Sun Ultra™ 45 and Ultra 25 Workstations Service and Diagnostics Manual

Adobe PostScript™

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Preface

Use the *Sun Ultra 45 and Ultra 25 Workstations Service and Diagnostics Manual* to replace Sun Ultra™ 45 or Ultra 25 workstation components and diagnose workstation problems.

This document is written for technicians, service personnel, and system administrators who service and repair computer systems.

To safely and successfully perform diagnostics on the Sun Ultra 45 and Ultra 25 workstations, you should be able to:

- Understand the Solaris™ Operating System and the command-line interface.
- Obtain superuser privileges for the workstation being serviced.
- Understand typical hardware troubleshooting tasks.

If you are not comfortable performing any of the procedures described in this document, contact your Sun service representative.

How This Document Is Organized

Chapter 1 provides a product description of the Sun Ultra 45 and Ultra 25 workstations.

Chapter 2 provides preliminary steps necessary to prepare for component replacement.

Chapter 3 provides replacement procedures for components found on the motherboard.

Chapter 4 provides replacement procedures for data storage components.

Chapter 5 provides replacement procedures for chassis components.

Chapter 6 provides procedures to finish component replacement.

Chapter 7 provides an overview of diagnostics tools and procedures.

Chapter 8 provides basic troubleshooting tasks, commands, and system responses.

Chapter 9 provides details on Solaris predictive self-healing diagnostics tools as well as other Solaris diagnostics tools.

Chapter 10 provides information about NVRAM and changing NVRAM settings.

Chapter 11 provides diagnostics information related to power-on self-test (POST),

Chapter 11 describes OpenBoot™ Diagnostics for the Sun Ultra 45 and Ultra 25 workstations.

Chapter 12 describes the OpenBoot PROM and related tools.

Chapter 13 provides basic SunVTS™ software information and references to SunVTS documentation.

Appendix A describes how to manage power-saving modes of the Sun Ultra 45 or Ultra 25 workstations.

Appendix B lists the specifications of the Sun Ultra 45 and Ultra 25 workstations.

Appendix C provides a functional description of the Sun Ultra 45 and Ultra 25 workstations.

Using UNIX Commands

This document might not contain information about basic UNIX® commands and procedures such as shutting down the system, booting the system, and configuring devices. Refer to the following for this information:

- Software documentation that you received with your system
- Solaris Operating System documentation, which is at:

  `http://docs.sun.com`

Shell Prompts

Shell	Prompt
C shell	*machine-name*%
C shell superuser	*machine-name*#
Bourne shell and Korn shell	$
Bourne shell and Korn shell superuser	#

Typographic Conventions

Typeface*	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
AaBbCc123	What you type, when contrasted with on-screen computer output	`%` **su** `Password:`
AaBbCc123	Document titles, new words or terms, words to be emphasized. Replace command-line variables with real names or values.	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be superuser to do this. To delete a file, type `rm` *filename*.

* The settings on your browser might differ from these settings.

Additional Support Resources

TABLE P-1 lists additional resources to assist with your Sun Ultra 45 or Ultra 25 workstation.

TABLE P-1   Additional Support Resources

Sun Ultra 45 and Ultra 25 Support Resources	URL or Telephone Number
Find Solaris and other software documents here. This is also an alternative web site for some Sun Ultra 45 and Ultra 25 documents. This web site has full search capabilities.	`http://docs.sun.com`
Warranty and Contract Support contacts. Links to other service tools.	`http://www.sun.com/service/online/`
Discussion and Troubleshooting Forums.	`http://supportforum.sun.com`
Support, Diagnostic Tools, Alerts, for all Sun products.	`http://www.sun.com/bigadmin/`
SunSolve[sm]: Contains links to software patches. Lists some workstation specifications, troubleshooting and maintenance information, and other tools.	`http://www.sunsolve.sun.com/handbook_pub/`
Lists warranties for every Sun product.	`http://www.sun.com/service/support/warranty/`
Sun Service Support phone number.	1-800-872-4786 (1-800-USA-4Sun) Select Option 1
This web site lists international telephone numbers for Sun Service Support.	`http://www.sun.com/service/contacting/index.html`

Note – Access to some Sun proprietary information is restricted to authorized Sun personnel.

Some low-level hardware and software failures require troubleshooting techniques that are beyond the scope of this document, and are best resolved by those persons with experience and skill in fault analysis. Your Sun Microsystems service representative can provide these types of services.

Documentation, Support, and Training

Sun Function	URL
Documentation	`http://www.sun.com/documentation/`
Support	`http://www.sun.com/support/`
Training	`http://www.sun.com/training/`

Third-Party Web Sites

Sun is not responsible for the availability of third-party web sites mentioned in this document. Sun does not endorse and is not responsible or liable for any content, advertising, products, or other materials that are available on or through such sites or resources. Sun will not be responsible or liable for any actual or alleged damage or loss caused by or in connection with the use of or reliance on any such content, goods, or services that are available on or through such sites or resources.

Related Documentation

TABLE P-2   Related Documentation

Application	Title	Part Number
Basic workstation hardware and software setup	*Sun Ultra 45 and Ultra 25 Workstations Installation Guide* (Available in ten languages.)	819-1891
Recent information and changes	*Sun Ultra 45 and Ultra 25 Workstations Product Notes*	819-1893
Basic workstation setup information	*Sun Ultra 45 and Ultra 25 Workstations Getting Started Guide*	819-1894
Safety and compliance	*Sun Ultra 45 and Ultra 25 Workstations Safety and Compliance Guide*	819-2785
	Important Safety Information for Sun Hardware Systems	816-7190
Solaris 10 Operating System	*Solaris 10 1/06 Sun Hardware Platform Guide*	817-6337
	Solaris 10 System Administration Guide	817-1895
Power Management and Dtpower	*Solaris Common Desktop Environment: User's Guide*	806-4743
SunVTS documentation	*SunVTS 6.1 User's Guide*	819-2361
	SunVTS Quick Reference Card	819-2365
	SunVTS Test Reference Manual for SPARC Platforms	819-2362
	SunVTS 6.1 Release Notes	819-2363
Graphics accelerator documentation	*Sun XVR-100 Graphics Accelerator Installation Guide*	816-7560
	Sun XVR-2500 Graphics Accelerator Installation and User's Guide	817-7517
SunPCi™ III co-processor board documentation	*SunPCi III 3.2.1 User's Guide*	817-3630
	Sun PCi III Quick Start Installation Guide	817-4343
	SunPCi III 3.2.2 Product Notes	817-3631

Sun Welcomes Your Comments

Sun is interested in improving its documentation and welcomes your comments and suggestions. You can submit your comments by going to:

`http://www.sun.com/hwdocs/feedback`

Please include the title and part number of your document with your feedback:

Sun Ultra 45 and Ultra 25 Workstations Service and Diagnostics Manual, part number 819-1892-12.

Product Description

Topics covered in this chapter are:

1.1 Product Overview

The Sun Ultra 45 and Ultra 25 workstations can be configured with the features described in TABLE 1-1 and shown in FIGURE 1-1.

TABLE 1-1   Sun Ultra 45 and Ultra 25 Workstations Features

Feature	Description
Processor	One or two CPUs – 1.6GHz UltraSPARC™ IIIi CPU with 1 MB integrated Level2 cache, heat sink, and fan
	Note: Ultra 25 workstation has one 1.34GHz UltraSPARC IIIi CPU with 1 MB integrated Level2 cache, heat sink, and fan.
Operating system	Preinstalled Solaris 10 1/06 Operating System, supporting 32-bit and 64-bit applications
Memory options	1 GB to 16 GB of ECC DDR-1 SDRAM 266MHz memory, using matched pairs of 512 MB, 1 GB, or 2 GB DIMMs.
	(Maximum of 4 DIMM pairs per CPU, 8 DIMMS total)
	Note: Ultra 25 workstation can accept up to 8 GB of the same memory used in the Ultra 45 workstation. (Maximum of 4 DIMMs, installed as matched pairs)
Power supply	1000 W autoranging

TABLE 1-1	Sun Ultra 45 and Ultra 25 Workstations Features *(Continued)*
Feature	**Description**
Internal storage	Up to four 3.5-inch hard drives – either 250-GB Serial ATA (SATA), 7,200 rpm, or 146-GB Serial Attached SCSI (SAS), 15,000 rpm (supports up to four hard drives. All four installed hard drives must be the same type. **Note:** Ultra 25 workstation also supports 80-GB SATA, 7,200 rpm hard drives.
Optical media	DVD-dual drive, slot loading
Audio	CD-quality audio
Graphics accelerators	Sun XVR-100 graphics accelerator – one Sun XVR-2500 graphics accelerator – up to two
Keyboard	Sun Type 7 USB AT 101 layout
Mouse	Sun 3-button longbow USB mouse
Expansion slots on the motherboard	Two PCI-X slots at 100 MHz Two PCI-Express slots at x8 speed (8 lanes) One PCI-Express slot at x4 speed (4 lanes)
Connectors	Six universal serial bus (USB) 2.x connectors (four rear panel, two front panel) Two serial connectors (DB-9) Two twisted-pair Ethernet (TPE) 10/100/1000 Mbit (RJ-45) One audio line-in connector One audio line-out connector One headphone connector (front panel) One microphone connector (front panel)

Note – Some Sun Ultra 45 or Ultra 25 workstations are configured without a hard drive or DVD-dual drive.

