS™ software

POST diagnostics verify the core functionality of the system, including the main logic board, system memory, and any on-board I/O devices. You can run POST even if the system is unable to boot. For more information about POST, see “About Power-On Self-Test (POST) Diagnostics” on page 388 and “How to Use POST Diagnostics” on page 389.

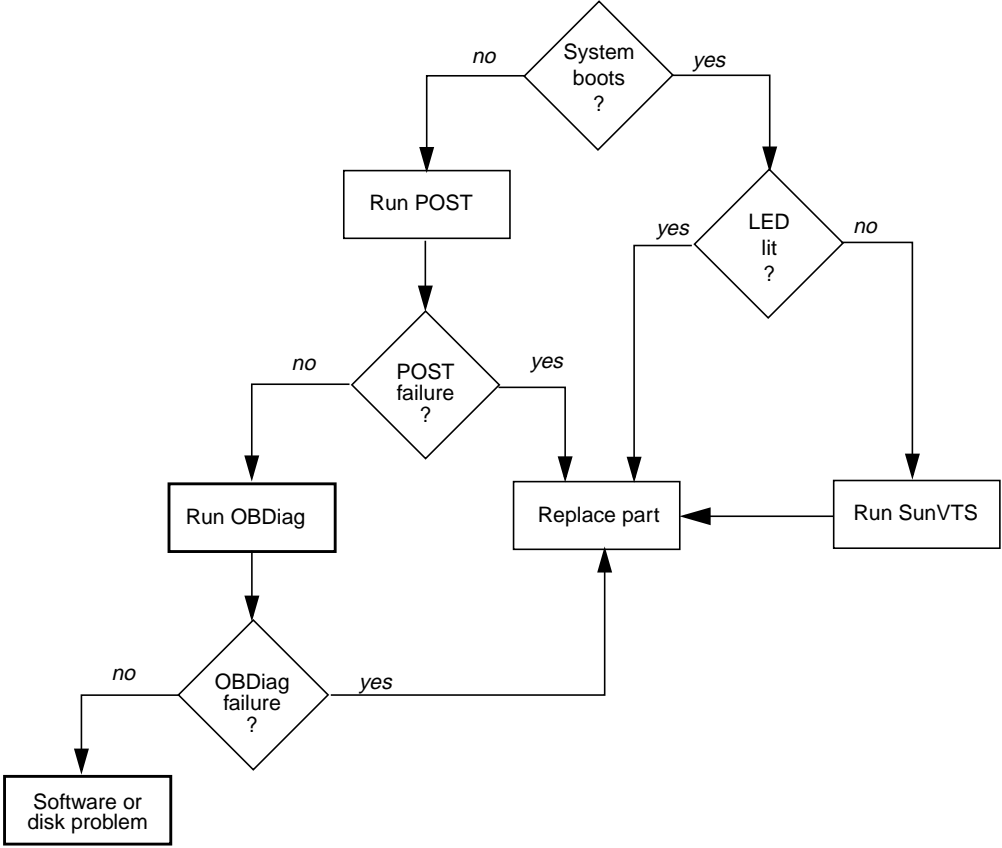
OBDiag tests focus on system I/O and peripheral devices. Like POST, you can run OBDiag even if the system is unable to boot. For more information about OBDiag, see “About OpenBoot Diagnostics (OBDiag)” on page 391 and “How to Use OpenBoot Diagnostics (OBDiag)” on page 399.

The SunVTS system exerciser is a graphically-oriented UNIX application that permits the continuous exercising of system resources and internal and external peripheral equipment. For more information about SunVTS, see “About SunVTS Software” on page 403.

Which method or tool you use to diagnose system problems depends upon the nature of those problems:

- If your machine isn't able to boot its operating system software, you need to run POST and OBDiag tests.
- If your machine is “healthy” enough to start up and load its operating system software, you can use SunVTS software to diagnose system problems.

The following chart provides an overview of when to use the various diagnostic tools to diagnose hardware problems.



---

# About Power-On Self-Test (POST) Diagnostics

The POST diagnostic code resides in flash PROM on the main logic board. It runs whenever the system is turned on or when a system reset is issued. POST tests the following system components:

- CPU modules
- Memory modules
- NVRAM
- Main logic board

POST reports its test results via LEDs located on the system keyboard and on the system front panel. It also displays diagnostic and error messages on a console terminal, if one is attached to the system. See “Error Indications” on page 408 for more information about LEDs and error messages.

For information about running POST, see:

- “How to Use POST Diagnostics” on page 389



---

# How to Use POST Diagnostics

When you turn on the system power, POST diagnostics run automatically if any of the following conditions apply:

- The `diag-switch?` NVRAM parameter is set to `true`.
- You hold down the keyboard's Stop and D keys as you power on the system.
- You power on the system by turning the front panel keyswitch to the Diagnostics position (Ⓜ).

If the event of an automatic system reset, POST diagnostics run under either of the following conditions:

- The `diag-switch?` NVRAM parameter is set to `true` and the `diag-trigger` parameter is set to `error-reset` or `soft-reset`.
- The front panel keyswitch is in the Diagnostics position (Ⓜ) and the `diag-trigger` parameter is set to `error-reset` or `soft-reset`.

For information about the various keyswitch positions, see “About the Status and Control Panel” on page 9.

## Before You Begin

To view POST error messages, you need to connect an alphanumeric terminal or establish a `tip` connection to another Sun system. Otherwise, you cannot view POST diagnostic messages generated by the system. For more information, see:

- “About Setting Up a Console” on page 23.

You can choose to run an abbreviated POST with concise error and status reporting or run an extensive POST with more detailed messages. For more information, see:

- “How to Set the Diagnostic Level for POST and OBdiag” on page 402.

## What to Do

1. **Ensure that the front panel keyswitch is in the Standby position (Ⓜ).**

The main AC power switch, located on the rear panel, must be in the On position. If you need to turn on the main power switch now, you must wait 15 seconds before completing Step 2.

## 2. Turn the keyswitch to the Diagnostics position (ⓧ).

The system runs the POST diagnostics. POST displays status and error messages on the system console.

Upon successful completion of POST, the system will run OBDiag. For more information on OBDiag, see “About OpenBoot Diagnostics (OBDiag)” on page 391 and “How to Use OpenBoot Diagnostics (OBDiag)” on page 399.

## Results

While POST is running, you can observe its progress and any error indications in the following locations:

- System console
- Front panel Fault LED
- Keyboard LEDs (if a keyboard is present)

As POST runs, it displays status messages on the system console. If POST detects an error, it displays an error message on the system console that indicates the failing part. A sample error message is provided below:

```
Power On Self Test Failed. Cause: DIMM U1701 or System Board
ok
```

POST status and error indications are reported to the general fault LED (ⓧ) on the front panel. The LED blinks slowly to indicate that POST is running. It remains lit if POST detects a fault.

If a Sun Type-5 keyboard is attached, POST status and error indications are also displayed via the four LEDs on the keyboard. When POST starts, all four keyboard LEDs blink on and off simultaneously. After that, the Caps Lock LED blinks slowly to indicate POST is running. If an error is detected, the pattern of the lit LEDs provides an error indication. See “Error Indications” on page 408 for more information.

If POST detects an error condition that prevents the system from booting, it will halt operation and display the `ok` prompt. The last message displayed by POST prior to the `ok` prompt indicates which part needs to be replaced.

---

# About OpenBoot Diagnostics (OBDiag)

OpenBoot Diagnostics (OBDiag) reside in flash PROM on the main logic board. OBDiag can isolate errors on the following system components:

- Main logic board
- Audio module
- Diskette drive
- CD-ROM drive
- Tape drive
- Hard drives
- UPA graphics cards
- Any option card that contains an on-board self-test

On the main logic board, OBDiag tests not only the main logic board but also its interfaces:

- PCI
- SCSI
- Ethernet
- Serial
- Parallel
- Keyboard/mouse

OBDiag reports test results via the LEDs on the system front panel and on the keyboard. It also displays diagnostic and error messages on a console terminal, if one is attached to the system. See “Error Indications” on page 408 for more information about LEDs and error messages.

For information about running OBDiag, see:

- “How to Use OpenBoot Diagnostics (OBDiag)” on page 399

## OBDiag Menu

The OBDiag menu is created dynamically whenever you invoke OBDiag in interactive mode. OBDiag determines if any optional devices are installed in the system. If the device has an on-board self-test, OBDiag incorporates the test name into the list of menu entries. It alphabetizes the menu entries and numbers them accordingly. Therefore, the menu entries vary from system to system, depending upon the system configuration.

The menu always displays the core tests that exercise parts of the basic system. These tests are `envctrl`, `ebus`, `ecpp`, `eeprom`, `fdthree`, `network`, `scsi@2`, and `scsi@3`. For information on each test, see “OBDDiag Test Descriptions” on page 395.

After invoking OBDDiag as described in “How to Use OpenBoot Diagnostics (OBDDiag)” on page 399, the OBDDiag menu is displayed.

OBDDiag - Version X.X		
1 SUNW,CS4231@14,200000	2 SUNW,envctrl@14,60000	3 SUNW,ffb@1d,0
4 ebus@1	5 ecpp@14,3043bc	6 eeprom@14,0
7 fdthree@14,3023f0	8 network@1.1	9 scsi@2
10 scsi@3	11 scsi@3	12 scsi@3,1
13 scsi@4	14 scsi@4,1	15 se@14,400000
16 su@14,3062f8	17 su@14,3083f8	
Commands: test test-all except help what printenvs setenv exit		

command>

## OBDDiag Commands

The following table provides information on the OBDDiag interactive commands that are available at the OBDDiag command prompt:

Command	Description
<code>exit</code>	Exits the OBDDiag tool and returns to the <code>ok</code> prompt.
<code>help</code>	Displays a brief description of each command and NVRAM variable used to run OBDDiag.
<code>printenvs</code>	Displays the value of all of the OBDDiag variables. (See “Configuration Variables” on page 393 for information about settings.)
<code>setenv <i>variable value</i></code>	Sets the value for a configuration variable. (See “Configuration Variables” on page 393 for information about settings.)

Command	Description
test-all	Runs all of the tests displayed in the menu.
test #,#, ...	Runs only the test(s) identified by menu entry number (#) in the command line.
except #,#, ...	Run all test(s) except those identified by menu entry number (#) in the command line.
what #,#, ...	Displays selected properties of the device(s) identified by menu entry number (#) in the command line. The exact information provided varies according to device type.

## Configuration Variables

The following table provides information about configuration variables that affect the operation of OBDiag. Use the `printenvs` command to show current values and the `setenv` command to set or change a value. Both commands are described in “OBDiag Commands” on page 392.

Variable	Setting	Description	Default
diag-level <sup>1</sup>	off	No tests are run at power up.	
	min	Performs minimal testing of core functionality.	min
	med	Performs functional tests for all system functions.	
	max	Runs exhaustive tests for all functions except external loopbacks. External loopback tests are run only if <code>diag-targets</code> is set to <code>loopback</code> , <code>loopback2</code> , or <code>loopbacks</code> and <code>diag-level</code> is set to <code>max</code> .	
diag-continue?	false	Stops testing within a test routine and prints a message as soon as an error is detected. OBDiag then skips to the next test routine in the sequence.	false
	true	Causes OBDiag to run all subtests within a test, even if an error is detected.	

Variable	Setting	Description	Default
diag-passes	<i>n</i>	Repeats each test the number of times specified by <i>n</i> . Works with the <code>test</code> , <code>except</code> , and <code>test-all</code> commands.	1
diag-targets	none	Runs internal tests only, no I/O testing.	none
	iopath	Extends testing to external device interfaces (connectors/cables).	
	media	Extends testing to external devices and media, if present.	
	device	Invokes built-in self-test (BIST) on PCI cards and external devices.	
	loopback	Runs external loopback tests on the parallel, serial, keyboard, mouse and TPE ports.	
	loopback2	Runs an external loopback test on MII port.	
	loopbacks	Runs external loopback tests on the parallel, serial, keyboard, mouse, TPE, and MII ports.	
	nomem	Performs tests without testing system memory.	
diag-trigger	power-reset	Runs diagnostics only on power-on resets.	power-reset
	error-reset	Runs diagnostics only on power-on resets, fatal hardware errors, and watchdog reset events.	
	soft-reset	Runs diagnostics on all resets (except XIR).	
diag-verbosity	0	Prints one line that indicates the device being tested and its pass/fail status.	0
	1	Prints more detailed test status, which varies in content from test to test.	
	2	Prints subtest names.	
	4	Prints debug messages.	
	8	Prints back trace of callers on error.	

1. This variable is also used by POST. See "How to Set the Diagnostic Level for POST and OBDiag" on page 402.

# OBDiag Test Descriptions

The following table provides information on the tests available through OBDiag. It provides the test name, a brief description of the test, and any special considerations involved in running the test.

Test Name	Description	Special Considerations
SUNW,CS4231 @14,200000	<p>Tests the interface to the audio module, and the audio module. This test also provides tone tests that produce a continuous sine wave that can be checked with an oscilloscope to isolate faults in the audio circuitry.</p> <p>Tone tests have to be invoked manually from the <code>ok</code> prompt:</p> <pre>ok test /ebus/SUNW,CS4231 ok " /ebus/SUNW,CS4231" begin-select-dev ok tone-mike</pre>	<p>This test does not appear in the OBDiag menu if the audio module is not installed in the system.</p> <p>External loopback cables are required: one unattenuated cable for Line-In/Line-Out and one for Headphone/Microphone ports.</p>
SUNW,envctrl @14,60000	Verifies that the fans are operational. Checks that the temperature in the enclosure, at the CPUs, and at the power supplies does not exceed the maximum allowable range. Also tests the disk and front panel LEDs.	
SUNW,ffb @1d,0	Runs the self-test located on the Creator-series graphics card.	This test does not appear in the OBDiag menu if a Creator-series graphics card is not installed in the system.
ebus@1	Tests the on-board ASIC that interfaces the following devices with the PCI bus: parallel port, serial port, audio module, keyboard, mouse, diskette drive, NVRAM, and the system environmental monitoring and control system.	
ecpp @14,3043bc	Tests parallel port I/O logic, including internal and external loopback tests.	<p>To run external loopback tests, you must have a special passive loopback connector attached to the parallel port, the NVRAM variable <code>diag-level</code> must be set to <code>max</code> and <code>diag-targets</code> must be set to <code>loopback</code> or <code>loopbacks</code>.</p> <p>The part number for the parallel port loopback connector is 501-2965-01.</p>
eprom@14,0	Tests the NVRAM functionality.	

Test Name	Description	Special Considerations
fdthree@14,3023f0	Tests diskette drive control logic and the operation of the drive. The test does not differentiate among a drive, media or main logic board error; if any of these fail, it reports the diskette drive as the FRU.	A formatted diskette must be inserted into the drive.
network@1,1	Tests the on-board Ethernet logic, including internal and external loopback tests.	<p>To run external loopback tests, you must have the MII or TPE loopback connector attached to the appropriate port, the NVRAM variable <code>diag-level</code> must be set to <code>max</code> and <code>diag-targets</code> must be set to <code>loopback2</code> or <code>loopbacks</code>.</p> <p>The part number for the MII loopback connector is 501-4410-01.</p> <p>The part number for the TPE loopback connector is 501-4689-01.</p>
scsi@2	Tests the on-board SCSI controller and SCSI bus subsystem for internal removable media devices and the main logic board external SCSI interface. Checks associated registers and performs a DMA transfer.	
scsi@3	Tests the on-board SCSI controller and SCSI bus subsystem for the 4-slot UltraSCSI backplane. Checks associated registers and performs a DMA transfer.	
scsi@3	Tests the SCSI controller and the SCSI bus subsystem on a SCSI controller PCI card. Checks associated registers and performs a DMA transfer.	This test does not appear in the OBDiag menu if a SCSI controller PCI card is not installed in the system.
scsi@3,1	Tests the second SCSI controller and the SCSI bus subsystem on a dual-channel SCSI controller PCI card. Checks associated registers and performs a DMA transfer.	This test does not appear in the OBDiag menu if a SCSI controller PCI card is not installed in the system.
scsi@4	Tests the SCSI controller and the SCSI bus subsystem on a SCSI controller PCI card. Checks associated registers and performs a DMA transfer.	This test does not appear in the OBDiag menu if a SCSI controller PCI card is not installed in the system.
scsi@4,1	Tests the second SCSI controller and the SCSI bus subsystem on a dual-channel SCSI controller PCI card. Checks associated registers and performs a DMA transfer.	This test does not appear in the OBDiag menu if a SCSI controller PCI card is not installed in the system.



Test Name	Description	Special Considerations
se@14,40000	Tests serial port control and I/O logic, including internal and external loopback tests. The test checks I/O logic only if the external loopback test is enabled.	<p>Port A tests are not run if ttya is being used as the input/output device.</p> <p>To run external loopback tests, you must have a special passive loopback connector attached to the serial port, the NVRAM variable <code>diag-level</code> must be set to <code>max</code> and <code>diag-targets</code> must be set to <code>loopback</code> or <code>loopbacks</code>.</p> <p>There are two passive connectors available for this test: 501-4205-01 and 501-4206-01. Use 501-4205-01 when ports A and B are not attached to external devices. Use 501-4206-01 when port A is attached to a device, in which case port A is not tested.</p>
su@14,3062f8	Tests keyboard control and input logic, including internal and external loopback tests.	<p>No keyboard tests are run if a keyboard is not being used as the input device.</p> <p>To run external loopback tests, you must have a special passive loopback connector attached to the keyboard/mouse port, the NVRAM variable <code>diag-level</code> must be set to <code>max</code> and <code>diag-targets</code> must be set to <code>loopback</code> or <code>loopbacks</code>.</p> <p>The part number for the loopback connector is 501-4690-10.</p>

Test Name	Description	Special Considerations
su@14,3083f8	Tests mouse control and input logic, including internal and external loopback tests.	<p>No mouse tests are run if a keyboard is being used as an input device.</p> <p>To run external loopback tests, you must have a special passive loopback connector attached to the keyboard/mouse port, the NVRAM variable <code>diag-level</code> must be set to <code>max</code> and <code>diag-targets</code> must be set to <code>loopback</code> or <code>loopbacks</code>.</p> <p>The part number for the loopback connector is 501-4690-01.</p>

---

# How to Use OpenBoot Diagnostics (OBDiag)

When you turn on the system power, OBDiag runs automatically if any of the following conditions apply:

- The `diag-switch?` NVRAM parameter is set to `true`.
- You hold down the keyboard's Stop and D keys as you power on the system.
- You power on the system by turning the front panel keyswitch to the Diagnostics position (Ⓜ).