The Sun Ultra 45 and Ultra 25 workstations also support the following options. You should contact your Sun representative to confirm the exact option models that are supported.

- SunPCi III Pro coprocessor card
- PCI SCSI host bus adapters
- PCI serial communications adapters
- PCI network adapters
- PCI Fibre Channel adapters
- Sun StorEdge™ hard drive arrays
- Sun StorEdge tape drive arrays

1.2 External System Description

FIGURE 1-1, FIGURE 1-2, and FIGURE 1-3 identify external components and connectors of the Sun Ultra 45 or Ultra 25 workstation.
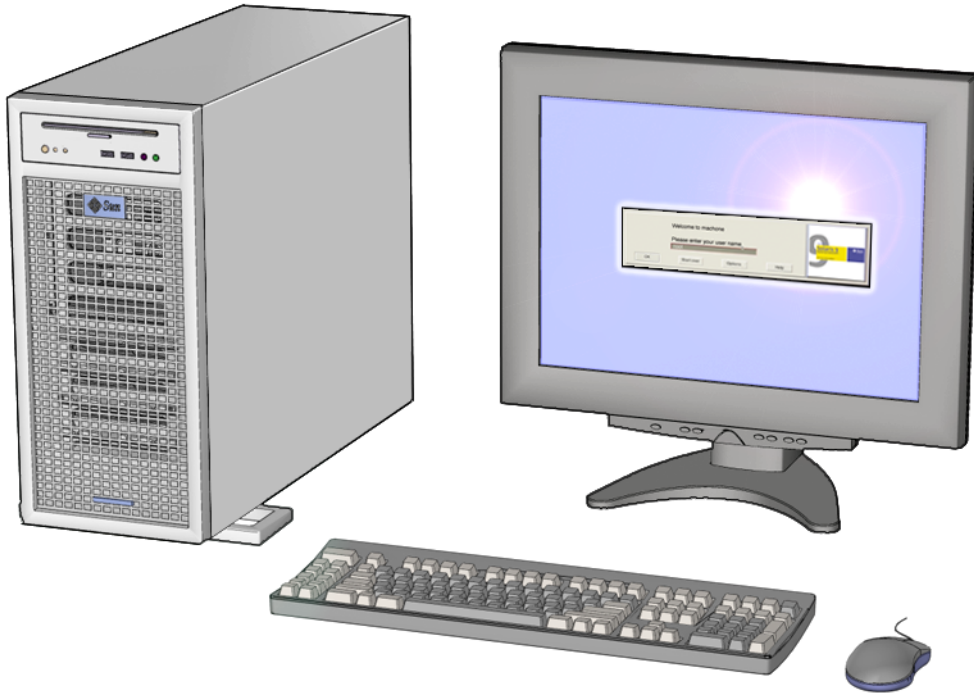
FIGURE 1-1 Monitor, Keyboard, Mouse, and Sun Ultra 45 or Ultra 25 Workstation
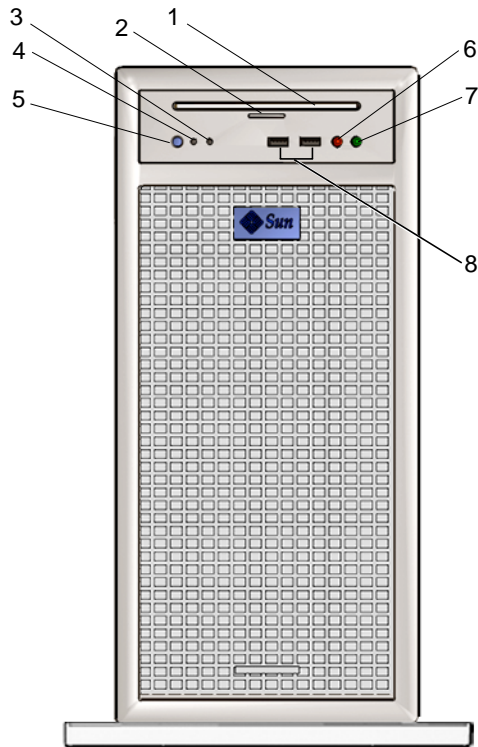
FIGURE 1-2   Front Panel Overview

TABLE 1-2   Front Panel Overview, Sun Ultra 45 and Ultra 25 Workstations

Callout in FIGURE 1-2	Part Description	Symbol
1	DVD-dual drive slot	none
2	DVD-dual drive Eject button	▲
3	Fault LED (not functional)	none
4	Workstation Status/Power LED (green)	none
5	Workstation Power button	⬆
6	Audio connector, microphone (pink)	🎤
7	Audio connector, headphone (lime green)	🎧
8	USB 2.x connector (2)	⟜
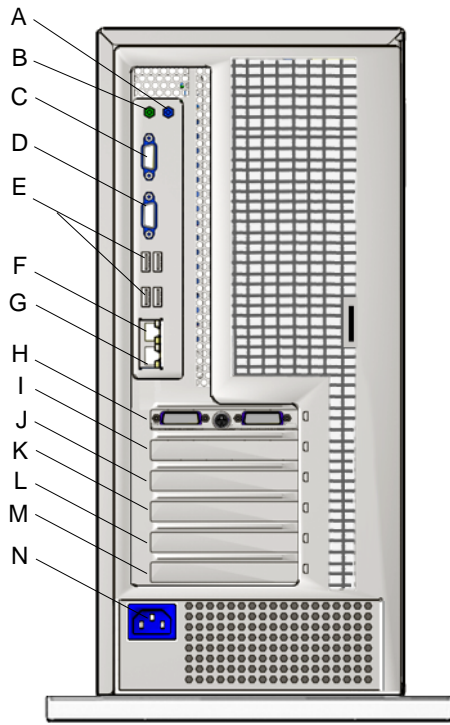
FIGURE 1-3 Rear Panel Overview

TABLE 1-3 Rear Panel Overview, Sun Ultra 45 and Ultra 25 workstations

Callout in FIGURE 1-3	Part Description	Rear Panel Symbol
A	Audio connector, line in (light blue)	⌥
B	Audio connector, line out (lime green)	⌥
C	Serial 2 connector TTYB (DB-9)	|O|O| TTY B
D	Serial 1 connector TTYA (DB-9)	|O|O| TTY A
E	USB 2.x connectors (4)	⟵⟶
F	Twisted-pair Ethernet 0	⟨⊶⟩
G	Twisted-pair Ethernet 1	⟨⊶⟩
H	PCI-E 2 PCI-Express x8 lanes (long connector, slot 4) (Shown with graphics accelerator)	**PCI-E 2**
I	Empty slot. Not used.	none

TABLE 1-3 Rear Panel Overview, Sun Ultra 45 and Ultra 25 workstations *(Continued)*

Callout in FIGURE 1-3	Part Description	Rear Panel Symbol
J	PCI-E 1 PCI-Express x8 lanes (long connector, slot 3)	**PCI-E 0**
K	PCI-E 0 PCI-Express x4 lanes (short connector, slot 2)	**PCI-E 1**
L	PCI-X 1 100 MHz 64-bit, 3.3 V (long green connector, slot 1)	**PCI-X 1**
M	PCI-X 0 100 MHz 64-bit, 3.3 V (long green connector, slot 0)	**PCI-X 0**
N	Power connector	none

Note – For details on PCI connectors, power consumption, and speeds see: "Functional Description" on page C-1.

1.3 Supported Sun Monitors

The Sun Ultra 45 and Ultra 25 workstations support the monitors listed in TABLE 1-4. The Sun XVR-100 graphics accelerator and the Sun XVR-2500 graphics accelerator can both be configured to support multiple displays.

TABLE 1-4 Monitors supported by the Sun Ultra 45 and Ultra 25Workstations

Monitor	Maximum resolution	Number of Monitors Supported	
		Sun XVR-100	Sun XVR-2500
17-inch color CRT	1280 x 1024 @ 60 Hz	Up to 2	Up to 2
19-inch color LCD	1280 x 1024 @ 60/76 Hz	Up to 2	Up to 2
21-inch color CRT	1600 x 1200 @ 75 Hz	Up to 2	Up to 2
24-inch color LCD	1920 x 1200 @ 60 Hz	Up to 2*	Up to 2

*Sun XVR-100 will not support two monitors at 1920 x 1200.

For more information about the graphics accelerators, refer to:

- *Sun XVR-100 Graphics Accelerator Installation Guide*, 816-7560
- *Sun XVR-2500 Graphics Accelerator Installation and User's Guide*, 817-7517

Preparing to Replace Components

This chapter describes common tasks that must be completed prior to performing a removal or installation procedure on any Sun Ultra 45 or Ultra 25 workstation.

The procedures described in this chapter are written for workstation service providers and system administrators.

Caution – To prevent equipment damage, review the safety requirements, safety symbols, and safety precautions in this chapter before you perform any replacement procedure.