If the event of an automatic system reset, POST diagnostics run under either of the following conditions:

- The `diag-switch?` NVRAM parameter is set to `true` and the `diag-trigger` parameter is set to `error-reset` or `soft-reset`.
- The front panel keyswitch is in the Diagnostics position (Ⓜ) and the `diag-trigger` parameter is set to `error-reset` or `soft-reset`.

For information about the various keyswitch positions, see “About the Status and Control Panel” on page 9.

OBDiag tests run automatically, without operator intervention, under the conditions described above. However, you can also run OBDiag in an interactive mode and select which tests you want to perform. The following procedure describes how to run OBDiag interactively from the system `ok` prompt.

## What to Do

To run OBDiag in interactive mode, complete the following procedure with system power turned *on*:

- 1. With the keyswitch in the Power-on position (I), press the Break key on your alphanumeric terminal's keyboard, or enter the `Stop-a` sequence on a Sun keyboard.**

To enter the `Stop-a` sequence, press the Stop key and the `a` key simultaneously. The `ok` prompt is displayed.

- 2. (Optional) Select the diagnostic level.**

You can choose to run OBDiag with or without external loopback tests. For more information, see “How to Set the Diagnostic Level for POST and OBDiag” on page 402.

**3. Enter obdiag at the ok prompt:**

```
ok obdiag
```

**4. When the OBDiag menu appears, enter the appropriate command and test name/number at the command prompt:**

OBDiag - Version X.X		
1 SUNW,CS4231@14,200000	2 SUNW,envctrl@14,60000	3 SUNW,ffb@1d,0
4 ebus@1	5 ecpp@14,3043bc	6 eeprom@14,0
7 fdthree@14,3023f0	8 network@1.1	9 scsi@2
10 scsi@3	11 scsi@3	12 scsi@3,1
13 scsi@4	14 scsi@4,1	15 se@14,400000
16 su@14,3062f8	17 su@14,3083f8	
Commands: test test-all except help what printenvs setenv exit		

```
command>
```

---

**Note** – For more information about OBDiag tests, see “About OpenBoot Diagnostics (OBDiag)” on page 391.

---

## Results

While OBDiag is running, you can observe its progress and any error messages on the system console. You can use two NVRAM variables to affect error reporting. Using the NVRAM variable `diag-verbosity`, you can determine the type and amount of information that is reported. Using the NVRAM variable `diag-continue?`, you can control how OBDiag behaves after an error is encountered. See “Configuration Variables” on page 393 for more information.

A sample error message is provided below:

```
ERROR : Did not receive expected loopback packet
DEVICE : /pci@1f,4000/network@1,1
FRU    : motherboard
TIME   : 03/21/1997 21:32:34 GMT
CALLER : loopback-test 100mb-xcvr-external-lpb-test catch ...
```

The following table defines the fields in an error message.

Field	Description
ERROR	Description of error
DEVICE	Address of failing device
FRU	List of FRUs that could be responsible for the error
TIME	Time error was detected
CALLER	Subtest that failed

OBDDiag also indicates error conditions by lighting the front panel LEDs. Anytime OBDDiag detects any error, it lights the general Fault LED (🔴). It also uses the other front panel LEDs to indicate faults in the system's internal disk drives, power supply subsystem, or fans. See "About the Status and Control Panel" on page 9 for more information about the front panel LEDs and their meaning.

---

# How to Set the Diagnostic Level for POST and OBDiag

## Before You Begin

Four different levels of diagnostic testing are available for power-on self-test (POST) and OpenBoot Diagnostics (OBDiag): *max* (maximum level), *med* (medium level), *min* (minimum level) and *off* (no testing). The system runs the appropriate level of diagnostics based upon the setting of the NVRAM variable called `diag-level`.

The default setting for `diag-level` is `min`.

## What to Do

---

**Note** – This procedure should be performed with the power on and the keyswitch set to the Power-on (I) position.

---

1. **Press the Break key on your alphanumeric terminal's keyboard, or enter the Stop-a sequence on a Sun keyboard.**

To enter the Stop-a sequence, press the Stop key and the a key simultaneously. The `ok` prompt is displayed.

2. **To set the `diag-level` variable, enter the following:**

```
ok setenv diag-level <value>
```

The `<value>` can be `off`, `min`, `med`, or `max`. See “Configuration Variables” on page 393 for information about each setting.

---

# About SunVTS Software

SunVTS, the Sun Validation and Test Suite, is an online diagnostics tool and system exerciser for verifying the configuration and functionality of hardware controllers, devices, and platforms. You can run SunVTS using any of these interfaces: a command line interface, a `tty` interface, or a graphical interface that runs within a windowed desktop environment.

SunVTS software lets you view and control a testing session over modem lines or over a network. Using a remote system, you can view the progress of a SunVTS testing session, change testing options, and control all testing features of another system on the network.

Useful tests to run on your system include:

SunVTS Test	Description
<code>audio</code>	Verifies the functionality of the audio subsystem
<code>ecpptest</code>	Verifies the ECP1284 parallel port printer functionality
<code>cdtest</code>	Tests the CD-ROM drive by reading the disc and verifying the CD table of contents (TOC), if it exists
<code>disktest</code>	Verifies local disk drives
<code>envtest</code>	Tests the I <sup>2</sup> C environment including all fans, front panel LEDs and keyswitch, backplane LEDs, power supplies, and thermistor readings
<code>ffbttest</code>	Tests the Creator-series graphics card
<code>fputest</code>	Checks the floating-point unit
<code>fstest</code>	Tests the integrity of the software's file systems
<code>mpptest</code>	Verifies multiprocessor features (for systems with more than one processor)
<code>nettest</code>	Checks all the hardware associated with networking (for example, Ethernet, token ring, quad Ethernet, fiber optic, 100-Mbit per second Ethernet devices)
<code>pmem</code>	Tests the physical memory (read only)
<code>sptest</code>	Tests the system's on-board serial ports
<code>tapetest</code>	Tests the various Sun tape devices
<code>vmem</code>	Tests the virtual memory (a combination of the swap partition and the physical memory)

## For More Information

The following documents provide information about SunVTS software. They are available on *Solaris on Sun Hardware AnswerBook*. This AnswerBook documentation is provided on the SMCC Updates CD for the Solaris release you are running.

- *SunVTS User's Guide*

This document describes the SunVTS environment, including how to start and control the various user interfaces. SunVTS features are described in this document.

- *SunVTS Test Reference Manual*

This document contains descriptions of each test SunVTS software runs in the SunVTS environment. Each test description explains the various test options and gives command line arguments.

- *SunVTS Quick Reference Card*

This card gives an overview of the main features of the SunVTS Open Look interface.



---

# How to Check Whether SunVTS Software Is Installed

SunVTS software is an optional package that may or may not have been loaded when your system software was installed.

## What to Do

### 1. Enter the following:

```
% pkginfo -l SUNWvts
```

- If SunVTS software is loaded, information about the package will be displayed.
- If SunVTS software is not loaded, you'll see an error message:

```
ERROR: information for "SUNWvts" was not found
```

### 2. If necessary, use the `pkgadd` utility to load the `SUNWvts` package onto your system from the SMCC Update CD.

Note that `/opt/SUNWvts` is the default directory for installing SunVTS software.

## What Next

For more information, refer to the appropriate Solaris documentation, as well as the `pkgadd` reference manual page.

---

# How to Use SunVTS Software

## Before You Begin

If your system passes the firmware-based diagnostics and boots the operating system, yet does not function correctly, you can use SunVTS, the Sun Validation and Test Suite, to run additional tests. These tests verify the configuration and functionality of most hardware controllers and devices.

You'll need root or superuser access to run SunVTS tests.

## What to Do

### 1. Check whether SunVTS software is loaded on your system.

SunVTS is an optional package that may or may not have been loaded when system software was installed. For more information, see “How to Check Whether SunVTS Software Is Installed” on page 405.

### 2. To start the SunVTS software, enter:

```
# cd /opt/SUNWvts/bin
# ./sunvts
```

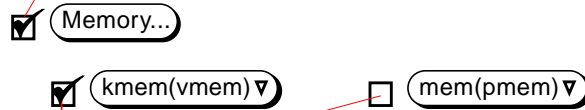
Note that `/opt/SUNWvts/bin` is the default `/bin` directory for SunVTS software. If you've installed SunVTS software in a different directory, use the appropriate path instead.

When you start SunVTS software, the SunVTS kernel probes the test system devices. The results of this probe are displayed on the Test Selection panel. For each hardware device on your system, there is an associated SunVTS test.

### 3. Fine-tune your testing session by selecting only the tests you want to run.

Click to select and deselect tests. (A check mark in the box indicates the item is selected.)

To select or deselect all the tests in the Memory group



To select or deselect individual memory tests

## Results

If SunVTS tests indicate an impaired or defective part, see “Parts Installation and Repair” on page 99 to locate instructions for replacing the part.

---

# About Troubleshooting Your System

The system provides the following features to help you identify and isolate hardware problems:

- Error indications
- Software commands
- Diagnostic tools

This section describes the error indications and software commands provided to help you troubleshoot your system. Diagnostic tools are covered in “About Diagnostic Tools” on page 386.

## Error Indications

The system provides error indications via LEDs and error messages. Using the two in combination, you can isolate a problem to a particular field-replaceable unit (FRU) with a high degree of confidence.

The system provides fault LEDs in the following places:

- Front panel
- Keyboard
- Power supplies
- Disk drives

Error messages are logged in the `/var/adm/messages` file and also displayed on the system console by the diagnostic tools.

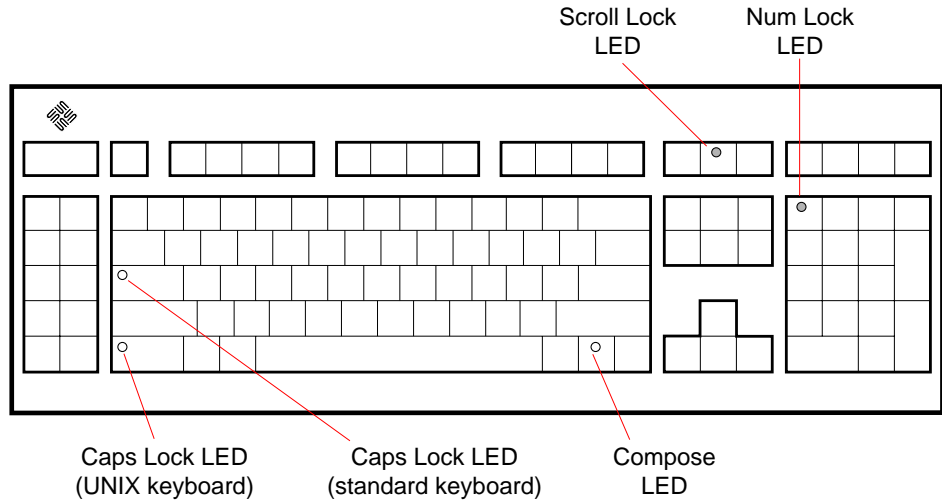
## Front Panel LEDs

Front panel LEDs provide your first indication if there is problem with your system. Usually, a front panel LED is not the sole indication of a problem. Error messages and even other LEDs can help to isolate the problem further.

The front panel has a general fault indicator (☛) that lights whenever POST or OBdiag detects any kind of fault. In addition, it has LEDs that indicate problems with the internal disk drives, power supply subsystem, or fans. See “About the Status and Control Panel” on page 9 for more information on these LEDs and their meaning.

## Keyboard LEDs

Four LEDs on the Sun Type-5 keyboard are used to indicate the progress and results of POST diagnostics. These LEDs are on the Caps Lock, Compose, Scroll Lock, and Num Lock keys, as shown below.



To indicate the beginning of POST diagnostics, the four LEDs briefly light all at once. The monitor screen remains blank, and the Caps Lock LED blinks for the duration of the testing.

If the system passes all POST diagnostic tests, all four LEDs light again and then go off. Once the system banner appears on the monitor screen, the keyboard LEDs assume their normal functions and should no longer be interpreted as diagnostic error indicators.

If the system fails any test, one or more LEDs will light to form an error code that indicates the nature of the problem.

---

**Note** – The LED error code may be lit continuously, or for just a few seconds, so it is important to observe the LEDs closely while POST is running.

---

The following table provides error code definitions.

---

LED				
Caps Lock	Compose	Scroll Lock	Num Lock	Failing FRU
X				Main logic Board
	X			CPU 0
	X		X	CPU 1
	X	X		CPU 2
	X	X	X	CPU 3
X			X	No memory detected
X	X			Memory bank 0
X	X		X	Memory bank 1
X	X	X		Memory bank 2
X	X	X	X	Memory bank 3
			X	NVRAM

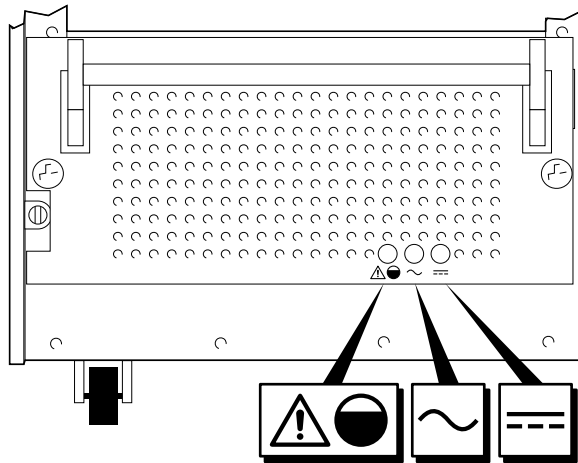
---

**Note** – The Caps Lock LED blinks on and off to indicate that the POST diagnostics are running. When it lights steadily, it indicates an error.




---

## Power Supply LEDs

Power supply LEDs are visible from the rear of the system. The following figure shows the LEDs on the power supply in bay 0.

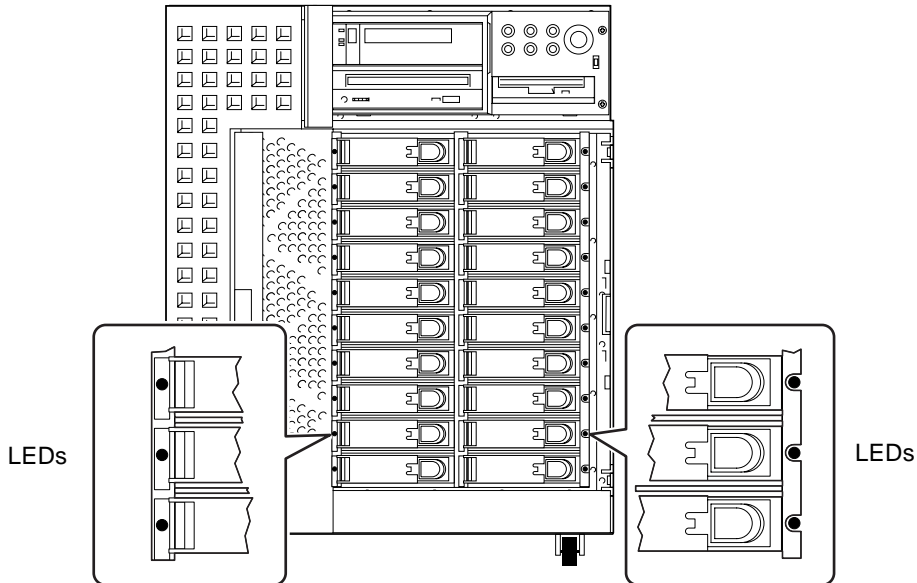


The following table provides a description of each LED.

LED Name	Icon	Description
Load Status		<p>The LED is green when any output (excluding pre-charge and standby) is loaded at less than 90% of its rated output.</p> <p>The LED is amber when any output (excluding pre-charge and standby) is loaded beyond 90% of its rated output.</p>
AC-Present-Status		This green LED is lit to indicate that the primary circuit has power.
DC Status		This green LED is lit to indicate that all DC outputs from the power supply are functional.

## Disk LEDs

The disk LEDs are visible from the front of the system when the bottom door is open, as shown in the following figure.



---

**Note** – The center support of the disk cage is marked with the slot number for each disk drive. Starting at the bottom, the disks are numbered from 0 to 19.

---

When a disk LED lights steadily and is green, it indicates that the slot is populated and that the drive is receiving power. When an LED is green and blinking, it indicates that there is activity on the disk. Some applications may use the LED to indicate a fault on the disk drive. In this case, the LED changes color to yellow and remains lit. The disk drive LEDs do not retain their state when the system is powered off or the keyswitch is turned to the Standby position (⏻).

## Error Messages

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



The two diagnostic tools, POST and OBDDiag, provide error messages on the system console. These error messages can help to further refine your problem diagnosis. The amount of error information displayed in diagnostic messages is determined by the value of the NVRAM variable `diag-verbosity`. See “Configuration Variables” on page 393 for additional details.

## Software Commands

System software provides Solaris and OBP commands that you can use to diagnose problems. For more information on Solaris commands, see the appropriate man pages. For additional information on OBP commands, see the *OpenBoot 3.x Command Reference Manual*. (An on-line version of the manual is included with the *Solaris System Administrator Answerbook* that ships with Solaris software.)

### Solaris `prtdiag` Command

The `prtdiag` command is a UNIX shell command used to display system configuration and diagnostic information. 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)

To run `prtdiag`, type:

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

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`.

---

**Note** – Refer to the `prtdiag` man page for additional information.

---

### OBP `show-devs` Command

If you are working from the OBP prompt (`ok`), you can use the OBP `show-devs` command to list the devices in the system configuration.

## OBP `printenv` Command

Use the OBP `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.

## OBP `probe-scsi` and `probe-scsi-all` Commands

To diagnose problems with the SCSI subsystem, you can use the OBP `probe-scsi` and `probe-scsi-all` commands. Both commands require that you halt the system.

---

**Note** – When it is not practical to halt the system, you can use SunVTS as an alternate method of testing the SCSI interfaces. See “About Diagnostic Tools” on page 386 for more information.