This chapter contains the following topics:

2.1   Safety Information

This section provides safety precautions to follow when servicing the Sun Ultra 45 or Ultra 25 workstation.

2.1.1   Safety Precautions

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

- Follow all Sun standard cautions, warnings, and instructions marked on the equipment and described in *Important Safety Information for Sun Hardware Systems*, 816-7190.

- Follow the cautions, warnings, and instructions in the *Sun Ultra 45 and Ultra 25 Workstations Safety and Compliance Guide*, 819-2785. The document is available from:

  `http://www.sun.com/documentation/`

- 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 might be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

2.1.2 Safety Symbols

The following symbols might appear in this document:

Caution – There is a risk of personal injury and equipment damage. To avoid personal injury and equipment damage, follow the instructions.

Caution – Hot surface. Avoid contact. Surfaces are hot and might 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.

2.1.3 Electrostatic Discharge Safety

Electrostatic discharge (ESD)-sensitive devices, such as the motherboard, PCI cards, hard drives, and the NVRAM, require special handling.

Caution – The boards and hard drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy components. Do not touch the components along their connector edges.

Caution – Wear an antistatic wrist strap and use an antistatic mat when handling components such as drive assemblies, boards, or DIMMs. When servicing or removing workstation components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Then disconnect the power cord from the workstation and the wall receptacle. Following this caution equalizes all electrical potentials with the workstation.

2.2 Required Tools

Use the following tools to service the Sun Ultra 45 or Ultra 25 workstations (FIGURE 2-1):

- No. 2 Phillips screwdriver
- No. 0 Phillips screwdriver
- Antistatic wrist strap
- Antistatic mat
- Container for screws
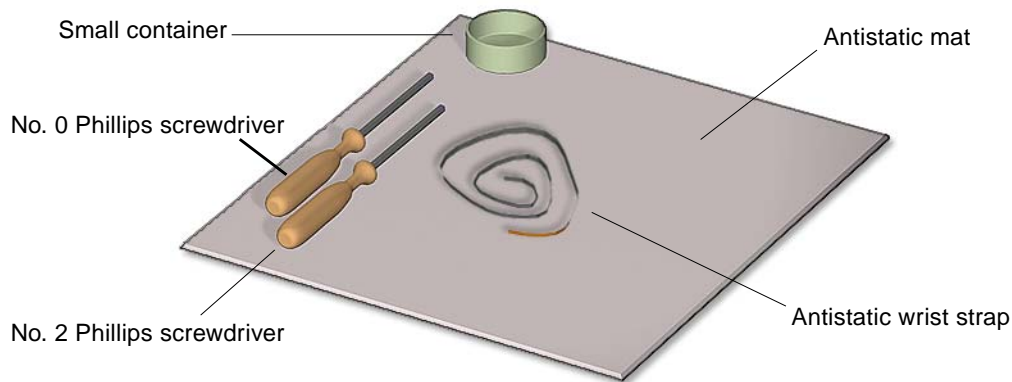
FIGURE 2-1 Required Tools

Though not required for component replacement, the following tools have proven helpful in certain situations:

- Needle nose pliers, tweezers, or hemostat
- Large jeweler's screwdriver
- Flashlight
- Digital voltage meter (DVM)

Place ESD-sensitive components such as the motherboard, memory, PCI cards, hard drives, and the NVRAM on an antistatic mat. The following items can be used as an antistatic mat:

■ Antistatic bag used to wrap a Sun replacement part

■ Sun ESD mat, part number 250-1088 (available through your Sun sales representative)

■ Disposable ESD mat (shipped with replacement parts or optional system components)

2.3 Powering Off the Workstation

1. **Notify any affected users that the system will be powered down.**

2. **Save any open files and quit all applications.**

3. **Press and release the Power button or the Sleep key (**FIGURE 2-2**).**

   If you pressed the Sleep key, select "Shutdown," from the menu.

   Caution – If the system is not running the Solaris Operating System (OS), you may need to press and hold the Power button for five seconds. The file system could be corrupted. For more information, refer to the documentation for the operating system in use.

4. **Power off and disconnect any peripherals (**FIGURE 2-3**).**

5. **Disconnect the keyboard, mouse, monitor, and network connections.**
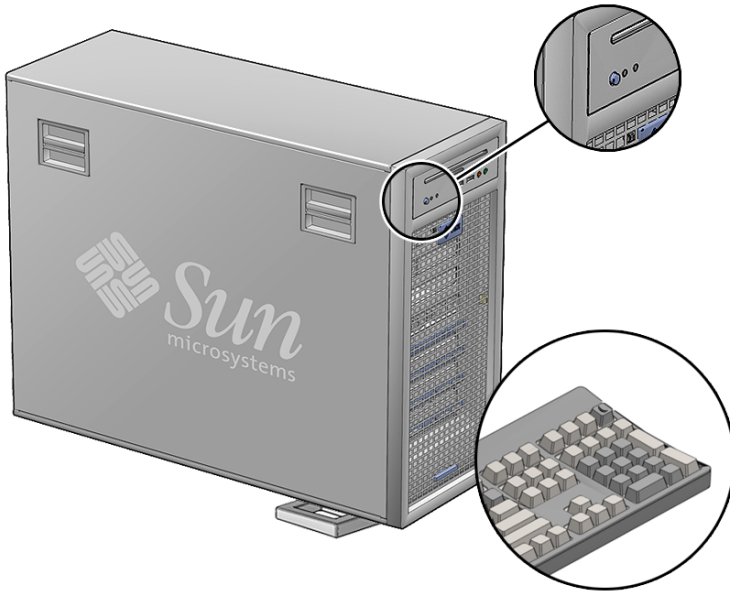
FIGURE 2-2 Power Button and Sleep Key Location
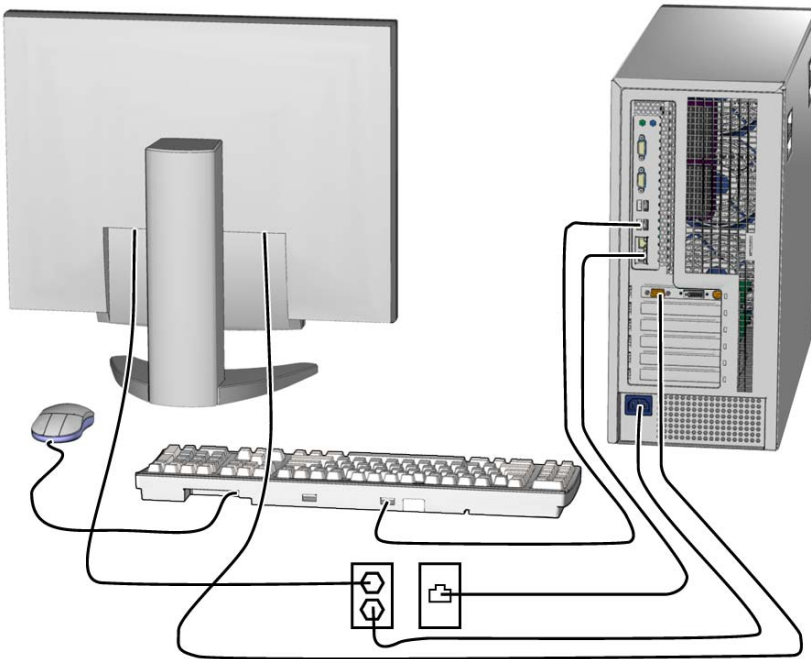
FIGURE 2-3 Disconnecting the Workstation Cables

2.3.1 Opening the Workstation

1. **Press down the two latches on the side cover and lift the cover off the workstation (**FIGURE 2-4**).**

2. **Using both hands, place the workstation on its side.**

3. **Pivot the workstation support stabilizer underneath the workstation.**

4. **Attach the antistatic wrist strap.**

   Wrap the adhesive portion around your wrist. Attach the copper end to the rear vent of the chassis. Ensure that the location does not interfere with your service procedure.

5. **Remove the access panel:**

   a. **Slide the lock block towards the front of the system.**

   b. **Press and release the two latches and lift the access panel.**

6. **Disconnect the power cord from the workstation.**

7. **If necessary, remove any long PCI cards and pull the fan tray out of the chassis.**

8. **Find your removal or replacement procedure (**TABLE 2-1**).**
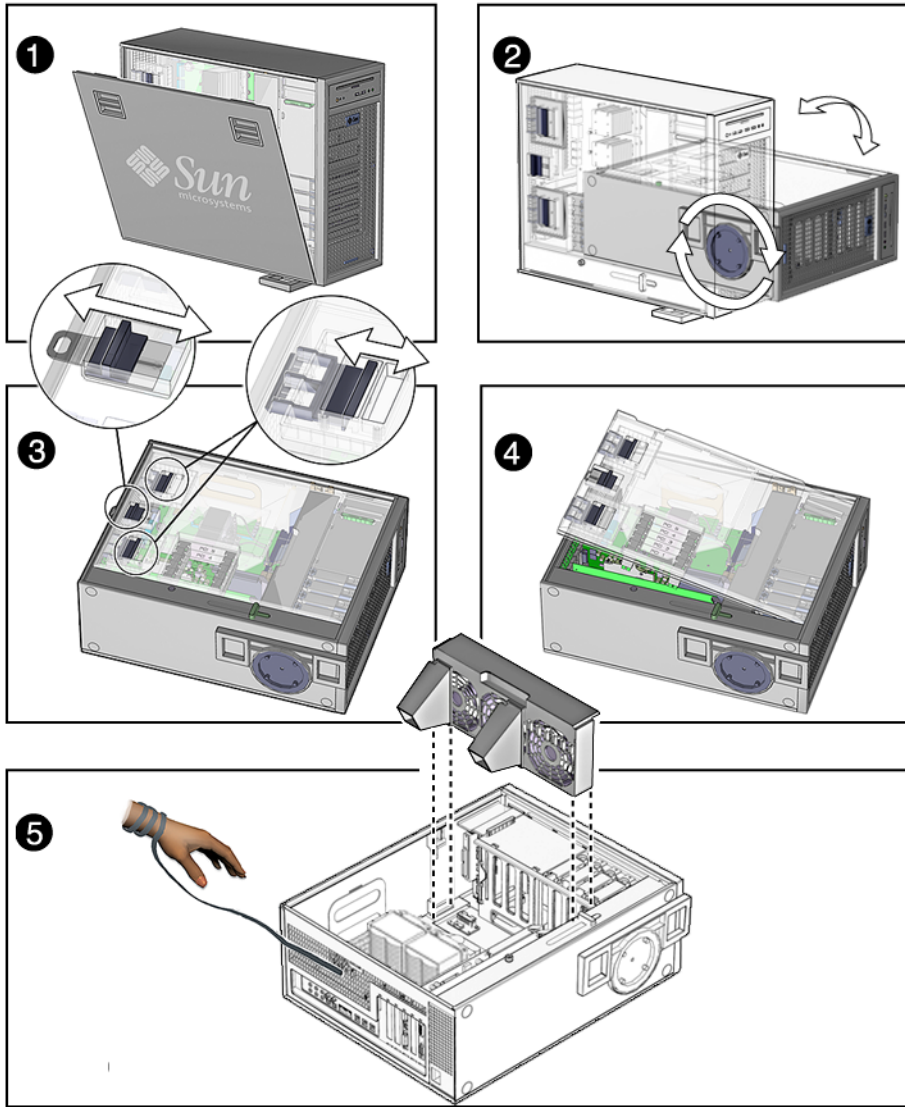
FIGURE 2-4   Removing the Side Cover and Access Panel

2.4   Finding Replacement Procedures

Identify the component that you need to replace in FIGURE 2-5 and refer to TABLE 2-1 to find the replacement procedure.
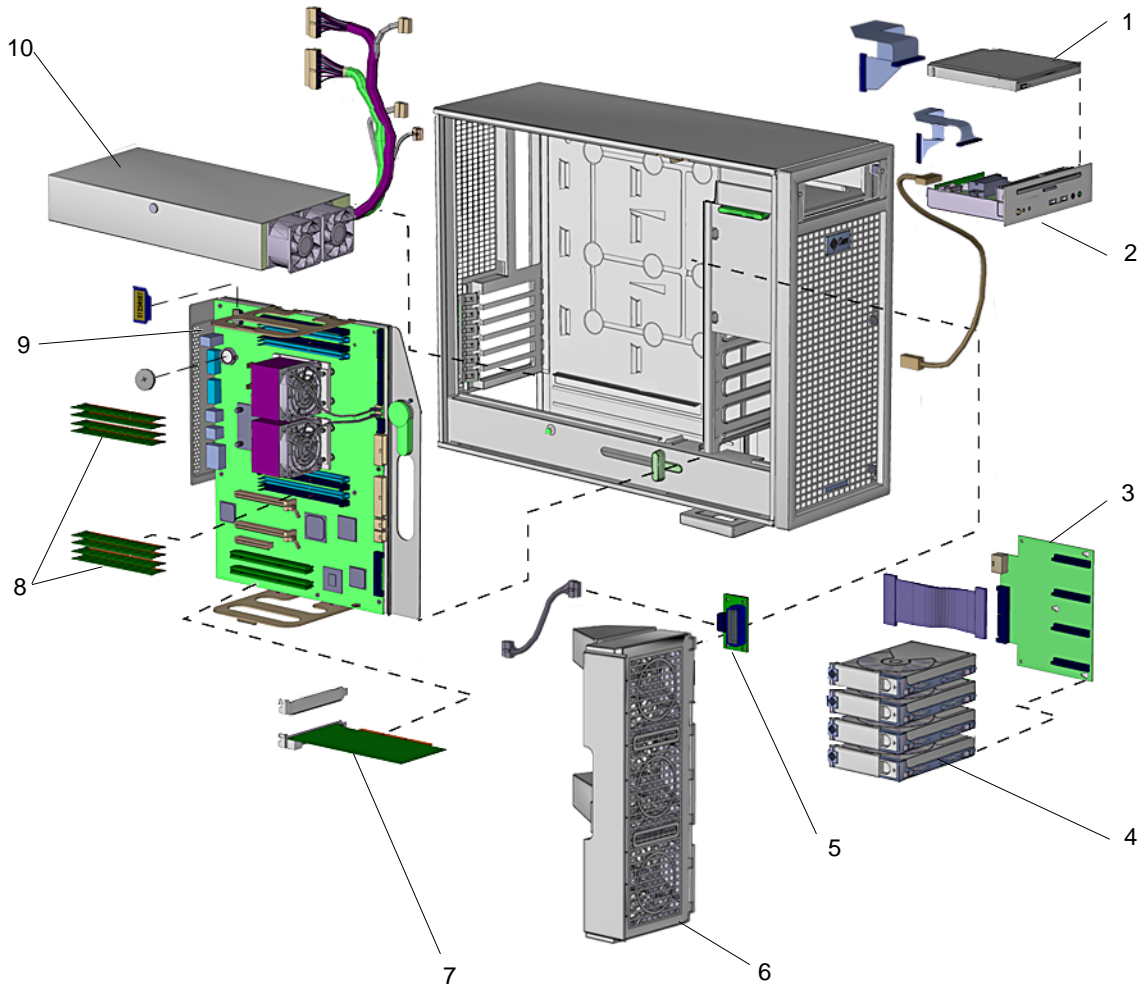
FIGURE 2-5   Major Workstation Components

TABLE 2-1   Sun Ultra 45 or Ultra 25 Workstation Replaceable Components

Item No.	Component	Description	Replacement Procedure	Animated Procedure?
1	DVD-dual drive and cable	Slot loading DVD-dual drive with one combined cable for power and signal	"Replacing the I/O Module With the DVD-Dual Drive and Audio USB Board" on page 4-6	Yes
2	I/O module with two cables	USB and audio board with speaker, mounting bracket, audio connectors, system LEDs, Power button. One signal cable and one power cable	"Replacing the I/O Module With the DVD-Dual Drive and Audio USB Board" on page 4-6	Yes
3	Hard drive backplane and cable	Hard drive connector board with one SAS or SATA signal cable	"Replacing the Hard Drive Backplane and Cables" on page 4-4	Yes
4	Hard drive	Either 250GB, 7,200 rpm SATA, or 146 GB, 15,000 rpm SAS	"Replacing a Hard Drive" on page 4-2	Yes
5	Fan tray backplane and cable	Connector board with one combined signal and power cable	"Replacing the Fan Tray and Fan Tray Backplane" on page 5-1	No
6	Fan tray	Fan tray with three fans, 12 VDC	"Replacing the Fan Tray and Fan Tray Backplane" on page 5-1	Yes
7	Graphics accelerator	Sun XVR-100 graphics accelerator (PCI-X) Sun XVR-2500 graphics accelerator (PCI Express)	"Replacing the PCI Cards" on page 3-13	Yes
8	DIMM (512 MB) DIMM (1 GB) DIMM (2 GB)	DIMM, 512 MB, DDR-1 SDRAM 266 MHz, ECC DIMM, 1 GB, DDR-1 SDRAM 266 MHz, ECC DIMM, 2 GB, DDR-1 SDRAM 266 MHz, EC	"Replacing the DIMMs" on page 3-3	Yes
9	Motherboard	Sun Ultra 45 or Ultra 25 workstation motherboard with one or two CPUs, NVRAM, and battery	"Replacing the Battery" on page 3-9 "Replacing the NVRAM" on page 3-11 "Replacing the Motherboard" on page 3-20	Yes
10	Power supply	Power Supply, 1000 W, 100 – 240 VAC (With five cables connected. One cable is not used in this workstation).	"Replacing the Power Supply" on page 5-4	Yes

Note – The components listed in TABLE 2-1 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 component, or search this web site: `http://www.sun.com/ibb/spares/`

Replacing the Motherboard and Associated Components

This chapter describes the removal and installation procedures for the Sun Ultra 45 and Ultra 25 motherboard and associated components.

Note – Only Sun authorized service providers should perform the procedures described in "Replacing the Motherboard" on page 3-20.