---

The `probe-scsi` command transmits an inquiry command to all SCSI devices connected to the main logic board SCSI interfaces. This includes any tape or CD-ROM drive in the removable media assembly (RMA), any disk drive connected to the 4-slot backplane, and any device connected to the external SCSI connector on the system rear panel. If a SCSI device is connected and active, its target address, unit number, device type, and manufacturer name is displayed.

The `probe-scsi-all` command transmits an inquiry command to all SCSI devices connected to the system SCSI host adapters. The first identifier listed in the display is the SCSI host adapter address in the system device tree followed by the SCSI device identification data.

The first example that follows shows a `probe-scsi` output message. The second example shows a `probe-scsi-all` output message.

probe-scsi *output*:

```
ok probe-scsi-all
This command may hang the system if a Stop-A or halt command
has been executed. Please type reset-all to reset the system
before executing this command.
Do you wish to continue? (y/n) n
ok reset-all
This command may hang the system if a Stop-A or halt command
has been executed. Please type reset-all to reset the system
before executing this command.
Do you wish to continue? (y/n) y
Primary UltraSCSI bus:
Target 0
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254
Target 1
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254
Target 2
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254
Target 3
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254

Removable-Media/External SCSI bus:
Target 4
  Unit 0  Removable Tape    EXABYTE EXB-8200      263H
  Unit 1  Removable Tape    EXABYTE EXB-8200      263H
  Unit 2  Removable Tape    EXABYTE EXB-8200      263H
  Unit 3  Removable Tape    EXABYTE EXB-8200      263H
  Unit 4  Removable Tape    EXABYTE EXB-8200      263H
  Unit 5  Removable Tape    EXABYTE EXB-8200      263H
  Unit 6  Removable Tape    EXABYTE EXB-8200      263H
  Unit 7  Removable Tape    EXABYTE EXB-8200      263H

Target 6
  Unit 0  Removable Read Only device TOSHIBA XM-5401TASUN4XCD3485
ok
```

probe-scsi-all *output*:

```
ok probe-scsi-all
This command may hang the system if a Stop-A or halt command
has been executed. Please type reset-all to reset the system
before executing this command.
Do you wish to continue? (y/n) y

/pci@6,4000/scsi@4,1
Target 0
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254
Target 1
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254

/pci@6,4000/scsi@4
Target 4
  Unit 0  Disk    CONNER CFP1080E SUN1.055150
Target 5
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G5050

/pci@1f,4000/scsi@3
Target 0
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254
Target 1
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254
Target 2
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254
Target 3
  Unit 0  Disk    SEAGATE ST34371W SUN4.2G8254

/pci@1f,4000/scsi@2
Target 4
  Unit 0  Removable Tape  EXABYTE  EXB-8200      263H
  Unit 1  Removable Tape  EXABYTE  EXB-8200      263H
  Unit 2  Removable Tape  EXABYTE  EXB-8200      263H
  Unit 3  Removable Tape  EXABYTE  EXB-8200      263H
  Unit 4  Removable Tape  EXABYTE  EXB-8200      263H
  Unit 5  Removable Tape  EXABYTE  EXB-8200      263H
  Unit 6  Removable Tape  EXABYTE  EXB-8200      263H
  Unit 7  Removable Tape  EXABYTE  EXB-8200      263H
```

probe-scsi-all *output continued:*

```
Target 6
  Unit 0 Removable Read Only device TOSHIBA XM-5401TASUB4XCD3485

/pci@6,4000/scsi@3
Target 0
  Unit 0 Disk SEAGATE ST34371W SUN4.2G8254
Target 1
  Unit 0 Disk SEAGATE ST34371W SUN4.2G8254
Target 2
  Unit 0 Disk SEAGATE ST34371W SUN4.2G8254
Target 3
  Unit 0 Disk SEAGATE ST34371W SUN4.2G8254

ok
```

---

# About Diagnosing Specific Problems

## Network Communications Failure

### Symptom

The system is unable to communicate over the network.

### Action

Your system conforms to the Ethernet 10/100BASE-T standard, which states that the Ethernet 10BASE-T link integrity test function should always be enabled on both the host system and the Ethernet hub. The system cannot communicate with a network if this function is not set identically for both the system and the network hub (either enabled for both or disabled for both). This problem applies only 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. Refer to the documentation provided with your Ethernet hub for more information about the link integrity test function.

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 most PCI Ethernet cards, the link integrity test function can be enabled or disabled with a hardware jumper on the PCI card, which you must set manually. (See the documentation supplied with the card.) For the standard TPE and MII main logic board ports, the link test is enabled or disabled through software, as shown below.

Remember also that the TPE and MII ports share the same circuitry and as a result, only one port can be used at a time.

---

**Note** – Some hub designs permanently enable (or disable) the link integrity test through a hardware jumper. In this case, refer to the hub installation or user manual for details of how the test is implemented.

---

### *Determining the Device Name of the Ethernet Interface*

To enable or disable the link integrity test for the standard Ethernet interface, or for a PCI-based Ethernet interface, you must first know the device name of the desired Ethernet interface. To list the device name:

1. Shut down the system and take the system to the `ok` prompt.
2. Determine the device name for the desired Ethernet interface:

a. Type:

```
ok show-devs
```

b. In the `show-devs` listing, find the device name for the desired Ethernet interface.

The device name is `/pci@1f,4000/network@1,1` for the standard Ethernet interface. For a PCI-based Ethernet interface, the device name may appear similar to the following: `/pci@6,2000/pci@1/SUNW,hme@0,1`.

### *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 `ok` 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.

## Power-on Failures

### Symptom

The system unit does not power up when the keyboard power switch is pressed.

### Action

1. **Make sure that the keyswitch, located on the front panel, is not in the Standby position (⏻).**

When the keyswitch is in the Standby position, the keyboard power switch has no effect.
2. **Turn the system power switch, located on the rear panel, to Off.**
3. **Ensure that the AC power cord is properly connected to the system unit and to the wall receptacle.**
4. **Verify with a volt-ohmmeter that the wall outlet is supplying AC power.**
5. **Press the power switch at the rear of the system unit.**

If the system powers on, the keyboard may be defective or the system unit is unable to accept the keyboard power-on signal.
6. **Power off the system and press the keyboard power-on switch again.**

If the system unit powers on, no further action is required.



- 7. If the system does not power on, connect a spare Sun type-5 keyboard to the system unit and press the keyboard power switch.**

If the system powers up, then the problem was with the keyboard. If the system unit does not power up and the wall receptacle AC power has been verified, a power supply may be defective. See “Power Supply Failure” on page 424.

## Symptom

The system attempts to power up but does not boot or initialize the monitor.

## Action

- 1. Turn off the rear panel system power switch.**
- 2. Turn on the rear panel system power switch and observe the keyboard.**

Turning the power on causes POST to run. The LEDs on the keyboard should briefly light and then the Caps Lock LED should blink slowly to indicate POST is running. You should also hear a tone from the keyboard.
- 3. If you hear no tone or see no lights on the keyboard, a power supply may be defective. See “Power Supply LEDs” on page 411.**
- 4. If you hear a tone and see lights on the keyboard, but the system still fails to initialize, see “How to Use POST Diagnostics” on page 389.**
- 5. If the Caps Lock LED doesn’t blink, then POST has failed.**

The most probable cause for this type of failure is the main logic board. However, before replacing the main logic board you should:

  - a. Remove optional PCI cards.**
  - b. Remove optional DIMMs.**

Leave only the four DIMMs in Bank A.
  - c. Repeat POST to determine if any of these modules caused the failure.**
  - d. If POST still fails, then replace the main logic board.**

# Video Output Failure

## Symptom

No video at the system monitor.

## Action

1. **Check that the power cord is connected to the monitor and to the wall outlet.**
2. **Verify with a volt-ohmmeter that the wall outlet is supplying AC power.**
3. **Verify that the video cable connection is secure between the monitor and the video output port.**

Use a volt-ohmmeter to perform the continuity test on the video cable.

4. **If the cables and their connections are okay, then troubleshoot the monitor and the graphics card.**

# Disk or CD-ROM Drive Failure

## Symptom

A disk drive read, write, or parity error is reported by the operating system or a software application.

A CD-ROM drive read error or parity error is reported by the operating system or a software application.

## Action

- **Replace the drive indicated by the failure message.**

## Symptom

Disk drive or CD-ROM drive fails to boot or is not responding to commands.

## Action

Test the drive response to the `probe-scsi-all` command as follows:

1. **At the system `ok` prompt, enter:**

```
ok reset-all
ok probe-scsi-all
```

2. **If the SCSI device responds correctly to `probe-scsi-all`, a message similar to the one on page 415 is printed out.**

If the device responds and a message is displayed, the system SCSI controller has successfully probed the device. This indicates that the main logic board is operating correctly.

- a. **If one drive does not respond to the SCSI controller probe but the others do, replace the unresponsive drive.**
- b. **If only one internal disk drive is configured with the system and the `probe-scsi-all` test fails to show the device in the message, replace the drive. If the problem is still evident after replacing the drive, replace the main logic board. If replacing both the disk drive and the main logic board does not correct the problem, replace the associated UltraSCSI data cable and UltraSCSI backplane.**

## SCSI Controller Failures

To check whether the main logic board SCSI controllers are defective, test the drive response to the `probe-scsi` command. To test additional SCSI host adapters added to the system, use the `probe-scsi-all` command. See “OBP `probe-scsi` and `probe-scsi-all` Commands” on page 414 for more information.

**1. At the `ok` prompt, enter:**

```
ok probe-scsi
```

If a message is displayed for each installed disk, the system SCSI controllers have successfully probed the devices. This indicates that the main logic board is working correctly.

**2. If a disk doesn't respond:**

**a. Make sure that each SCSI device on the SCSI bus has a unique SCSI target ID.**

See “About the SCSI Removable Media Bays and the External SCSI Port” on page 77 for more information on SCSI IDs.

**b. Verify that all SCSI cables and the SCSI terminator are connected securely.**

**c. Check the SCSI cables to make sure there are no bent pins.**

**3. If the problem persists, replace the unresponsive drive.**

**4. If the problem remains after replacing the drive, replace the main logic board.**

**5. If the problem persists, replace the associated SCSI cable and backplane.**

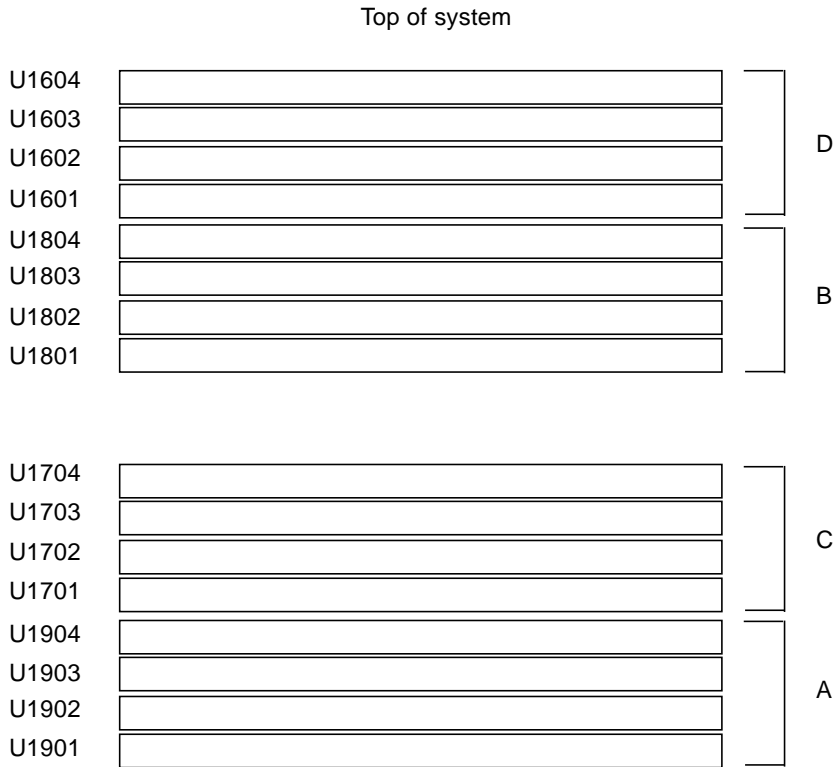
## Power Supply Failure

If there is a problem with a power supply, POST lights the general fault indicator (☛) and the power supply fault indicator (Ⓜ) on the front panel. If you have more than one power supply, then you can use the LEDs located on the power supplies themselves to identify the faulty supply. The power supply LEDs will indicate any problem with the AC input, DC output, or DC load. See “Power Supply LEDs” on page 411 for more information about the LEDs.

## DIMM Failure

SunVTS and POST diagnostics can report memory errors encountered during program execution. Memory error messages typically indicate the DIMM location number (“U” number) of the failing module.

Use the following diagram to identify the location of a failing memory module from its U number:



After you have identified the defective DIMM, remove it according to the instructions in “How to Remove a Memory Module” on page 122. Install the replacement DIMM according to the directions in “How to Install a Memory Module” on page 125.

# Environmental Failures

The environmental monitoring subsystem monitors the temperature of the system as well as the operation of the fans and power supplies. For more information on the environmental monitoring subsystem, see “Environmental Monitoring and Control” on page 46.

In response to an environmental error condition, the monitoring subsystem generates error messages that are displayed on the system console and logged in the `/var/adm/messages` file. These error messages are described in the following table.

Message	Type	Description
CPU <i>%d</i> OVERHEATING!!!	Warning	After this warning message, the system automatically shuts down. Indicates that the temperature as measured at the CPU has reached 80 degrees C. The value <i>%d</i> identifies the CPU that overheated.
Cannot read Power Supply Temps!!	Advisory	Indicates that the power supply is not properly seated or faulty.
A Power Supply is close to OVERHEATING!!!	Advisory	Indicates that the temperature as measured at the power supply has exceeded 95 degrees C.
Power Supply <i>%d</i> OVERHEATING!!!	Warning	After this message, the system automatically shuts down. Indicates that the temperature as measured at the power supply has reached 100 degrees C. The value <i>%d</i> identifies the power supply that overheated.
Power Supply <i>%d</i> NOT okay.	Advisory	Indicates that there is something wrong with the AC input to the supply. The system may shut down abruptly if the power supply shuts off. The value <i>%d</i> identifies the power supply.
Power Supply <i>%d</i> Overloaded	Advisory	Indicates that the limit of the +3.3 V, +5 V or +12 V power supply output has been exceeded. The system may shut down abruptly if the power supply shuts off. The value <i>%d</i> identifies the power supply.
Power Supply <i>%d</i> load share err	Advisory	Indicates that the power supplies in an N+1 configuration are not sharing the load equally. The system may shut down abruptly if a power supply shuts off. The value <i>%d</i> identifies the power supply.

Message	Type	Description
Ambient Temperature is %d, shutdown now.	Warning	After this message, the system shuts down. Indicates the ambient temperature as measured at the power inlet has reached 50 degrees C. The value %d identifies the temperature in Celsius.
Fan Fail is 0x%x retries = %d	Advisory	Indicates that a fan has failed. 0x%x identifies the fan that failed. The value %d identifies the number of times the fan was tried to verify the fan failure.
Fan Failure(S), System Shutdown	Warning	After this message, the system shuts down. Indicates a fan failure in either the CPU or power supply fan banks. A failure in the dual graphics cooling fan is not fatal and only generates the preceding advisory message.

If the environmental monitoring system detects a temperature problem, it also lights the temperature LED on the status and control panel. If it detects a power supply problem, it lights the power supply fault LED on the panel. The LEDs located on the power supplies themselves will help to further identify the problem. For information about system LEDs, see:

- “About the Status and Control Panel” on page 9
- “Front Panel LEDs” on page 408
- “Power Supply LEDs” on page 411

## Creator-Series Graphics Card

Creator-series graphics cards contain a built-in diagnostic test that verifies basic graphics functionality without booting the operating system software. To execute the built-in diagnostic test, the system must be at the `ok` prompt.

1. At the `ok` prompt, enter:

```
ok setenv diag-switch? true

diag-switch? = true
```

**2. To test the Creator-series graphics card, run the ffb test as follows:**

**a. If the graphics card is being used as the system display device, enter:**

```
ok test screen
```

```
Verifying Console Mode for Frame Buffer Board  
This will take a few minutes.
```

```
Verifying Frame Buffer Memory used for console mode.  
This will take about two minutes.
```

**b. If the graphics card is not being used as the system device, enter:**

```
ok test SUNW,ffb@1d,0
```

```
Verifying Console Mode for Frame Buffer Board  
This will take a few minutes.
```

```
Verifying Frame Buffer Memory for console mode.  
This will take about two minutes.
```

In either case, a series of patterns is displayed on the monitor and then the FFB Frame Buffer functional test passed message is printed on the monitor screen.

**3. When the graphics card on-board diagnostics are completed, enter:**

```
ok setenv diag-switch? false
```

```
diag-switch? = false
```



## Connector Pinouts

---

This appendix gives you reference information about the pins, signals, and ports built into the Sun Ultra 450 workstation. Topics covered in this appendix include:

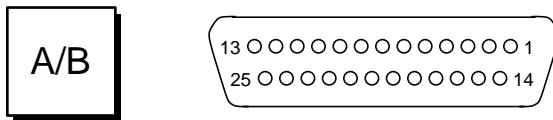
- *Reference for the Serial Port A and B Connectors—page 430*
- *Reference for the Parallel Connector—page 432*
- *Reference for the SCSI Connector—page 433*
- *Reference for the Keyboard/Mouse Connector—page 435*
- *Reference for the Twisted-Pair Ethernet (TPE) Connector—page 436*
- *Reference for the Media Independent Interface (MII) Ethernet Connector—page 437*
- *Reference for the 13W3 Video Connector—page 438*
- *Reference for the Audio Module Connectors—page 439*
- *Reference for Audio Specifications—page 441*

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# Reference for the Serial Port A and B Connectors

## Serial Port Connector Diagram

The serial port conforms to RS-423/RS-232 specifications.



## Serial Port Signals

Signal names ending in “A” indicate that the signal is associated with the high-speed synchronous/asynchronous port provided by a standard DB25 serial cable or the connector labeled “A” on the optional DB25 splitter cable. Signal names ending in “B” indicate that the signal is associated with the high-speed asynchronous port provided by the connector labeled B on the optional DB25 splitter cable.