This chapter contains the following topics:

Caution – To prevent equipment damage, review the safety requirements, safety symbols, and safety precautions in "Preparing to Replace Components" on page 2-1 before you perform any replacement procedure. Additional cautions, warnings, and instructions are provided in the *Sun Ultra 45 and Ultra 25 Workstations Safety and Compliance Guide*, 819-2785. The document is available from: `http://www.sun.com/documentation/`

Caution – When servicing or removing workstation components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Then disconnect the power cord from the workstation and the wall receptacle. Following this caution equalizes all electrical potentials within the workstation.

3.1 Motherboard Connector Overview

FIGURE 3-1 and FIGURE 3-2 show the connections for some cables and devices that connect to the motherboard.
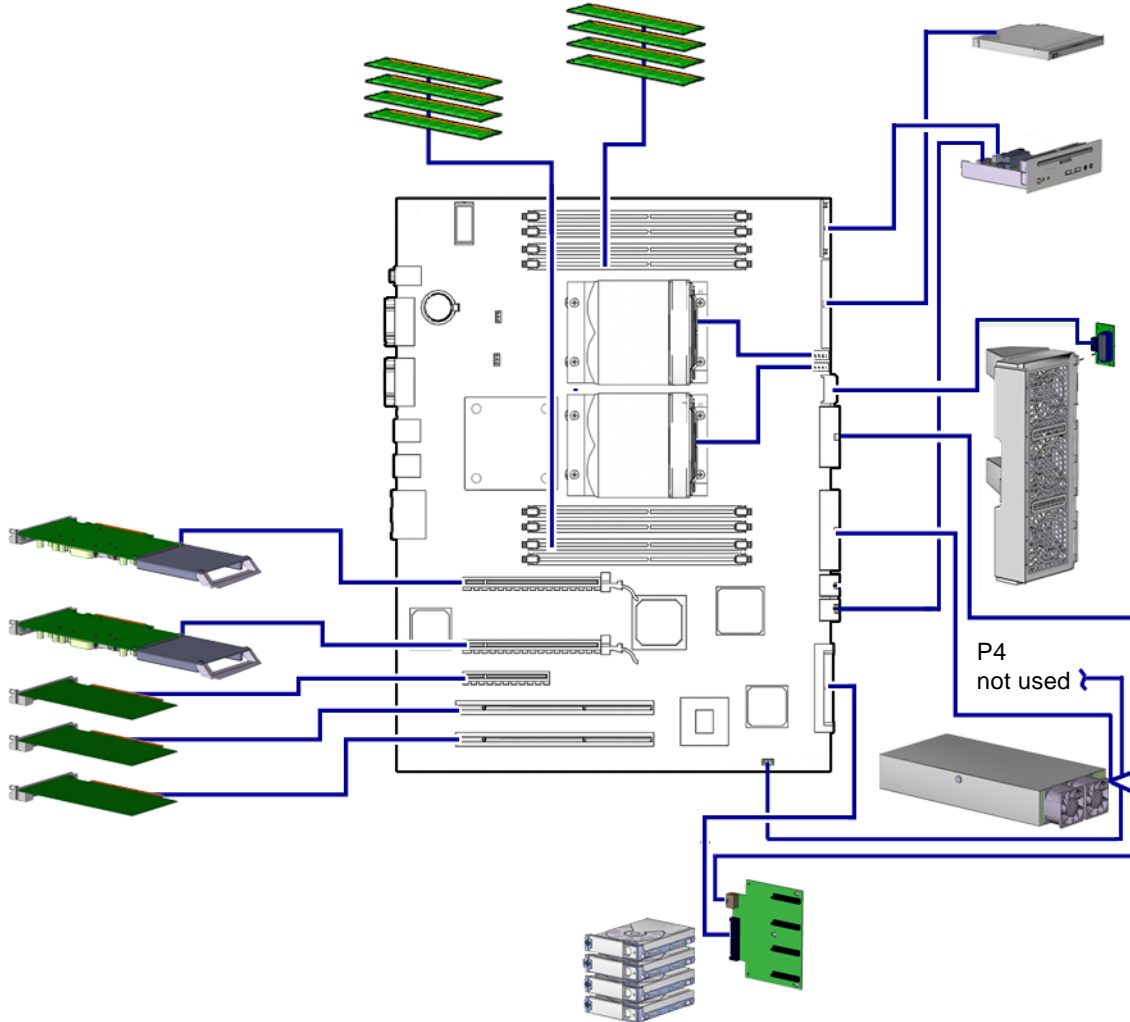
FIGURE 3-1   Motherboard With Component Connections
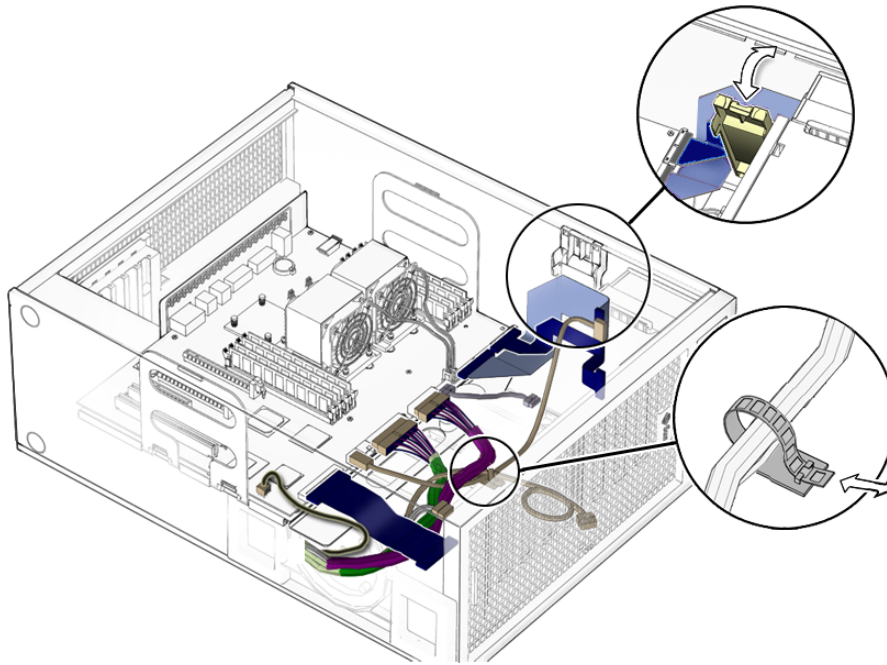
FIGURE 3-2 Motherboard Cables and Cable Clips

3.2　Replacing the DIMMs

This section describes removal and installation of the memory modules.

Caution – DIMM memory is installed in pairs. If you replace a single DIMM, the new DIMM must be identical to the DIMM that you removed.

Caution – Handle the DIMMs along the outside edges. *Do not* handle the DIMM along the gold contact edge. Do not touch DIMM components or other metal parts. Always wear an antistatic wrist strap when handling DIMMs.

3.2.1   DIMM Configuration Rules

Sun Ultra 45 or Ultra 25 workstation memory is installed as matched pairs of DDR-1 SDRAM 266-MHz DIMMs. Within a matched pair, DIMMs must be identical. They must be from the same manufacturer with the same type and number of memory devices, the same amount of memory per device, and the same memory speed.

- The Sun Ultra 45 or Ultra 25 workstation requires a minimum of two matching DIMMs installed in CPU0 (FIGURE 3-3).

- DIMM connectors on the motherboard are color-coded blue and black. Beginning with CPU0, install DIMMS in pairs, either in the blue or in the black connectors.

- If you have four DIMMS and two CPUs, install two DIMMs for CPU0 and two for CPU1 for optimum performance (FIGURE 3-4).

When the workstation boots, the OpenBoot PROM checks for compatible memory modules. See "OpenBoot PROM Memory Message" on page 3-6 for additional information.

Before replacing Sun Ultra 45 and Ultra 25 memory, verify that the latest versions of OpenBoot PROM, system firmware, and recommended system patches are installed on your system. If necessary, check the *Sun System Handbook* at SunSolve Online:
`http://sunsolve.sun.com/handbook_pub/`
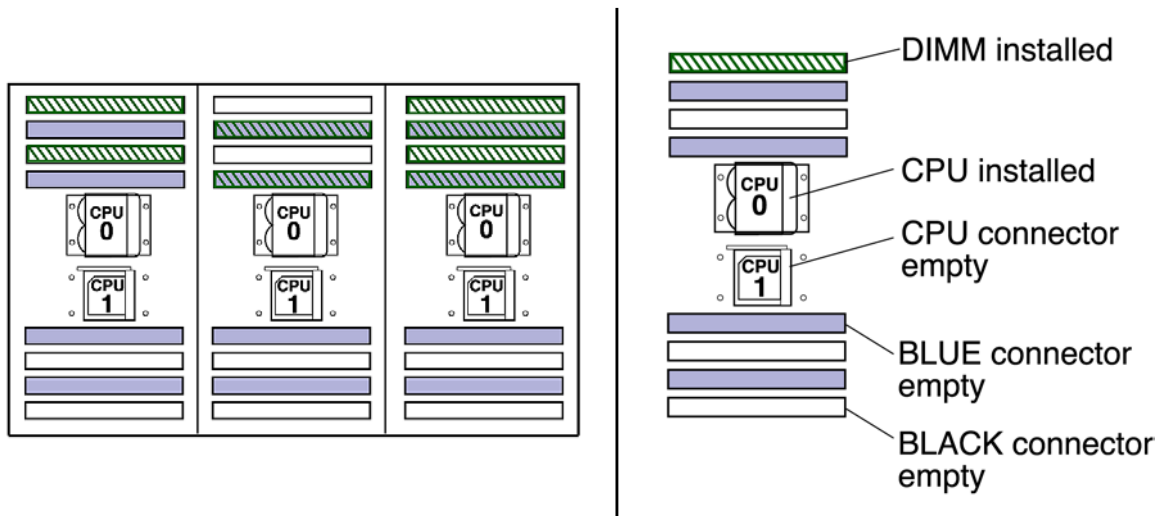
FIGURE 3-3   DIMM Configurations for Single-CPU Workstations

Note – The Ultra 25 workstation has one CPU (CPU0) and one bank of four DIMM slots on the motherboard.
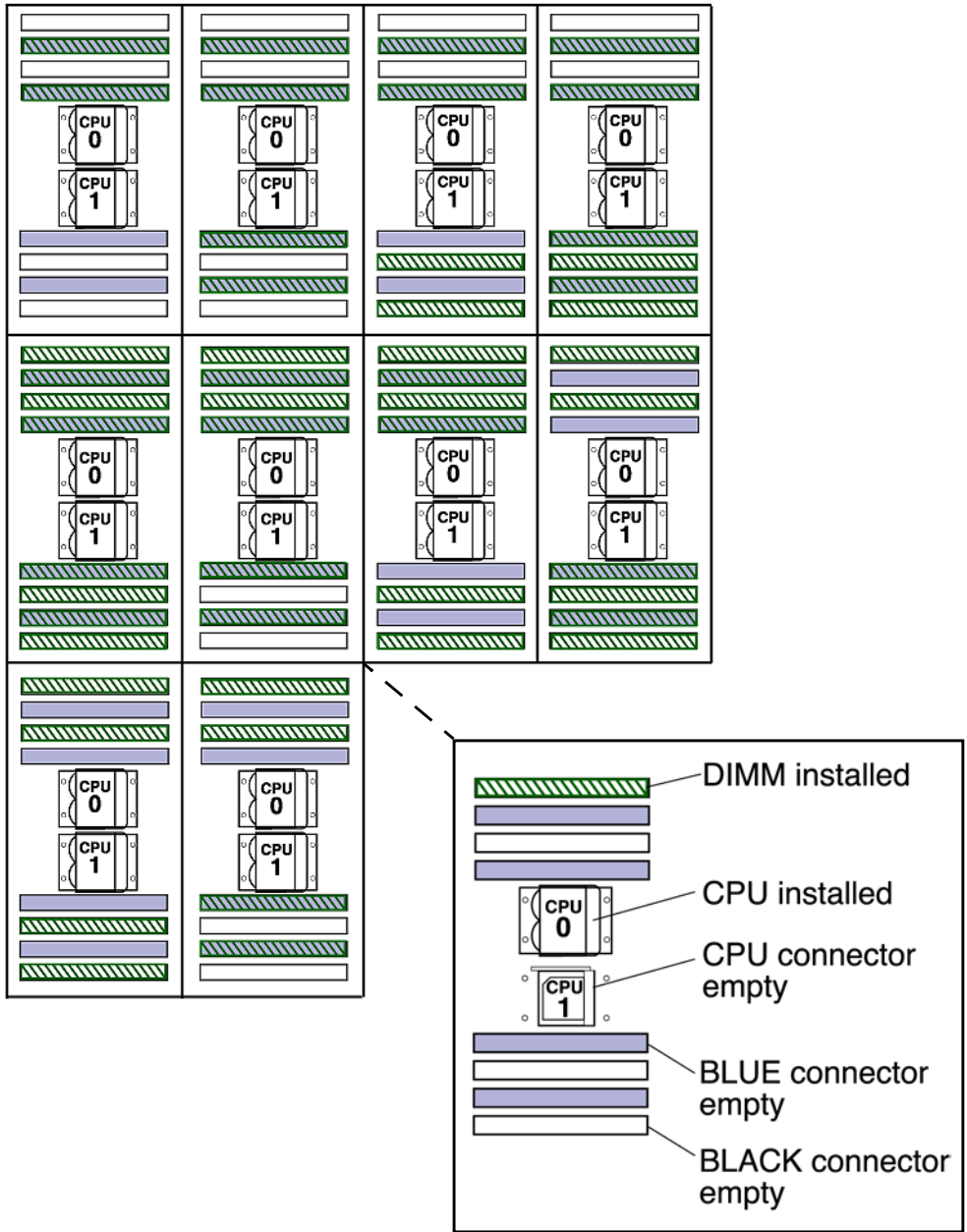
FIGURE 3-4 DIMM Configurations for Ultra 45 Dual-CPU Workstations

3.2.2 OpenBoot PROM Memory Message

During workstation startup, OpenBoot PROM checks for DIMM type and DIMM manufacturer. TABLE 3-1 shows some checks and the actions taken by the OpenBoot PROM.

TABLE 3-1   OpenBoot PROM Memory Checks and Actions

Check	Message	Action Taken by System
Wrong DIMM type	`NOTICE - CPUx Banky DIMMs are incorrect type.`	A message is displayed and the workstation powers off.
DIMMs in a pair have different architecture	`NOTICE - CPUx Banky DIMMs have different architectures and will not be used.`	Workstation does not use dissimilar DIMMs. A message is displayed and the workstation continues to boot; the workstation attempts to use the DIMM pair.
DIMMs in a pair are from different manufacturers	`NOTICE - CPUx Banky DIMMs are from different vendors.`	Workstation uses DIMMs from different manufacturers. A message is displayed and the workstation continues to boot.

Note – If you only have one DIMM pair installed and those DIMMs have different architectures, the OpenBoot PROM displays a message, and powers off.

Each CPU has four memory slots. The two blue slots make up physical bank 0 and the two black slots make up physical bank 1 (FIGURE 3-4).

If a problem is found, OpenBoot PROM references memory by bank, for example:

```
NOTICE - CPU0 Bank 0 DIMMS are from different vendors.
```

The preceding message means that each of the two DIMMs in the bank 0 slots comes from a different manufacturer. The workstation still attempts to use the DIMMs.

```
NOTICE - CPU0 Bank 1 DIMMs have different architectures and will
not be used.
```

This message means that each of the two DIMMs in the black slots has a different internal memory layout. The workstation does not use the DIMMs.

The workstation must have at least one functional pair of DIMMs to display a message. A workstation with more than one pair of DIMMs might display more than one message.

3.2.3　Removing the DIMMs

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Release the DIMM by simultaneously pressing down on both ejector levers at the ends of the DIMM slot (**FIGURE 3-5**).**

DIMM connector key
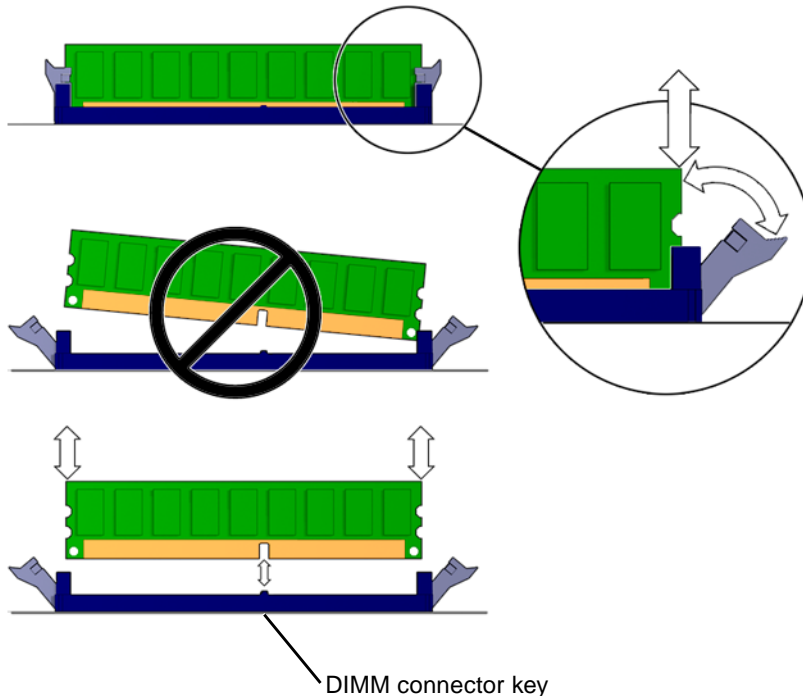
FIGURE 3-5　Releasing the DIMM

3. **Lift the DIMM straight out of the DIMM slot (**FIGURE 3-5**).**

> **Caution –** Handle the DIMMs along the outside edges. Do not handle DIMMs along the gold edge. Do not touch DIMM components or other metal parts. Always wear an antistatic wrist strap when handling DIMMs.

> **Caution –** Do not lift the DIMM out of the DIMM slot at an angle. This can damage the edge connector for the DIMM or the DIMM slot.