Pin Number	Function	I/O	Signal Description
1	none	none	N.C. <sup>1</sup>
2	TXD_A	O	Transmit Data
3	RXD_A	I	Receive Data
4	RTS_A	O	Ready To Send
5	CTS_A	I	Clear To Send
6	DSR_A	I	Data Set Ready
7	GND		Signal Ground
8	DCD_A	I	Data Carrier Detect
9	none	none	N.C.
10	none	none	N.C.
11	DTR_B	O	Data Terminal Ready

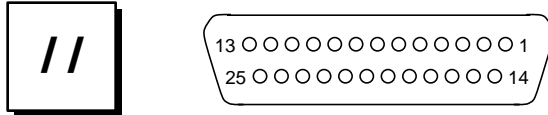
Pin Number	Function	I/O	Signal Description
12	DCD_B	I	Data Carrier Detect
13	CTS_B	I	Clear To Send
14	TXD_B	O	Transmit Data
15	TRXC_A	I	Transmit Clock
16	RXD_B	I	Receive Data
17	RXC_A	I	Receive Clock
18	RXC_B	I	Receive Clock
19	RTS_B	O	Ready To Send
20	DTR_A	O	Data Terminal Ready
21	none	none	N.C.
22	none	none	N.C.
23	none	none	N.C.
24	TXC_A	O	Transmit Clock
25	TXC_B	O	Transmit Clock

1. N.C. means "No Connection."

---

# Reference for the Parallel Connector

## Parallel Port Connector Diagram



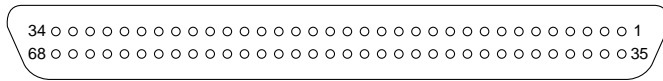
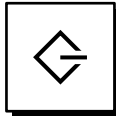
## Parallel Port Signals

Signal names ending in “L” indicate that the signal is active low.

Pin	Description	Pin	Description
1	STROBE_L	14	AUTO_FEED_L
2	DAT0	15	ERROR_L
3	DAT1	16	INIT_L
4	DAT2	17	SLIN_L
5	DAT3	18	GND
6	DAT4	19	GND
7	DAT5	20	GND
8	DAT6	21	GND
9	DAT7	22	GND
10	ACK_L	23	GND
11	BUSY	24	GND
12	PERROR	25	GND
13	SELECT_L		

# Reference for the SCSI Connector

## SCSI Connector Diagram



## SCSI Connector Signals

Signal names ending in “L” indicate that the signal is active low.

Pin	Signal	Pin	Signal
1	SCSI_GND	35	SCSI_CONN_DAT<12>
2	SCSI_GND	36	SCSI_CONN_DAT<13>
3	SCSI_GND	37	SCSI_CONN_DAT<14>
4	SCSI_GND	38	SCSI_CONN_DAT<15>
5	SCSI_GND	39	SCSI_CONN_PAR<1>
6	SCSI_GND	40	SCSI_CONN_DAT<0>
7	SCSI_GND	41	SCSI_CONN_DAT<1>
8	SCSI_GND	42	SCSI_CONN_DAT<2>
9	SCSI_GND	43	SCSI_CONN_DAT<3>
10	SCSI_GND	44	SCSI_CONN_DAT<4>
11	SCSI_GND	45	SCSI_CONN_DAT<5>
12	SCSI_GND	46	SCSI_CONN_DAT<6>
13	SCSI_GND	47	SCSI_CONN_DAT<7>
14	SCSI_GND	48	SCSI_CONN_PAR<0>
15	SCSI_GND	49	SCSI_GND
16	SCSI_GND	50	SCSI_TERMDIS_L<0>
17	SCSI_CONN_TERM_PWR	51	SCSI_CONN_TERM_PWR

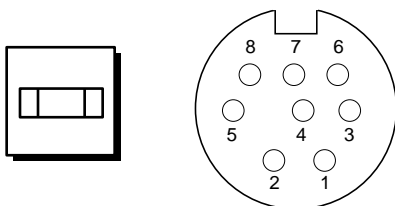
<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>
18	SCSI_CONN_TERMPOWER	52	SCSI_CONN_TERMPOWER
19	N.C. <sup>1</sup>	53	N.C.
20	SCSI_GND	54	SCSI_CONN_GND
21	SCSI_GND	55	SCSI_CONN_ATN
22	SCSI_GND	56	SCSI_GND
23	SCSI_GND	57	SCSI_CONN_BSY_L
24	SCSI_GND	58	SCSI_CONN_ACK_L
25	SCSI_GND	59	SCSI_CONN_RST_L
26	SCSI_GND	60	SCSI_CONN_MSG_L
27	SCSI_GND	61	SCSI_CONN_SEL_L
28	SCSI_GND	62	SCSI_CONN_CD_L
29	SCSI_GND	63	SCSI_CONN_REQ_L
30	SCSI_GND	64	SCSI_CONN_IO_L
31	SCSI_GND	65	SCSI_CONN_DAT<8>
32	SCSI_GND	66	SCSI_CONN_DAT<9>
33	SCSI_GND	67	SCSI_CONN_DAT<10>
34	SCSI_GND	68	SCSI_CONN_DAT<11>

1. N.C. means "No Connection."

---

# Reference for the Keyboard/Mouse Connector

## Keyboard/Mouse Connector Diagram



## Keyboard/Mouse Connector Signals

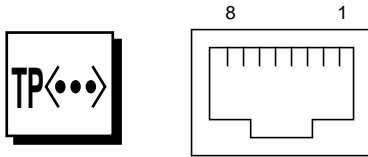
Signal names ending in “L” indicate that the signal is active low.

Pin	Description	Pin	Description
1	GND	5	KYBD_OUT_L
2	GND	6	KYBD_IN_L
3	+5 VDC	7	POWERON_L
4	MOUSE_IN_L	8	+5 VDC

---

# Reference for the Twisted-Pair Ethernet (TPE) Connector

## TPE Connector Diagram



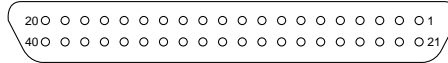
## TPE Connector Signals

Pin	Description	Pin	Description
1	Transmit Data +	5	Common Mode Termination
2	Transmit Data -	6	Receive Data -
3	Receive Data +	7	Common Mode Termination
4	Common Mode Termination	8	Common Mode Termination



# Reference for the Media Independent Interface (MII) Ethernet Connector

## MII Connector Diagram



## MII Connector Signals

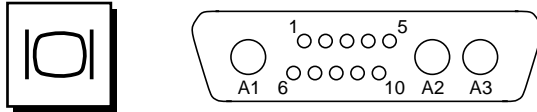
Pin	Function	Pin	Function
1	+5 VDC	21	+5 VDC
2	MDIO	22	GND
3	MDC	23	GND
4	RXD<3>	24	GND
5	RXD<2>	25	GND
6	RXD<1>	26	GND
7	RXD<0>	27	GND
8	RX_DV	28	GND
9	RX_CLK	29	GND
10	RX_ER	30	GND
11	TX_ER	31	GND
12	TX_CLK	32	GND
13	TX_EN	33	GND
14	TXD<0>	34	GND
15	TXD<1>	35	GND
16	TXD<2>	36	GND
17	TXD<3>	37	GND
18	COL	38	GND
19	CRS	39	GND
20	+5 VDC	40	+5 VDC

**Note** – The +5V supply is fuse-protected with a fuse that automatically resets.

---

# Reference for the 13W3 Video Connector

## 13W3 Video Connector Diagram



## 13W3 Connector Signals

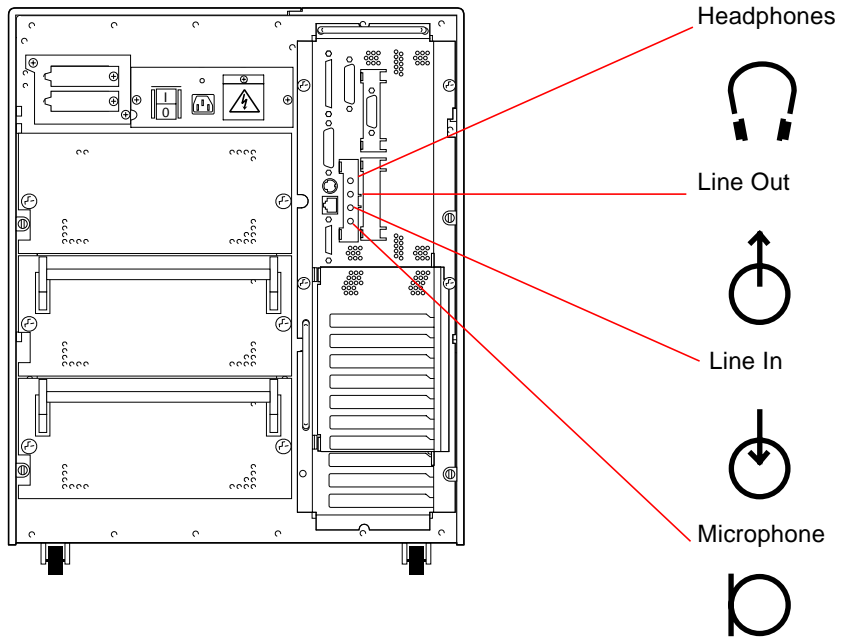
Pin	Function	I/O	Level
A1	Red	O	Analog
A2	Green	O	Analog
A3	Blue	O	Analog
1	Serial Read		TTL
2	Vert Sync	O	TTL
3	Sense <0>	I	TTL
4	GND		Ground
5	Comp Sync	O	TTL
6	Horiz Sync	O	TTL
7	Serial Write		TTL
8	Sense <1>	I	TTL
9	Sense <2>	I	TTL
10	GND		Ground

---

# Reference for the Audio Module Connectors

All audio ports use EIA standard 3.5-mm/0.125-inch jacks.

## Audio Port Diagram



# Audio Port Signals

	Headphones	Line Out	Line In	Microphone
Tip	Left Channel	Left Channel	Left Channel	Left Channel
Ring (Center)	Right Channel	Right Channel	Right Channel	Right Channel
Shield	Ground	Ground	Ground	Ground

# Audio Port Functions

Port	Function
Headphones	Connects stereophonic headphones for private listening of audio output
Line Out	Connects the system audio output to an external stereophonic amplifier and loudspeakers
Line In	Connects external stereophonic audio sources such as a compact disc player or cassette tape player to the system
Microphone	Connects the SunMicrophone™ II (or other suitable microphone <sup>1</sup> ) to the system

1. The microphone port accepts stereophonic input; however, the Sun microphone II is a monophonic device. Note also that the older SunMicrophone is not compatible with this system.

---

# Reference for Audio Specifications

The specifications in the following table assume use of the Audio Tool format setting “CD-ROM or DAT” selected. The microphone input specifications are for the SunMicrophone II.

## Audio Inputs and Outputs

<b>Stereo I/O</b>	<b>Specification</b>
Line In	2V typical, 4V max.; 5–50 $\Omega$ impedance
Frequency Response	20 Hz–17 kHz, +/- 0.5 dB
Microphone Input	15 mV typical, 0.6–1.0 k $\Omega$ impedance; +5 VDC input bias via a 2.2-k $\Omega$ resistor
Headphones Output	1V typical, 2.4V max.; 16 $\Omega$ –1-k $\Omega$ impedance
Line Out	1V typical, 2.4V max.; 5–50-k $\Omega$ impedance

## Internal Monaural Speaker Specifications

<b>Speaker</b>	<b>Specification</b>
Power Output	1.5W avg., 3W peak
Distortion	0.02%, typical at 1 kHz
Impedance	16 $\Omega$ +/- 20%
Frequency Response	150 Hz–17 kHz +/- 0.5 dB



# System Specifications

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This appendix provides physical, clearance and service, electrical, and environmental specifications.

---

# Reference for System Specifications

## Physical Specifications

The dimensions and weight of the system are as follows:

	<b>U.S</b>	<b>Metric</b>	<b>Comments</b>
Height	22.87 in	58.1 cm	
Width	17.64 in	44.8 cm	
Depth	27.40 in	69.6 cm	
Weight	205 lb, max	94 kg, max	Actual weight depends upon the installed options
Power Cord	8.2 ft	2.5 m	

## Clearance and Service Access Specifications

Clearances needed when servicing the system are as follows:

	<b>U.S</b>	<b>Metric</b>
Front	36 in	91.44 cm
Rear	36 in	91.44 cm
Right	36 in	91.44 cm
Left	36 in	91.44 cm
Top	36 in	91.44 cm



# Electrical Specifications

The following table provides the electrical specifications for a system with one power supply.

Parameter	Value
Input	
Nominal Frequencies	50 Hz or 60 Hz nominal
Nominal Voltage Range	Autoranging 100-240 Vac
Maximum Current AC RMS	4.0 A @ 100 VAC
AC Operating Range	90 - 264 Vrms, 47 - 63Hz
Output	
+3.3 VDC	4 to 47 A
+5 VDC	4 to 65 A
+12 VDC	0.5 to 16 A
-12 VDC	0 to 1 A
Power Dissipation	560 Watts
Maximum Power Consumption	832 Watts
Maximum Heat Output	2840 BTU/hr
Volt-Ampere Rating	857 VA with 560 W load

The following table provides the electrical specifications for a system with two power supplies.

Parameter	Value
Input	
Nominal Frequencies	50 Hz or 60 Hz nominal
Nominal Voltage Range	Autoranging 100-240 Vac
Maximum Current AC RMS	8.0 A @ 100 VAC
AC Operating Range	90 - 264 Vrms, 47 - 63Hz
Output	
+3.3 VDC	4 to 94 A
+5 VDC	4 to 130 A
+12 VDC	0.5 to 32 A
-12 VDC	0 to 2 A
Power Dissipation	1120 Watts
Maximum Power Consumption	1664 Watts
Maximum Heat Output	5680 BTU/hr
Volt-Ampere Rating	1714 VA with 1120 W load

# Environmental Requirements

The operating and non-operating environmental requirements for the system are as follows.

Parameter	Value
Operating	
Temperature	5°C to 35°C (41°F to 95°F)—IEC 68-2-1, 68-2-2
Humidity	20% to 80% RH, noncondensing; 27 °C max wet bulb—IEC 68-2-2, 68-2-3
Altitude	0 to 3000 meters (0 to 10,000 feet)—IEC 68-2-40, 68-2-41
Vibration	0.2 gravity (g) peak, 5–500 Hz, 3 perpendicular axes—IEC 68-2-6
Shock	4g peak, 11 milliseconds half-sine pulse—IEC 68-2-27
Acoustic Noise	49/55 dB(A) closed office (idle/seeking) 57/65 dB(A) open area (idle/seeking)
Non-Operating	
Temperature	-20°C to 60°C (-4°F to 140°F)—IEC 68-2-1, 68-2-2
Humidity	95% RH, noncondensing at 40°C—IEC 68-2-2, 68-2-3
Altitude	0 to 12,000 meters (0 to 40,000 feet)—IEC 68-2-40, 68-2-41
Vibration	1g peak, 5–500 Hz, 3 perpendicular axes—IEC 68-2-6
Shock	30g peak, 11 milliseconds half-sine pulse—IEC 68-2-27e
Handling Drops	50 mm—IEC 68-2-31
Threshold Times-Roman	1 m/s—SUN 900-1813

# Agency Compliance Specifications

The system complies with the following specifications.

Category	Relevant Standards
Safety	EN60950/IEC950 DEMKO, TUV UL 1950, CB Scheme IEC 950, C22.2 No. 950 from UL
RFI/EMI	EN55022/CISPR22 Class B VCCI Class II FCC part 15 Sub Part B
Immunity	EN50082/IEC-1000-2 IEC-1000-3 IEC-1000-4 IEC-1000-5
X-ray	DHHS 21 Subchapter J PTB German X-ray Decree

# Safety Precautions

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This appendix supplies you with reference information about safety precautions you should take when setting up your equipment.

## Reference for Safety Precautions

Read this section before beginning any procedure. The following text provides safety precautions to follow when installing a Sun Microsystems product.

### Safety Precautions

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

- Follow all cautions and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.



12A



16A

**Caution** – See “About Power Budget Constraints” on page 81.

### Symbols

The following symbols may appear in this book:



**Caution** – There is risk of personal injury and equipment damage. Follow the instructions.



**Caution** – Hot surface. Avoid contact. Surfaces are hot and may cause personal injury if touched.



**Caution** – Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.



**On** – Applies AC power to the system.



**Off** – Removes AC power from the system.



**Standby** – The On/Standby switch is in the *standby* position.

### Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. Sun Microsystems is not responsible for regulatory compliance of a modified Sun product.

### Placement of a Sun Product



**Caution** – Do not block or cover the openings of your Sun product. Never place a Sun product near a radiator or heat register. Failure to follow these guidelines can cause overheating and affect the reliability of your Sun product.

### SELV Compliance

Safety status of I/O connections comply to SELV requirements.

### European Ergonomics

In order to conform with the German ZH1/618 ergonomic standard, an antiglare treatment to the CRT has been provided. For text processing applications, a positive mode display (black characters on a white background) is required.

### Power Cord Connection



**Caution** – Sun products are designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electric shock, do not plug Sun products into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.



**Caution** – Not all power cords have the same current ratings. Household extension cords do not have overload protection and are not meant for use with computer systems. Do not use household extension cords with your Sun product.



**Caution** – Your Sun product is shipped with a grounding type (three-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

The following caution applies only to devices with a **Standby** power switch:



**Caution** – The power switch of this product functions as a standby type device only. The power cord serves as the primary disconnect device for the system. Be sure to plug the power cord into a grounded power outlet that is nearby the system and is readily accessible. Do not connect the power cord when the power supply has been removed from the system chassis.

## Lithium Battery



**Caution** – On Sun CPU boards, there is a lithium battery molded into the real-time clock, SGS No. MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, or MK48T08. Batteries are not customer replaceable parts. They may explode if mishandled. Do not dispose of the battery in fire. Do not disassemble it or attempt to recharge it.

## System Unit Cover

You must remove the cover of your Sun computer system unit in order to add cards, memory, or internal storage devices. Be sure to replace the top cover before powering up your computer system.



**Caution** – Do not operate Sun products without the top cover in place. Failure to take this precaution may result in personal injury and system damage.

## Laser Compliance Notice

Sun products that use laser technology comply with Class 1 laser requirements.



## Einhaltung sicherheitsbehördlicher Vorschriften

Auf dieser Seite werden Sicherheitsrichtlinien beschrieben, die bei der Installation von Sun-Produkten zu beachten sind.