4. **Set the DIMM aside on an antistatic mat.**

5. **Repeat** Step 2 **through** Step 4 **until you have removed all relevant DIMMs.**

3.2.4 Installing the DIMMs

Caution – If you are installing additional memory, remember that DIMMs must be installed in matched pairs of DIMMs (FIGURE 3-4). The workstation requires a minimum of one pair of matching DIMMs.

The minimum OpenBoot Prom level for the Sun Ultra 45 or Ultra 25 workstations is OpenBoot 4.21.x. Before installing Sun Ultra 45 and Ultra 25 memory, verify that the latest versions of OpenBoot PROM, system firmware, and recommended system patches are installed on your system. If necessary, check the *Sun System Handbook* at SunSolve Online:
`http://sunsolve.sun.com/handbook_pub/`

Note – If your Ultra 45 workstation has two CPUs and four DIMMs, the workstation operates most efficiently with two DIMMs per CPU. DIMM connectors are color-coded blue and black. You must install DIMMs in pairs in the same color connectors.

Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an antistatic mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

Caution – Do not remove any DIMM from its antistatic package until you are ready to install it.

1. **Power off the system, attach an antistatic wrist strap, open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Remove the new DIMM from its antistatic container.**

Caution – Handle DIMMs only by the edges. Do not touch DIMM components or metal parts. Always wear an antistatic wrist strap when handling DIMMs.

3. **Review the recommended DIMM installation and configurations before installing the DIMM.**

   See "Replacing the DIMMs" on page 3-3.

   Caution – If you replace a single DIMM, the replacement DIMM must be identical to the DIMM that you removed.

   ---

4. **Align the DIMM notch to the DIMM connector key (**FIGURE 3-5**).**

5. **Using both thumbs, press the DIMM straight down into the DIMM connector slot until both ejector levers close (**FIGURE 3-5**).**

   The DIMM is seated when you hear a click and the ejector levers are in the vertical position.

6. **Repeat** Step 4 **through** Step 5 **until all DIMMs are installed.**

7. **Verify that all DIMM ejector levers are upright, seated, and tight.**

8. **Reassemble the workstation, power on the system, and verify the DIMM installation.**

   Refer to "Reassembling the Workstation" on page 6-1 and "Verifying Component Installation" on page 6-5. You also might want to review the information in "OpenBoot PROM Memory Message" on page 3-6.

3.3 Replacing the Battery

This section describes removal and installation of the battery. TABLE 3-2 lists the battery specifications.

TABLE 3-2   Battery Specifications

Specification	Value
Voltage	3 VDC
Type	CR 2032

3.3.1 Removing the Battery

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Release the battery by pressing the battery clip away from the battery until the battery shifts out of the battery socket (**FIGURE 3-6**).**

3. **Remove the battery.**

Battery clip
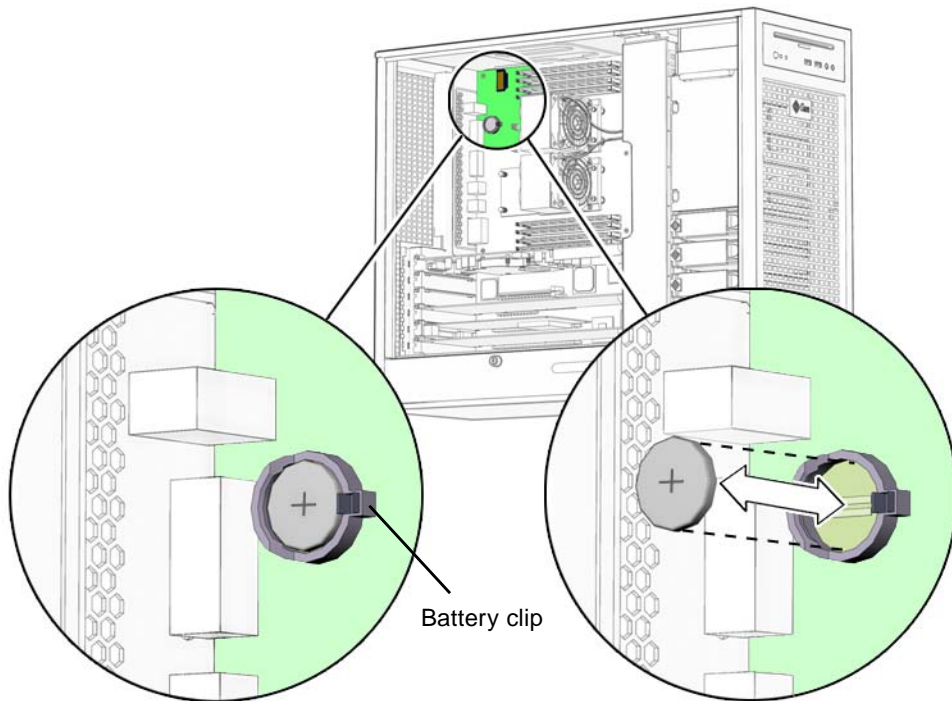
FIGURE 3-6 Removing and Installing the Battery

Note – The workstation does not function without the battery.

3.3.2   Installing the Battery

The battery fits directly into a socket on the motherboard. There are no additional fasteners or cables.

1. **Position the battery over the battery socket with the plus (+) side up (**FIGURE 3-6**).**

2. **Press the battery down into the socket until the battery clicks into place.**

3. **Reassemble the workstation, power on the system, and verify the battery installation.**

   Refer to "Finishing Component Replacement" on page 6-1 and "Verifying Component Installation" on page 6-5.

3.4   Replacing the NVRAM

This section describes removal and installation of the nonvolatile random access memory (NVRAM).

Note – If you are replacing a motherboard and you have software that is licensed to the HostID or Ethernet address, you should install the old NVRAM on the new motherboard.

3.4.1   Removing the NVRAM

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Pull the NVRAM straight up from the motherboard connector (**FIGURE 3-7**).**
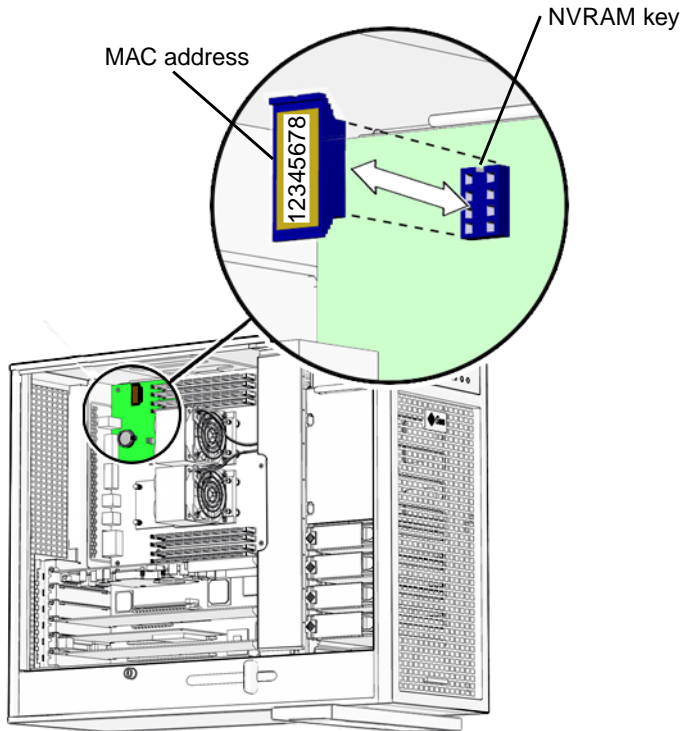
FIGURE 3-7   Removing and Installing the NVRAM

> **3. Set the NVRAM aside on an antistatic mat.**

3.4.2   Installing the NVRAM

The NVRAM installs directly onto the motherboard. There are no additional fasteners or cables.

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Align the NVRAM key to the NVRAM connector key on the motherboard (**FIGURE 3-7**).**

3. **Press the NVRAM down into the connector.**

4. **Ensure that the NVRAM is tight in its connector.**

5. **If you are finished working, reassemble the workstation, power on the workstation, and verify the NVRAM installation.**

   Refer to "Finishing Component Replacement" on page 6-1 and "Verifying Component Installation" on page 6-5.

3.5 Replacing the PCI Cards

This section describes removal and installation of PCI cards in the workstation.

3.5.1 Identifying the PCI Cards

There are five PCI connectors on the system motherboard. Two connectors are PCI-X, and three connectors are PCI-Express (FIGURE 3-8). The long PCI-E connectors are x16 physical lanes long and operate at x8 lanes. The short PCI-E connector is x8 lanes long and operates at x4 lanes.