### Sicherheitsvorkehrungen

Treffen Sie zu Ihrem eigenen Schutz die folgenden Sicherheitsvorkehrungen, wenn Sie Ihr Gerät installieren:

- Beachten Sie alle auf den Geräten angebrachten Warnhinweise und Anweisungen.
- Vergewissern Sie sich, daß Spannung und Frequenz Ihrer Stromquelle mit der Spannung und Frequenz übereinstimmen, die auf dem Etikett mit den elektrischen Nennwerten des Geräts angegeben sind.
- Stecken Sie auf keinen Fall irgendwelche Gegenstände in Öffnungen in den Geräten. Leitfähige Gegenstände könnten aufgrund der möglicherweise vorliegenden gefährlichen Spannungen einen Kurzschluß verursachen, der einen Brand, Stromschlag oder Geräteschaden herbeiführen kann.

### Symbole

Die Symbole in diesem Handbuch haben folgende Bedeutung:



**Achtung** – Gefahr von Verletzung und Geräteschaden. Befolgen Sie die Anweisungen.



**Achtung** – Hohe Temperatur. Nicht berühren, da Verletzungsgefahr durch heiße Oberfläche besteht.



**Achtung** – Gefährliche Spannungen. Anweisungen befolgen, um Stromschläge und Verletzungen zu vermeiden.



**Ein** – Setzt das System unter Wechselstrom.



**Aus** – Unterbricht die Wechselstromzufuhr zum Gerät.



**Wartezustand** (Stand-by-Position) - Der Ein-/Wartezustand-Schalter steht auf Wartezustand. Änderungen an Sun-Geräten.

Nehmen Sie keine mechanischen oder elektrischen Änderungen an den Geräten vor. Sun Microsystems, übernimmt bei einem Sun-Produkt, das geändert wurde, keine Verantwortung für die Einhaltung behördlicher Vorschriften

## Aufstellung von Sun-Geräten



**Achtung** – Um den zuverlässigen Betrieb Ihres Sun-Geräts zu gewährleisten und es vor Überhitzung zu schützen, dürfen die Öffnungen im Gerät nicht blockiert oder verdeckt werden. Sun-Produkte sollten niemals in der Nähe von Heizkörpern oder Heizluftklappen aufgestellt werden.

## Einhaltung der SELV-Richtlinien

Die Sicherung der I/O-Verbindungen entspricht den Anforderungen der SELV-Spezifikation.

## Ergonomie-Richtlinien

Um den Anforderungen der in Deutschland geltenden Ergonomie-Richtlinie ZH1/618 zu entsprechen, wurde der Bildschirm entspiegelt. Für Textverarbeitungsanwendungen wird ein positiver Anzeigemodus (schwarze Zeichen auf weißem Hintergrund) empfohlen.

## Anschluß des Netzkabels



**Achtung** – Sun-Produkte sind für den Betrieb an Einphasen-Stromnetzen mit geerdetem Nulleiter vorgesehen. Um die Stromschlaggefahr zu reduzieren, schließen Sie Sun-Produkte nicht an andere Stromquellen an. Ihr Betriebsleiter oder ein qualifizierter Elektriker kann Ihnen die Daten zur Stromversorgung in Ihrem Gebäude geben.



**Achtung** – Nicht alle Netzkabel haben die gleichen Nennwerte. Herkömmliche, im Haushalt verwendete Verlängerungskabel besitzen keinen Überlastungsschutz und sind daher für Computersysteme nicht geeignet.



**Achtung** – Ihr Sun-Gerät wird mit einem dreidadrigen Netzkabel für geerdete Netzsteckdosen geliefert. Um die Gefahr eines Stromschlags zu reduzieren, schließen Sie das Kabel nur an eine fachgerecht verlegte, geerdete Steckdose an.

Die folgende Warnung gilt nur für Geräte mit Wartezustand-Netzschalter:



**Achtung** – Der Ein/Aus-Schalter dieses Geräts schaltet nur auf Wartezustand (Stand-By-Modus). Um die Stromzufuhr zum Gerät vollständig zu unterbrechen, müssen Sie das Netzkabel von der Steckdose abziehen. Schließen Sie den Stecker des Netzkabels an eine in der Nähe befindliche, frei zugängliche, geerdete Netzsteckdose an. Schließen Sie das Netzkabel nicht an, wenn das Netzteil aus der Systemeinheit entfernt wurde.

## Lithiumbatterie



**Achtung** – CPU-Karten von Sun verfügen über eine Echtzeituhr mit integrierter Lithiumbatterie (Teile-Nr. MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, oder MK48T08). Diese Batterie darf nur von einem qualifizierten Servicetechniker ausgewechselt werden, da sie bei falscher Handhabung explodieren kann. Werfen Sie die Batterie nicht ins Feuer. Versuchen Sie auf keinen Fall, die Batterie auszubauen oder wiederaufzuladen.

## Gehäuseabdeckung

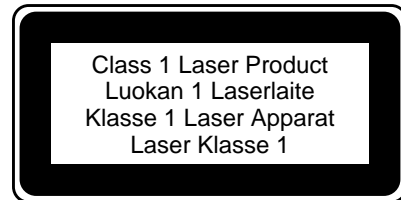
Sie müssen die obere Abdeckung Ihres Sun-Systems entfernen, um interne Komponenten wie Karten, Speicherchips oder Massenspeicher hinzuzufügen. Bringen Sie die obere Gehäuseabdeckung wieder an, bevor Sie Ihr System einschalten.



**Achtung** – Bei Betrieb des Systems ohne obere Abdeckung besteht die Gefahr von Stromschlag und Systemschäden.

## Einhaltung der Richtlinien für Laser

Sun-Produkte, die mit Laser-Technologie arbeiten, entsprechen den Anforderungen der Laser Klasse 1.



## Conformité aux normes de sécurité

Ce texte traite des mesures de sécurité qu'il convient de prendre pour l'installation d'un produit Sun Microsystems.

### Mesures de sécurité

Pour votre protection, veuillez prendre les précautions suivantes pendant l'installation du matériel :

- Suivre tous les avertissements et toutes les instructions inscrites sur le matériel.
- Vérifier que la tension et la fréquence de la source d'alimentation électrique correspondent à la tension et à la fréquence indiquées sur l'étiquette de classification de l'appareil.
- Ne jamais introduire d'objets quels qu'ils soient dans une des ouvertures de l'appareil. Vous pourriez vous trouver en présence de hautes tensions dangereuses. Tout objet conducteur introduit de la sorte pourrait produire un court-circuit qui entraînerait des flammes, des risques d'électrocution ou des dégâts matériels.

### Symboles

Vous trouverez ci-dessous la signification des différents symboles utilisés :



**Attention** : risques de blessures corporelles et de dégâts matériels. Veuillez suivre les instructions.



**Attention** : surface à température élevée. Evitez le contact. La température des surfaces est élevée et leur contact peut provoquer des blessures corporelles.



**Attention** : présence de tensions dangereuses. Pour éviter les risques d'électrocution et de danger pour la santé physique, veuillez suivre les instructions.



**MARCHE** – Votre système est sous tension (courant alternatif).



**ARRÊT** – Votre système est hors tension (courant alternatif).



**VEILLEUSE** – L'interrupteur Marche/Veilleuse est en position « Veilleuse ».

### Modification du matériel

Ne pas apporter de modification mécanique ou électrique au matériel. Sun Microsystems n'est pas responsable de la conformité réglementaire d'un produit Sun qui a été modifié.

## Positionnement d'un produit Sun



**Attention** : pour assurer le bon fonctionnement de votre produit Sun et pour l'empêcher de surchauffer, il convient de ne pas obstruer ni recouvrir les ouvertures prévues dans l'appareil. Un produit Sun ne doit jamais être placé à proximité d'un radiateur ou d'une source de chaleur.

### Conformité SELV

Sécurité : les raccordements E/S sont conformes aux normes SELV.

### Ergonomie européenne

Conformément à la norme d'ergonomie allemande ZH1/618, le CRT a été soumis à un traitement antireflets. Pour le traitement de texte, un affichage en mode positif (c'est-à-dire des caractères noirs sur fond blanc) est nécessaire.

### Connexion du cordon d'alimentation



**Attention** : les produits Sun sont conçus pour fonctionner avec des alimentations monophasées munies d'un conducteur neutre mis à la terre. Pour écarter les risques d'électrocution, ne pas brancher de produit Sun dans un autre type d'alimentation secteur. En cas de doute quant au type d'alimentation électrique du local, veuillez vous adresser au directeur de l'exploitation ou à un électricien qualifié.



**Attention** : tous les cordons d'alimentation n'ont pas forcément la même puissance nominale en matière de courant. Les rallonges d'usage domestique n'offrent pas de protection contre les surcharges et ne sont pas prévues pour les systèmes d'ordinateurs. Ne pas utiliser de rallonge d'usage domestique avec votre produit Sun.



**Attention** : votre produit Sun a été livré équipé d'un cordon d'alimentation à trois fils (avec prise de terre). Pour écarter tout risque d'électrocution, branchez toujours ce cordon dans une prise mise à la terre.

L'avertissement suivant s'applique uniquement aux systèmes équipés d'un interrupteur VEILLEUSE:



**Attention** : le commutateur d'alimentation de ce produit fonctionne comme un dispositif de mise en veille uniquement. C'est la prise d'alimentation qui sert à mettre le produit hors tension. Veuillez donc à installer le produit à proximité d'une prise murale facilement accessible. Ne connectez pas la prise d'alimentation lorsque le châssis du système n'est plus alimenté.

## Batterie au lithium



**Attention** : sur les cartes CPU Sun, une batterie au lithium (référence MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, ou MK48T08.) a été moulée dans l'horloge temps réel SGS. Les batteries ne sont pas des pièces remplaçables par le client. Elles risquent d'exploser en cas de mauvais traitement. Ne pas jeter la batterie au feu. Ne pas la démonter ni tenter de la recharger.

## Couvercle

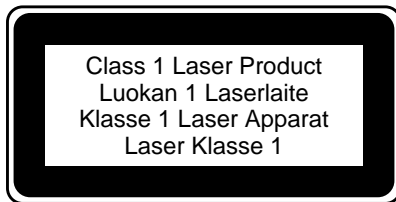
Pour ajouter des cartes, de la mémoire, ou des unités de stockage internes, vous devez démonter le couvercle de l'unité système Sun. Ne pas oublier de remettre ce couvercle en place avant de mettre le système sous tension.



**Attention** : il est dangereux de faire fonctionner un produit Sun sans le couvercle en place. Si l'on néglige cette précaution, on encourt des risques de blessures corporelles et de dégâts matériels.

## Conformité aux certifications Laser

Les produits Sun qui font appel aux technologies lasers sont conformes aux normes de la classe 1 en la matière.



## Normativas de seguridad

El siguiente texto incluye las medidas de seguridad que se deben seguir cuando se instale algún producto de Sun Microsystems.

## Precauciones de seguridad

Para su protección observe las siguientes medidas de seguridad cuando manipule su equipo:

- Siga todas las avisos e instrucciones marcados en el equipo.
- Asegúrese de que el voltaje y la frecuencia de la red eléctrica concuerdan con las descritas en las etiquetas de especificaciones eléctricas del equipo.
- No introduzca nunca objetos de ningún tipo a través de los orificios del equipo. Pueden haber voltajes peligrosos. Los objetos extraños conductores de la electricidad pueden producir cortocircuitos que provoquen un incendio, descargas eléctricas o daños en el equipo.

## Símbolos

En este libro aparecen los siguientes símbolos:



**Precaución** – Existe el riesgo de lesiones personales y daños al equipo. Siga las instrucciones.



**Precaución** – Superficie caliente. Evite el contacto. Las superficies están calientes y pueden causar daños personales si se tocan.



**Precaución** – Voltaje peligroso presente. Para reducir el riesgo de descarga y daños para la salud siga las instrucciones.



**Encendido** – Aplica la alimentación de CA al sistema.



**Apagado** – Elimina la alimentación de CA del sistema.



**En espera** – El interruptor de Encendido/En espera se ha colocado en la posición de *En espera*.

## Modificaciones en el equipo

No realice modificaciones de tipo mecánico o eléctrico en el equipo. Sun Microsystems no se hace responsable del cumplimiento de las normativas de seguridad en los equipos Sun modificados.



## Ubicación de un producto Sun



**Precaución** – Para asegurar la fiabilidad de funcionamiento de su producto Sun y para protegerlo de sobrecalentamientos no deben obstruirse o taparse las rejillas del equipo. Los productos Sun nunca deben situarse cerca de radiadores o de fuentes de calor.

## Cumplimiento de la normativa SELV

El estado de la seguridad de las conexiones de entrada/salida cumple los requisitos de la normativa SELV.

## Normativa ergonómica europea

Para cumplir con el estándar de ergonomía alemán ZH1/618, se ha dotado a la pantalla con un tratamiento antireflectante. Para las aplicaciones de tratamiento de textos, se precisa un modo de visualización positivo (caracteres negros sobre fondo blanco).

## Conexión del cable de alimentación eléctrica



**Precaución** – Los productos Sun están diseñados para trabajar en una red eléctrica monofásica con toma de tierra. Para reducir el riesgo de descarga eléctrica, no conecte los productos Sun a otro tipo de sistema de alimentación eléctrica. Póngase en contacto con el responsable de mantenimiento o con un electricista cualificado si no está seguro del sistema de alimentación eléctrica del que se dispone en su edificio.



**Precaución** – No todos los cables de alimentación eléctrica tienen la misma capacidad. Los cables de tipo doméstico no están provistos de protecciones contra sobrecargas y por tanto no son apropiados para su uso con computadores. No utilice alargadores de tipo doméstico para conectar sus productos Sun.



**Precaución** – Con el producto Sun se proporciona un cable de alimentación con toma de tierra. Para reducir el riesgo de descargas eléctricas conéctelo siempre a un enchufe con toma de tierra.

La siguiente advertencia se aplica solamente a equipos con un interruptor de encendido que tenga una posición "En espera":



**Precaución** – El interruptor de encendido de este producto funciona exclusivamente como un dispositivo de puesta en espera. El enchufe de la fuente de alimentación está diseñado para ser el elemento primario de desconexión del equipo. El equipo debe instalarse cerca del enchufe de forma que este último pueda ser fácil y rápidamente accesible. No conecte el cable de alimentación cuando se ha retirado la fuente de alimentación del chasis del sistema.

## Batería de litio



**Precaución** – En las placas de CPU Sun hay una batería de litio insertada en el reloj de tiempo real, tipo SGS Núm. MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, o MK48T08. Las baterías no son elementos reemplazables por el propio cliente. Pueden explotar si se manipulan de forma errónea. No arroje las baterías al fuego. No las abra o intente recargarlas.

## Tapa de la unidad del sistema

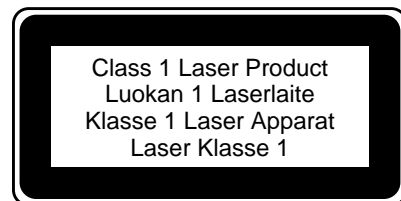
Debe quitar la tapa del sistema cuando sea necesario añadir tarjetas, memoria o dispositivos de almacenamiento internos. Asegúrese de cerrar la tapa superior antes de volver a encender el equipo.



**Precaución** – Es peligroso hacer funcionar los productos Sun sin la tapa superior colocada. El hecho de no tener en cuenta esta precaución puede ocasionar daños personales o perjudicar el funcionamiento del equipo.

## Aviso de cumplimiento con requisitos de láser

Los productos Sun que utilizan la tecnología de láser cumplen con los requisitos de láser de Clase 1.



# Nordic Lithium Battery Cautions

## Norge



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**A D V A R S E L** – Litiumbatteri — Eksplosjonsfare. Ved utskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

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## Sverige



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**VARNING** – Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

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## Danmark



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**ADVARSEL!** – Litiumbatteri — Eksplosionsfare ved fejlagtig håndtering. Udsiftingning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

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## Suomi



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**VAROITUS** – Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

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## Illustrated Parts Breakdown

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This appendix consists of a sequence of illustrations that show how the various pieces of the system fit together. Part numbers are also provided.

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# Illustrated Parts Breakdown

The following items for the Sun Ultra 450 workstation can be replaced at the customer site by a qualified service engineer.

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**Note** – Part numbers listed in this section are correct as of the manual publication date but are subject to change without notice. Consult your authorized Sun sales representative or service provider to confirm a part number prior to ordering a replacement part.

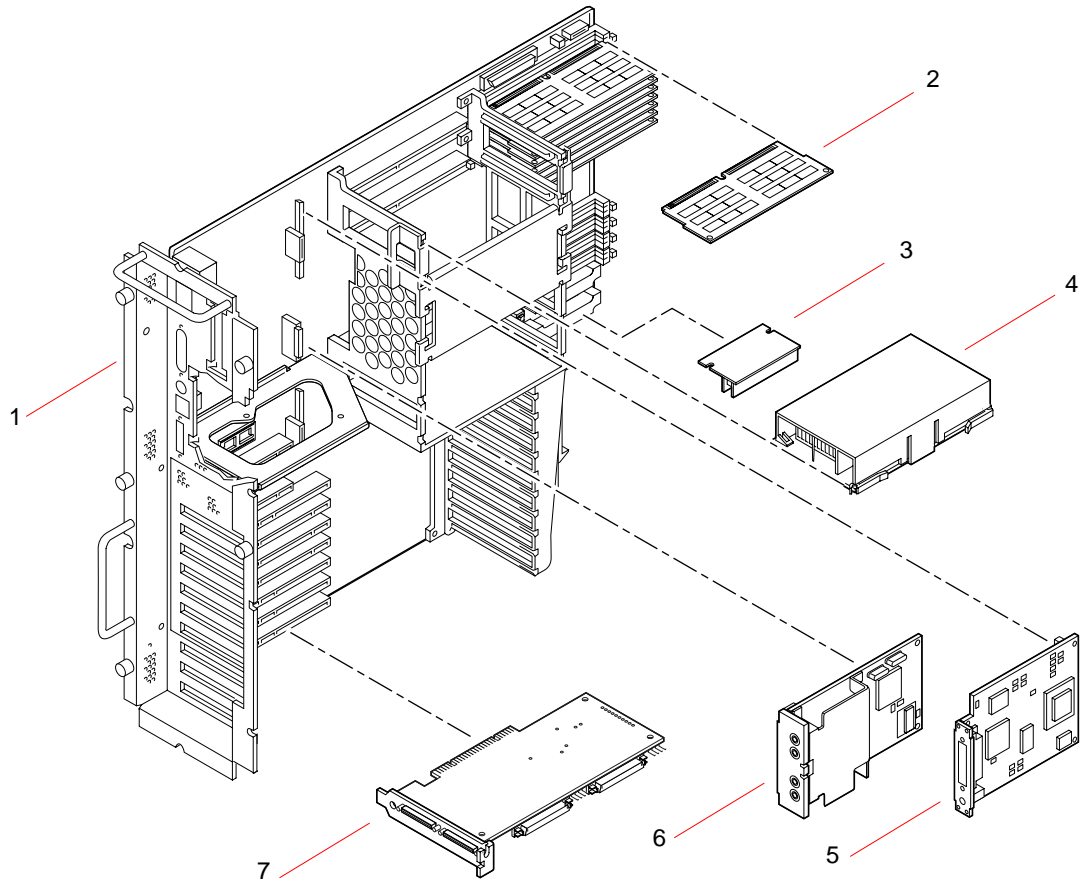
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Category	Replacement Part	Part Number	Illustration
Main Logic Board and Components	Main Logic Board	501-2996	page 459, page 464
	DIMM 16 MB, 60 NS	501-2479	page 459
	DIMM, 32 MB, 60 NS	501-2622	page 459
	DIMM, 64 MB, 60 NS	501-2480	page 459
	DIMM, 128 MB, 60 NS	501-3136	page 459
	Audio Module Card	501-2592	page 460
	Creator3D Series 2 Graphics Card	501-4173	page 460
	UltraSPARC II CPU (300 MHz, 2MB Ecache)	501-4196	page 459
	DC/DC Converter (45W)	300-1322	page 459
	Dual Single-Ended UltraSCSI Controller, PCI	375-0013	page 460
PGX Graphics Frame Buffer card, PCI	370-2256		
Backplanes	8-slot UltraSCSI Backplane	501-4189	page 461, page 471, page 472, page 473
	4-slot UltraSCSI Backplane	501-4148	page 461, page 471, page 472, page 473
	Removable Media Backplane	501-3128	page 466, page 470
	Power Distribution Board	501-3100	page 461

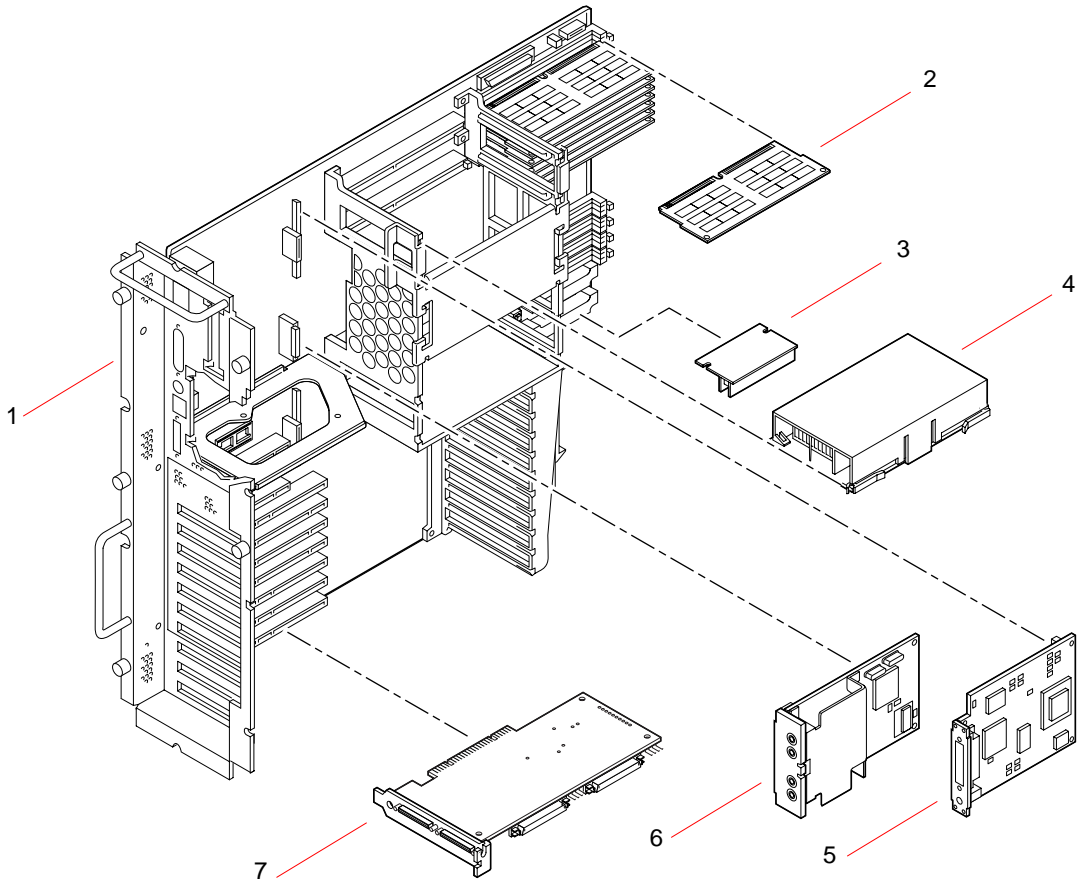
Category	Replacement Part	Part Number	Illustration
Storage Devices			
	4.2 GB UltraSCSI Disk Drive	540-2938	page 462
	12X CD-ROM Drive	370-2817	page 463
	Diskette Drive	370-2730	page 463
	12-24 GB 4mm DDS3 Tape Drive	370-2377	page 463
	7-14 GB 8mm Tape Drive	370-1922	page 463
Miscellaneous Assemblies			
	Removable Media Assembly (RMA)	540-2903	page 462, page 463, page 466, page 470
	Disk Fan Tray Assembly	540-2841	page 461
	CPU Fan Tray Assembly	540-2840	page 464
	Upper Blower Assembly	540-3023	page 461
	Power Supply (560W)	300-1302	page 465
	AC Line Filter Assembly (15A, 100-240 VAC)	370-2160	page 465
	Speaker Assembly	370-1579	page 461
	LED Interface Board	501-4270	page 466
	PCI/Graphics Rear Panel Insert	540-3388	page 464
	PCI Rear Panel Insert	540-2867	page 464
	Key	250-1317	
Covers			
	Right Side Panel	540-2836	page 468
	Left Side Panel	540-2835	page 468
	Front Door (Bottom Door)	540-2832	page 468
	Removable Media Door (Top Door)	540-2910	page 462, page 468

Category	Replacement Part	Part Number	Illustration
Internal Cables	Disk Fan Tray/Interlock Cable	530-2305	page 469
	Removable Media SCSI Cable	530-2368	page 470
	Removable Media Power Cable	530-2365	page 470
	8-Slot UltraSCSI Power Cable	530-2364	page 471
	8-Slot UltraSCSI Data Cable	530-2366	page 472
	4-Slot UltraSCSI Power Cable	530-2364	page 471
	4-Slot UltraSCSI Data Cable	530-2367	page 473
	LED Interface Cable	530-2363	page 466
	Diskette Data Cable	530-2339	page 467
	Diskette Power Cable	530-2340	page 467
	SCSI Drive Power Cable	530-2338	page 467
	SCSI Drive Data Cable	530-2337	page 467
	I <sup>2</sup> C Cable	530-2355	page 471
	Keypress cable	530-2314	page 466

# Assembly Illustrations

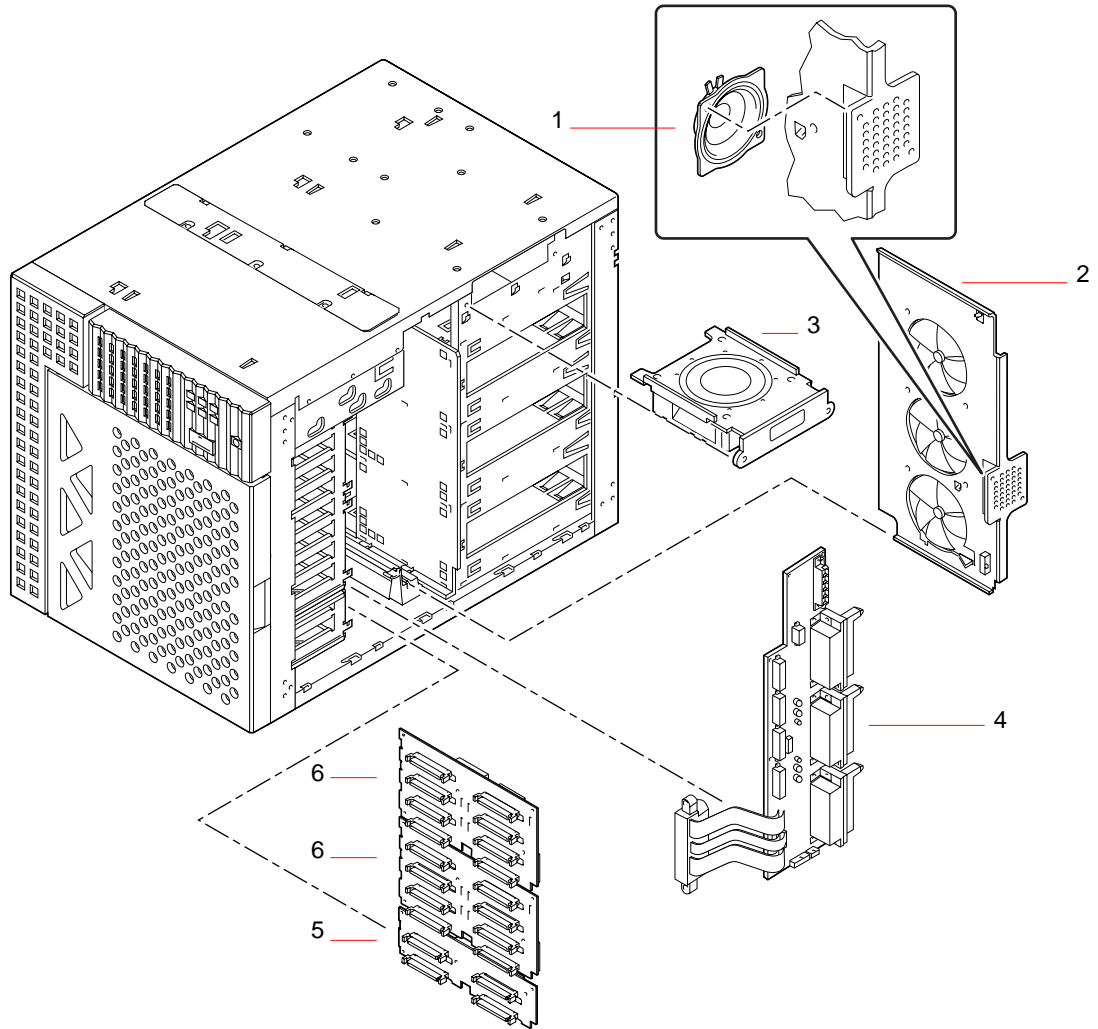


Key	Description	Part Number
1	Main Logic Board	501-2996
2	DIMM	
	16 MB	501-2479
	32 MB	501-2622
	64 MB	501-2480
	128 MB	501-3136
3	DC/DC Converter	300-4488
4	UltraSPARC II CPU Module (300 MHz)	501-4196

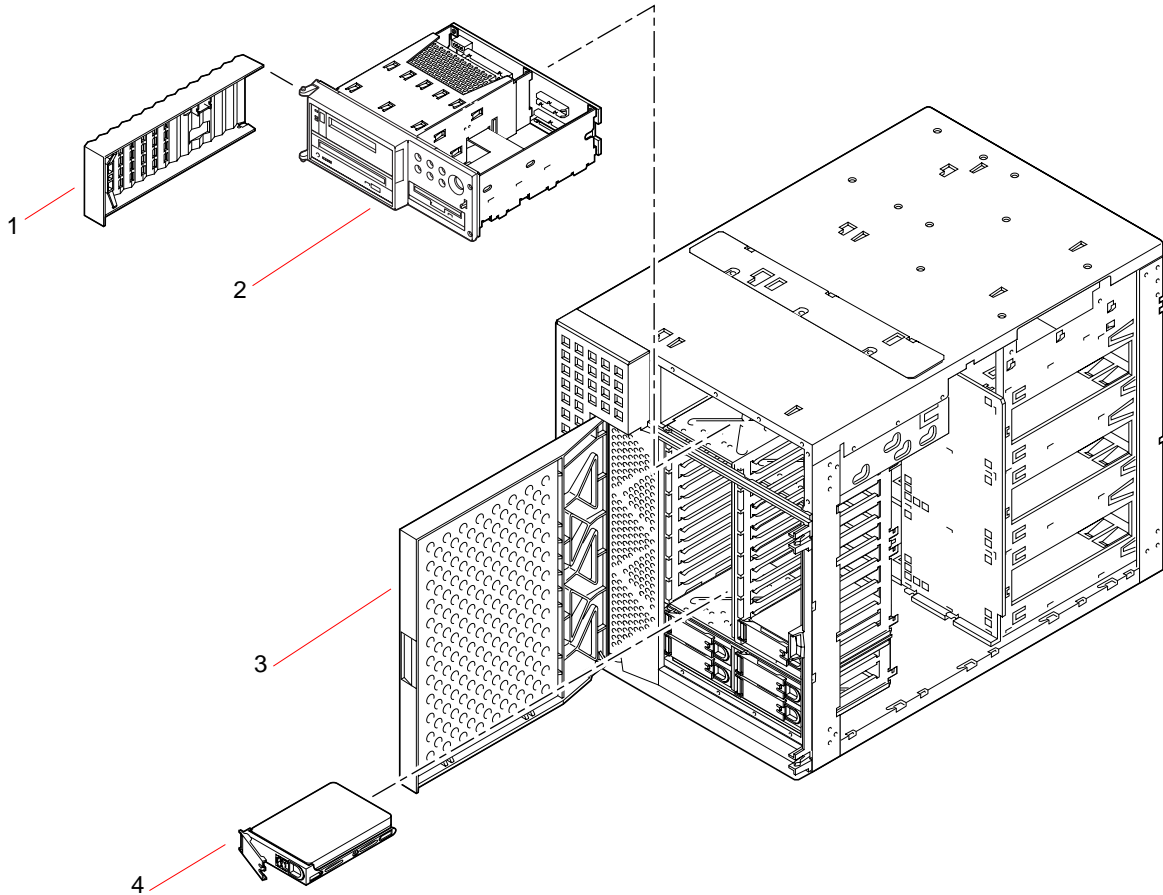


Key	Description	Part Number
5	Creator3D Series 2 Graphics Card	501-4173
6	Audio Module Card	501-2592
7	Dual Single-Ended UltraSCSI Controller, PCI	375-0013

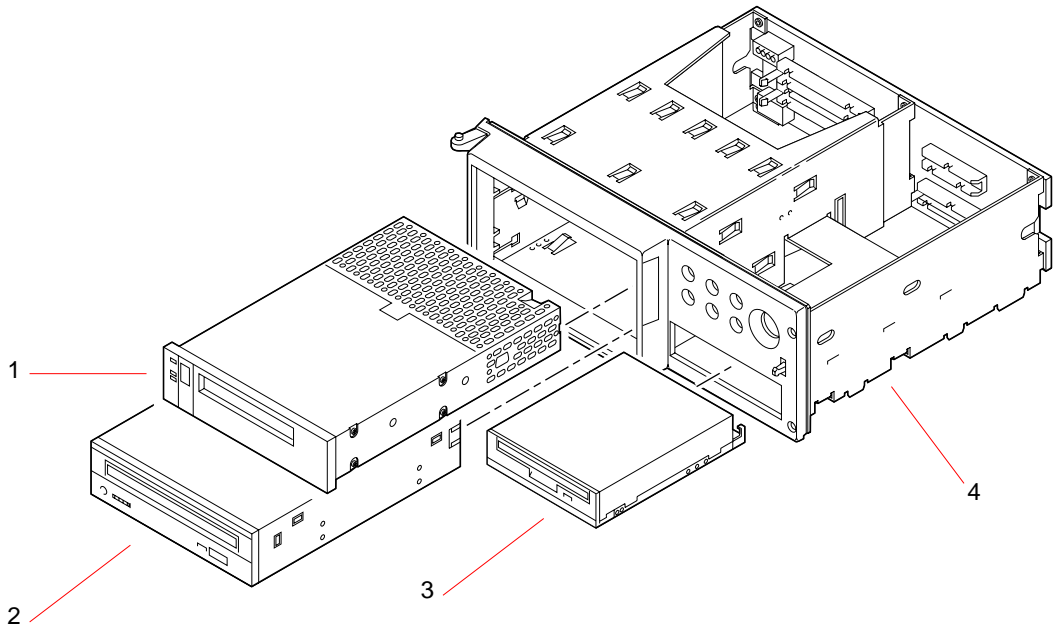




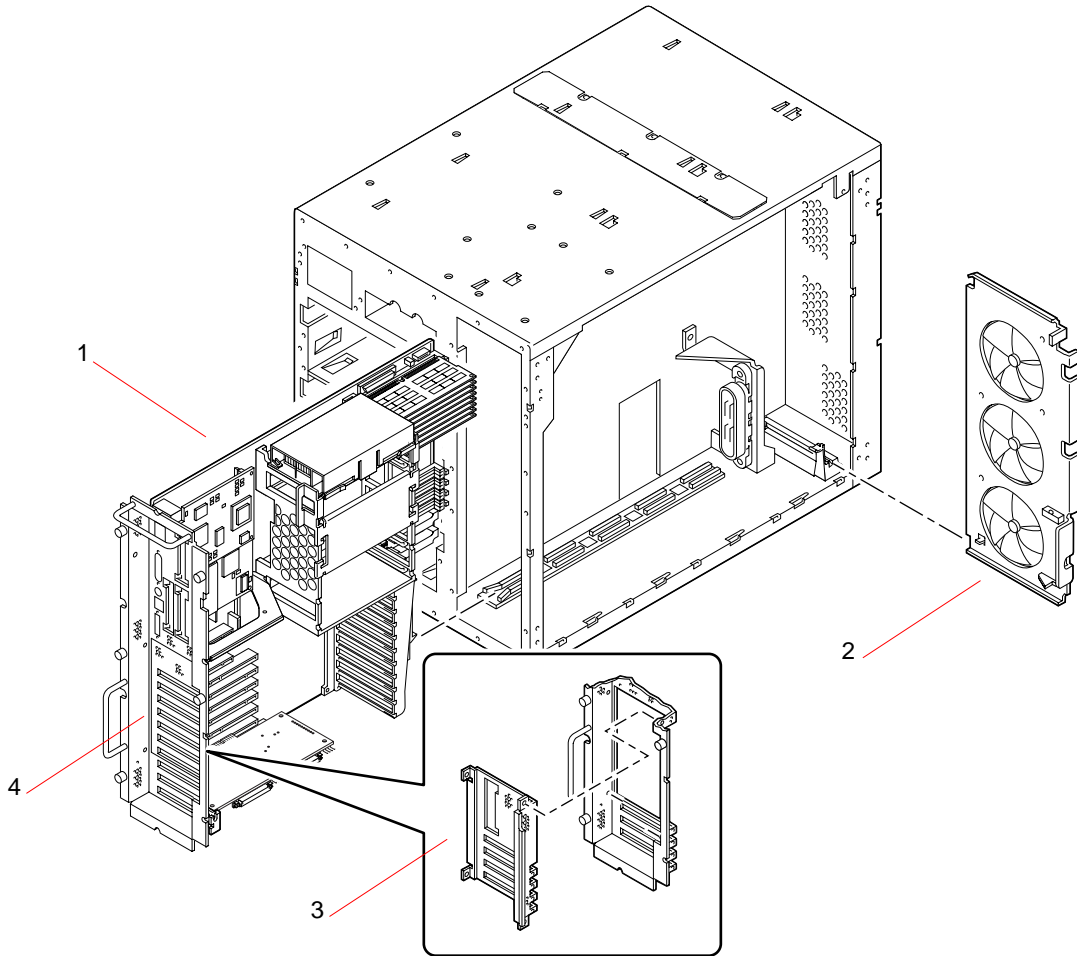
Key	Description	Part Number
1	Speaker Assembly	370-1579
2	Disk Fan Tray Assembly	540-2841
3	Upper Blower Assembly	540-3023
4	Power Distribution Board	501-3100
5	4-Slot UltraSCSI Backplane	501-4148
6	8-Slot UltraSCSI Backplane	501-4189



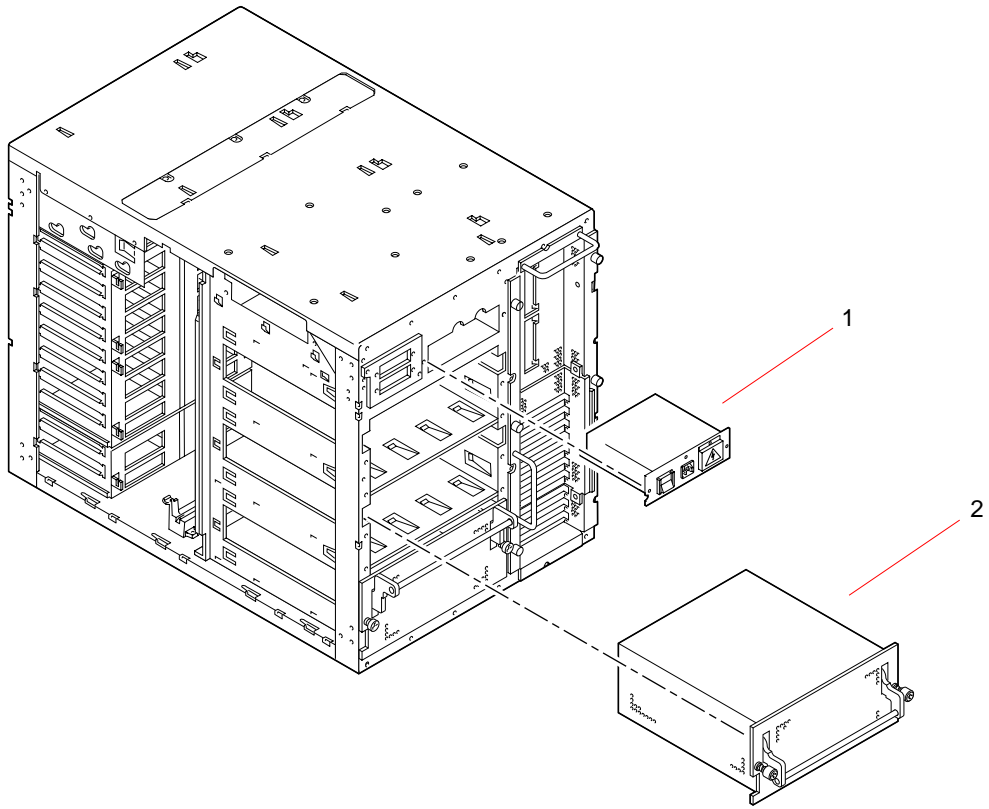
Key	Description	Part Number
1	Removable Media Door	540-2910
2	Removable Media Assembly	540-2903
3	Front Door	540-2832
4	4.2 GB UltraSCSI Disk Drive	540-2938



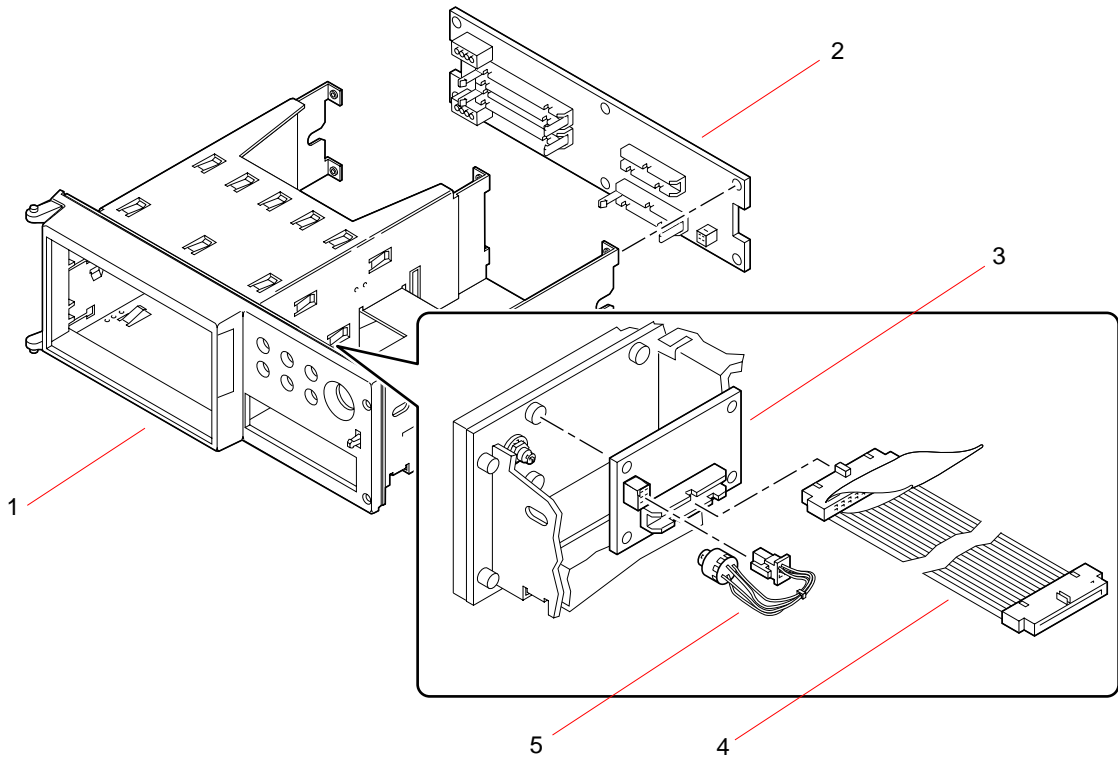
Key	Description	Part Number
1	12-24 GB 4mm DDS3 Tape Drive 7-14 GB 8mm Tape Drive	370-2377 370-1922
2	12X CD-ROM Drive	370-2817
3	Diskette Drive	370-2817
4	Removable Media Assembly	540-2903



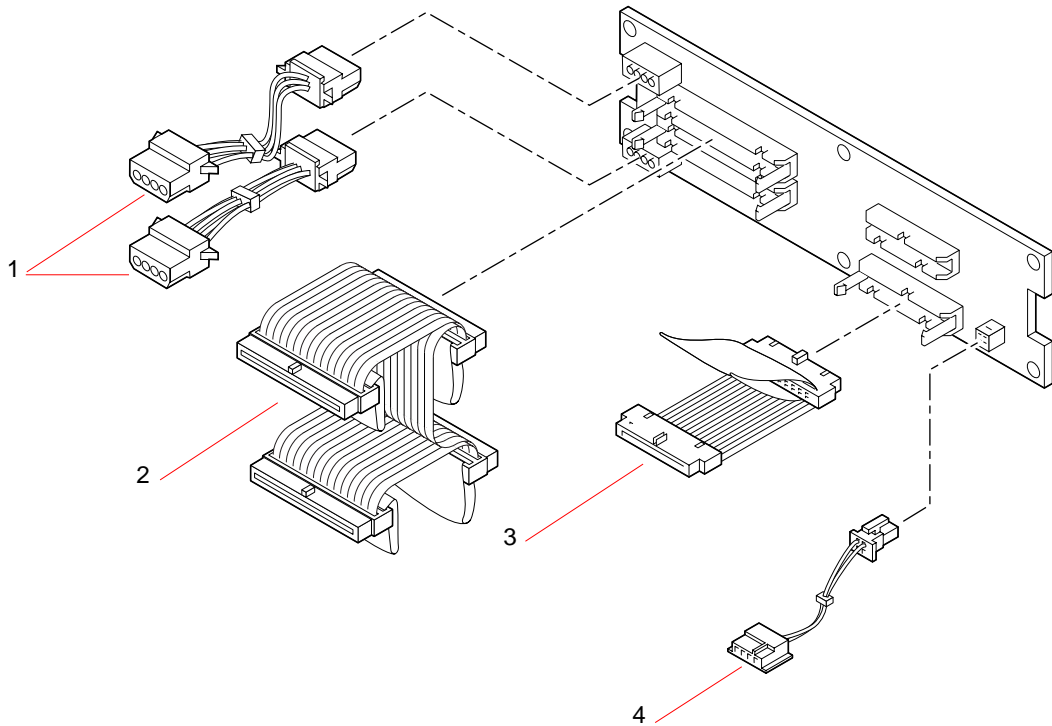
Key	Description	Part Number
1	Main Logic Board	501-2996
2	CPU Fan Tray Assembly	540-2840
3	PCI/Graphics Rear Panel Insert	540-3388
4	PCI Rear Panel Insert	540-2867



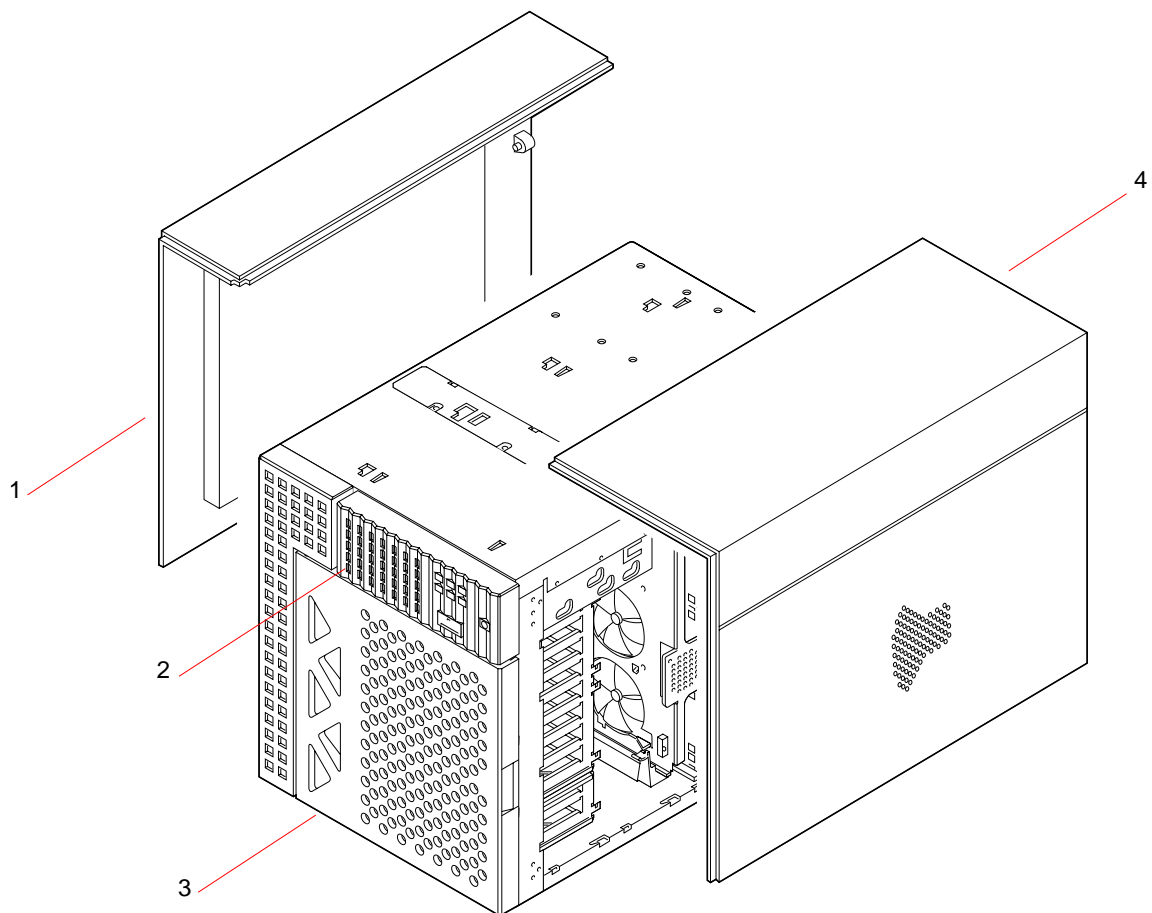
Key	Description	Part Number
1	AC Line Filter Assembly	370-2160
2	Power Supply	300-1302



Key	Description	Part Number
1	Removable Media Assembly	540-2903
2	Removable Media Backplane	501-3128
3	LED Interface Board	501-4270
4	LED Interface Cable	530-2362
5	Keyswitch Cable	530-2314

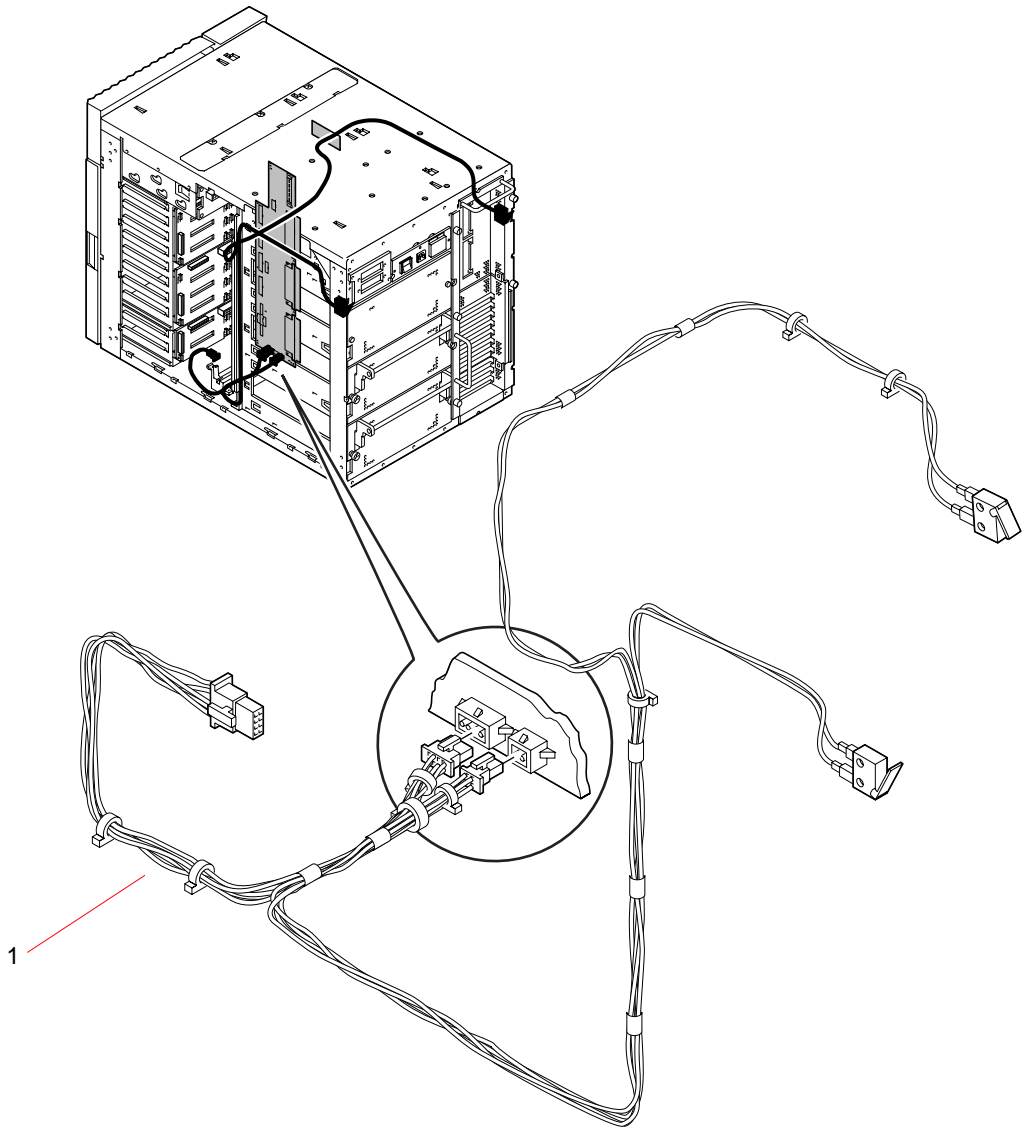


Key	Description	Part Number
1	SCSI Drive Power Cable	530-2338
2	SCSI Drive Data Cable	530-2337
3	Diskette Data Cable	530-2339
4	Diskette Power Cable	530-2340

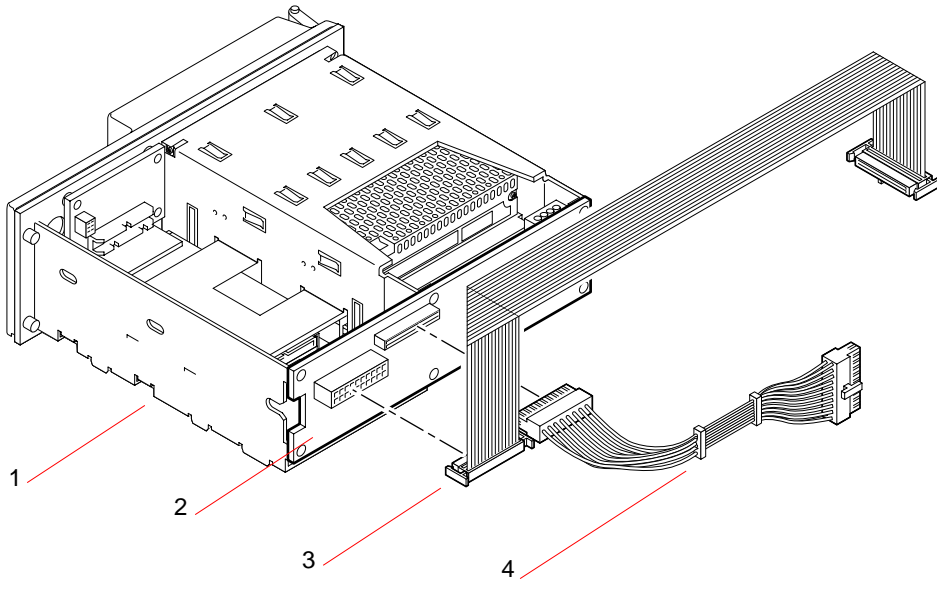


Key	Description	Part Number
1	Left Side Panel	540-2835
2	Removable Media Door	540-2910
3	Front Door	540-2910
4	Right Side Panel	540-2836

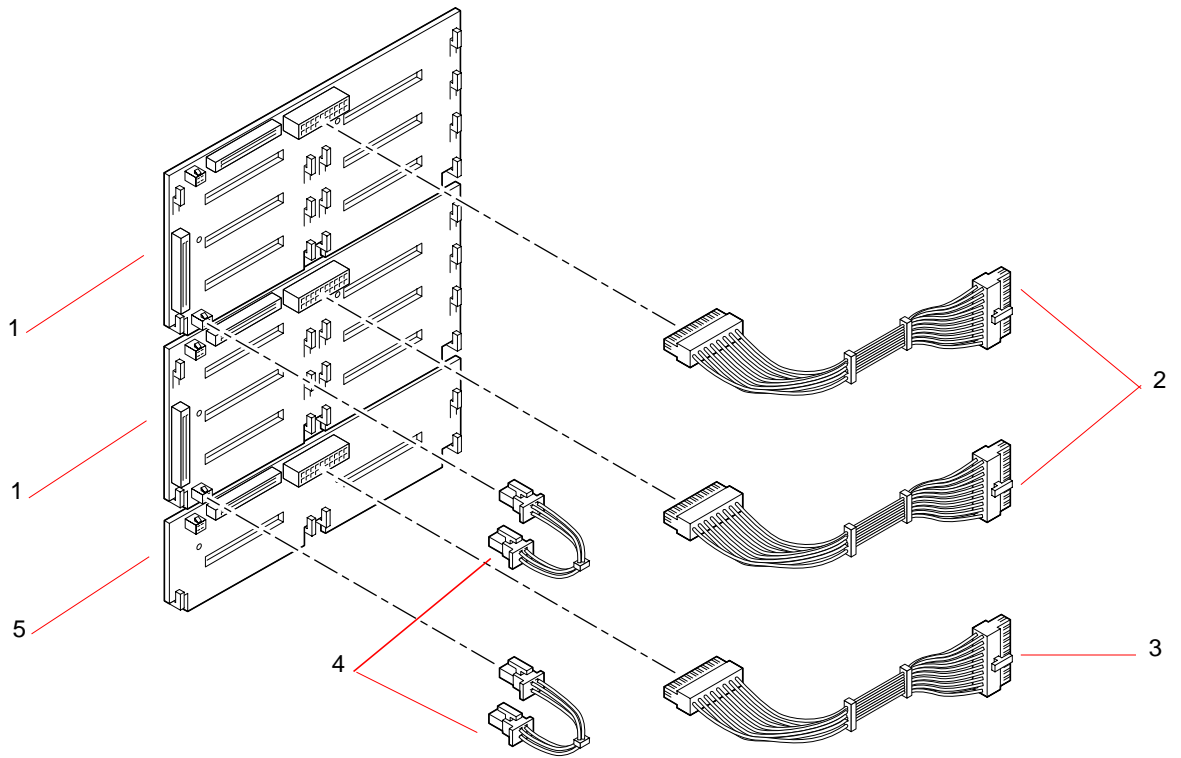




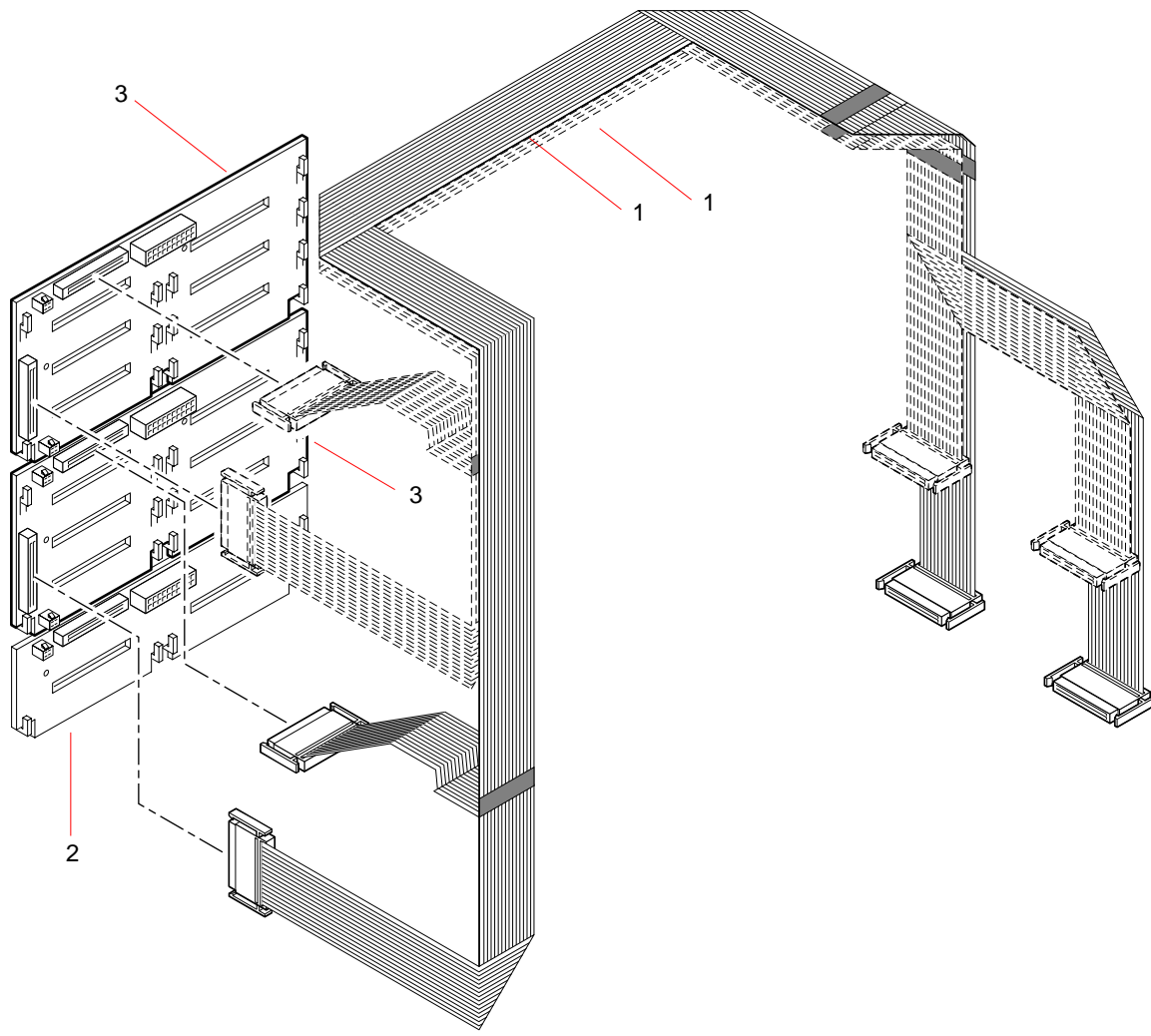
Key	Description	Part Number
1	Disk Fan Tray/Interlock Cable	530-2305



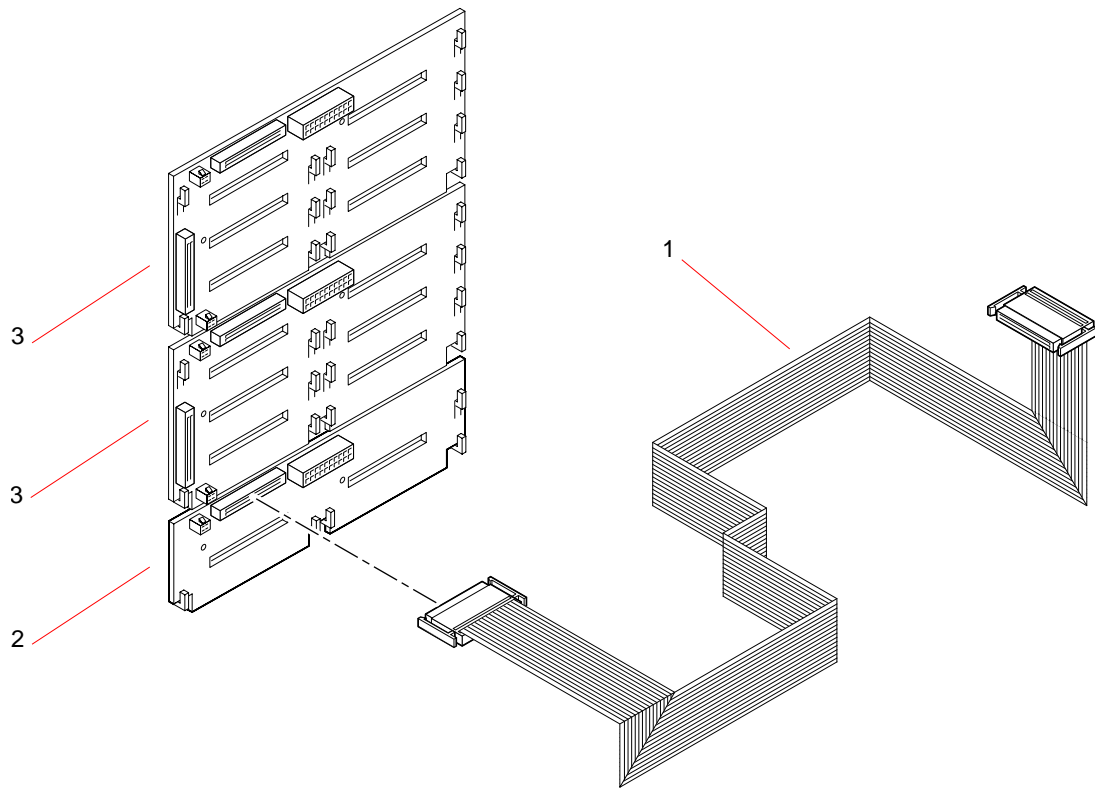
Key	Description	Part Number
1	Removable Media Assembly	540-2903
2	Removable Media Backplane	501-3128
3	Removable Media SCSI Cable	530-2368
4	Removable Media Power Cable	530-2365



Key	Description	Part Number
1	8-Slot UltraSCSI Backplane	501-4189
2	8-Slot UltraSCSI Power Cable	530-2364
3	4-Slot UltraSCSI Power Cable	530-2364
4	I <sup>2</sup> C Cable	530-2355
5	4-Slot UltraSCSI Backplane	501-4148



Key	Description	Part Number
1	8-Slot UltraSCSI Data Cable	530-2366
2	4-Slot UltraSCSI Backplane	501-4148
3	8-Slot UltraSCSI Backplane	501-4189



Key	Description	Part Number
1	4-Slot UltraSCSI Data Cable	530-2367
2	4-Slot UltraSCSI Backplane	501-4148
3	8-Slot UltraSCSI Backplane	501-4149



# Glossary

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- 10BASE-T** A network implementation that supports data transfer at 10 megabits per second and uses unshielded twisted-pair wire with an RJ-45 modular connector.
- 100BASE-T** Also known as Fast Ethernet, a network implementation that supports data transfer at 100 megabits per second over special grades of twisted-pair wire.
- 100BASE-TX** A subset of 100BASE-T technology that defines digital transmission over two pairs of shielded twisted-pair wire. 100BASE-TX also defines digital transmission over fiber optic cable.
- AnswerBook documentation** Sun Microsystems' online documentation for use with the OpenWindows and Common Desktop environments.
- AUI** Attachment unit interface. A special port that attaches the system unit to a thick (not twisted-pair) Ethernet network.
- boot PROM** A non-volatile memory device that contains the PROM monitor program, a command interpreter used for booting, resetting, low-level configuration, and simple test procedures. *See also* NVRAM.
- boot server** A server system that provides client systems on the network with the programs and information that they need to start up.
- bps** Bits per second.
- composite drive** A single logical drive made up of more than one physical drive. *See also* disk array, metadvice, and RAID.
- DAT** Digital audio tape.
- data compression** A technique that reduces the amount of storage required to store data.
- DIMM** Dual in-line memory module. A printed circuit card that contains dynamic random-access memory (DRAM) chips.

- disk array** One or more physical disk drives that may form a single logical drive. A disk array may contain several disk drive trays. *See also* composite drive.
- disk concatenation** A disk array configuration technique that increases capacity by creating one large metadvice from two or more smaller drives. *See also* metadvice.
- disk mirroring** A disk array configuration technique that uses redundant disks to protect against disk failure and data loss. *See also* metadvice.
- disk partition** A portion of the disk reserved for a specific file system and function.
- disk striping** A disk array configuration technique that increases throughput by using several disk drives in parallel. *See also* metadvice.
- diskette** A 3.5-inch removable file storage medium.
- DRAM** Dynamic random-access memory.
- DS HD** Double-sided, high-density.
- ESD** Electrostatic discharge.
- Ethernet** A type of local area network that enables real-time communication between machines connected directly through cables. *See also* 10BASE-T, 100BASE-T, and 100BASE-TX.
- Fast Ethernet** *See* 100BASE-T.
- FDDI** Fiber distributed data interface. A high-speed fiber-optic networking standard.
- frame buffer** Display memory that temporarily stores (buffers) data.
- hard disk** An inflexible platter that allows magnetic recording of data.
- host name** The human-parsable name given to a networked computer. *See also* IP address.
- hot spares** A disk array configuration technique in which one or more drives are dormant, waiting to fill when an active drive becomes defective.
- IP address** Internet protocol address. A unique 32-bit address that identifies each host in a network. *See also* host name.
- man pages** UNIX online documentation.
- memory module** A small card containing a number of integrated circuit “chips” that hold data.
- metadvice** Logical disk device comprising several physical disks or partitions from several disks.
- mount** To make a file system accessible over the network by executing the `mount` command. *See also* `unmount`.
- mount point** A directory in which you mount a file system that exists on a remote machine.



<b>NVRAM</b>	Non-volatile random-access memory. A type of memory that retains information when power is removed from the system.
<b>parity</b>	A method used by a system for checking that data received matches data sent. A parity error indicates that data was not received as it was transmitted.
<b>partition</b>	The unit into which disk space is divided by software.
<b>PCI</b>	Peripheral Component Interconnect. A high-performance input/output interconnect for multimedia and graphics products, disk expansion, and high-performance networking products.
<b>physical address</b>	An address that corresponds to a hardware memory location. <i>See also</i> virtual memory.
<b>physical address space</b>	The set of possible 41-bit physical addresses that refer to locations in memory (memory space) or input/output space (device registers).
<b>physical memory</b>	The main memory connected to the processor. <i>See also</i> secondary storage and virtual memory.
<b>POST</b>	Power-on self-test. A set of routines stored in a computer's read-only memory (ROM) that tests various system components such as RAM, the disk drives, and the keyboard to see if they are properly connected and operating.
<b>RAID</b>	Redundant array of inexpensive disks. A series of techniques to increase disk throughput and availability.
<b>RAID-5</b>	An implementation of disk striping in which parity information is included with each disk drive. If one RAID-5 array fails, all information can be reconstructed from data and parity on the remaining disks. <i>See also</i> metadvice.
<b>RFI</b>	Radio frequency interference.
<b>SCSI</b>	Small computer system interface. An industry-standard bus used to connect disk and tape devices to a workstation.
<b>secondary storage</b>	A device, such as a disk drive, used to back up the contents of main memory. Also called auxiliary memory. <i>See also</i> physical memory and virtual memory.
<b>swap partition</b>	A disk partition reserved for use by the operating system.
<b>TCP</b>	Transmission control protocol. The major Internet transport protocol.
<b>unmount</b>	The process of removing access to a directory on a disk attached to a machine or a remote disk on a network. <i>See also</i> mount.
<b>virtual memory</b>	A method of allowing a program access to more memory space than is provided by physical memory through intelligently managing the transfer of data between main memory and storage devices. <i>See also</i> physical memory and secondary storage.



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For the Sun Ultra 450 Workstation Owner's Guide, part number 805-0430-10.

1. Were the procedures documented thoroughly? \_\_\_\_\_  
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  2. Were the illustrations helpful? \_\_\_\_\_  
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  3. Was the information accurate and easy to follow? \_\_\_\_\_  
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  4. Did you refer to this manual online? \_\_\_\_\_  
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  5. Additional comments. \_\_\_\_\_  
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SUN MICROSYSTEMS INC  
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UNITED STATES OF AMERICA