PCI-E2 x8
Blank slot
PCI-E1 x8
PCI-E0 x4
PCI-X1 100 MHz
PCI-X0 100 MHz
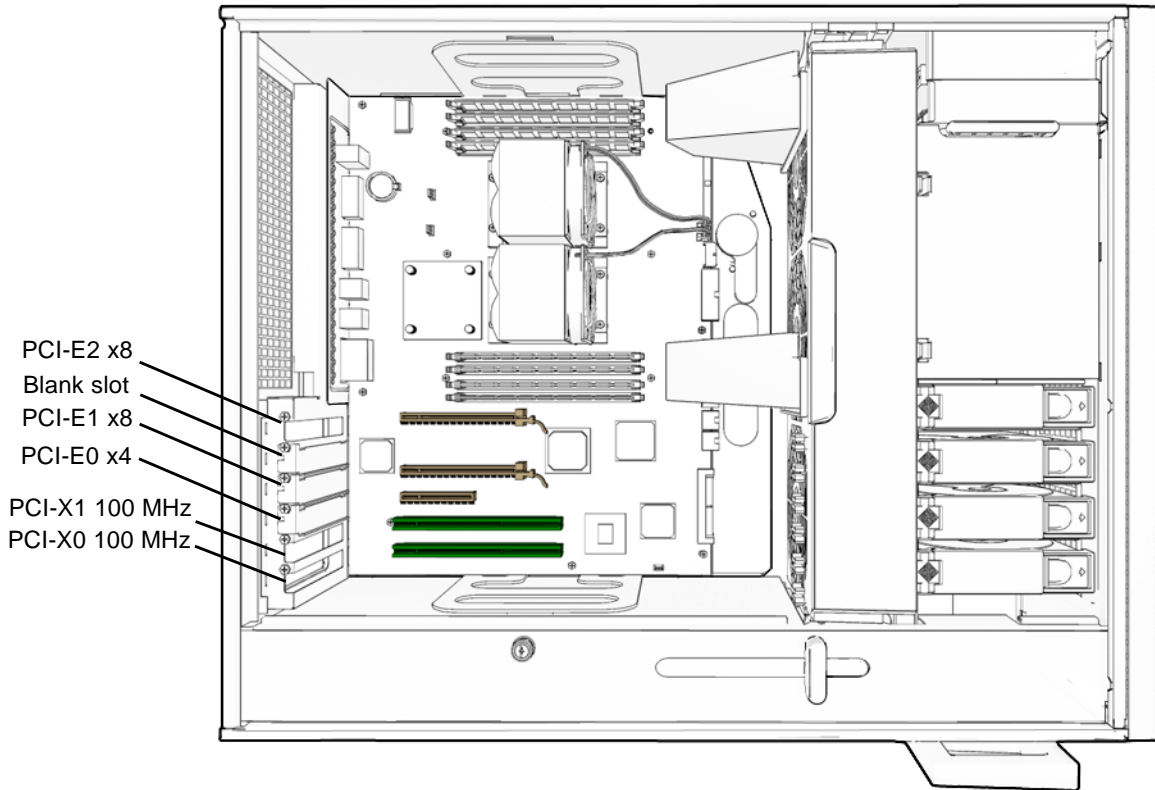
FIGURE 3-8 PCI Card Location and Identification

3.5.2   Removing a PCI Card

1. **Power off the system and attach an antistatic wrist strap. If necessary, disconnect external cables. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Using a No. 2 Phillips screwdriver, remove the screw that secures the PCI card retainer to the chassis rear panel (**FIGURE 3-9**).**

   Set the screw aside in a container.

⚠ **Caution –** If you are removing a graphics accelerator from a PCI-Express connector, be sure that you release the PCI-E connector latch (FIGURE 3-9).

3. Gently rock the PCI card forward, then lift it straight out of the PCI card slot, and set it aside on an antistatic mat.
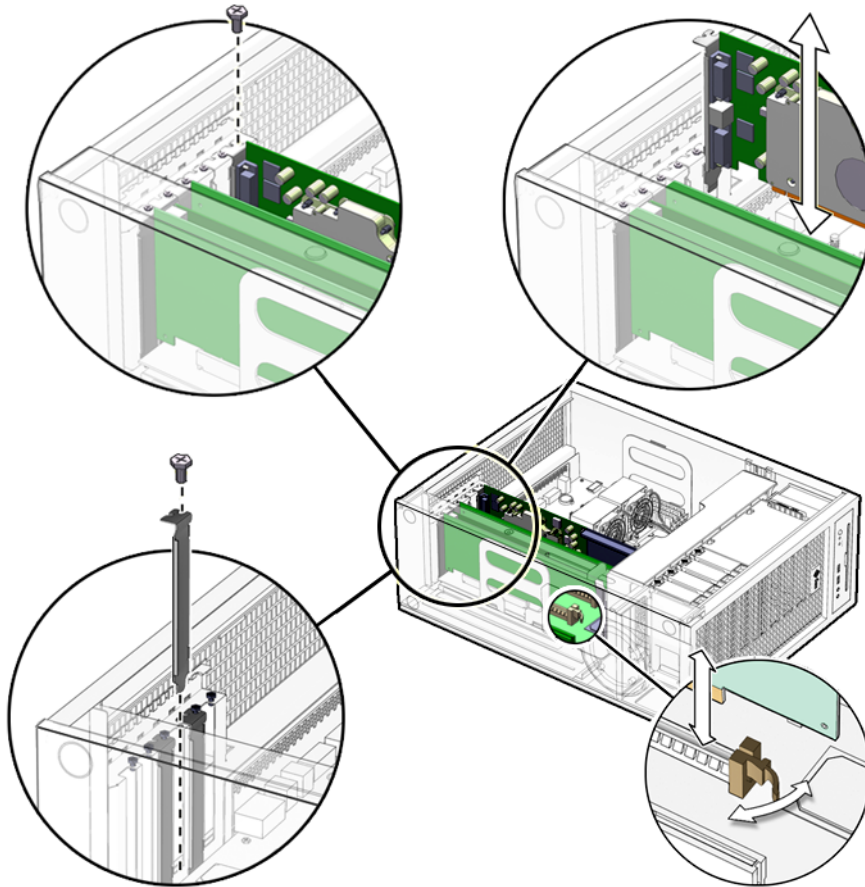
Removing the PCI Card

4. If you are not installing another PCI card in the empty slot, insert a filler panel into the rear panel slot.

The rear panel slot must be closed with a filler panel to meet system Electromagnetic Interference (EMI) and airflow requirements.

3.5.3 General PCI Card Guidelines

The total power consumption of all installed PCI cards must not exceed 400 Watts.

3.5.4 Installation Considerations for Graphics Accelerators

PCI-E 2 is the default console display. If there is no graphics accelerator installed into PCI-E 2, consider the probe order shown in TABLE 3-3.

3.5.4.1 Default Console Display

During the boot sequence, device nodes are probed. The PCI slots are probed in the order described in TABLE 3-3.

TABLE 3-3 PCI Card Probe Order

Probe Order	Slot Identifier	Device Node
1	PCI4 (PCI-E 2)	`/pci@1f,700000/ device 0`
2	PCI2 (PCI-E 0)	`/pci@1e,600000/pci@0/pci@3/ device 0`
3	PCI3 (PCI-E 1)	`/pci@1e,600000/pci@0/pci@8/ device 0`
4	PCI1 (PCI-X 1)	`/pci@1e,600000/pci@0/pci@9/pci@0,2/ device 1`
5	PCI0 (PCI-X 0)	`/pci@1e,600000/pci@0/pci@9/pci@0,2/ device 2`

Unless you reconfigure the default, the first graphics accelerator occurring in the probe order is designated the default console display and assigned the aliases `screen` and `/dev/fb`.

3.5.4.2 Changing the Console Display

You can configure the OpenBoot PROM to designate a different graphics accelerator as the console display. Use the `show-displays` utility, the `nvalias` command, and the `output-device` parameter to make this change. For the following example, a Sun XVR-2500 graphics accelerator is installed in physical slot PCI-E 2 as the default console display and a Sun XVR-100 graphics accelerator is installed in slot PCI-X 0. This example configures the Sun XVR-100 graphics accelerator to be the new console display.

1. Obtain the `ok` prompt.

See "Obtaining the `ok` Prompt" on page 10-2.

2. **Display the device nodes for the installed graphics accelerators.**

   For example:

   ```
   ok show-displays
   a) /pci@1f,700000/SUNW,XVR-2500@0
   b) /pci@1e,600000/pci@0/pci@9/pci@0,2/SUNW,XVR-100@2
   q) NO SELECTION
   ```

3. **Select the graphics accelerator to be the new console display by typing its respective letter.**

   For example:

   ```
   Enter Selection, q to quit: b
   ```

   The utility ends and the device node path is loaded into a text buffer.

4. **Make an alias for the device node path.**

   For example:

   ```
   ok nvalias newconsoledisplay (Ctrl + Y)
   ```

   Type a space, hold down the Control key, and press the Y key.

5. **Configure the** `output-device` **parameter for the new console display.**

   For example:

   ```
   ok setenv output-device newconsoledisplay
   ```

6. **Reset the OpenBoot PROM:**

   ```
   ok reset-all
   ```

   The system now uses the Sun XVR-100 graphics accelerator as the new console display.

   Note – The default console display, the first graphics accelerator found in probe order, is still aliased to `screen`. If you want to check the new console display, type:
   test newconsoledisplay

3.5.5   Installing a PCI Card

1. **Power off the system and attach an antistatic wrist strap. If necessary, disconnect external cables. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Locate the available PCI card slots.**

   You might have to remove a second chassis filler panel for some PCI cards that use two PCI card slots. Read the documentation that came with the PCI card and see "General PCI Card Guidelines" on page 3-15.
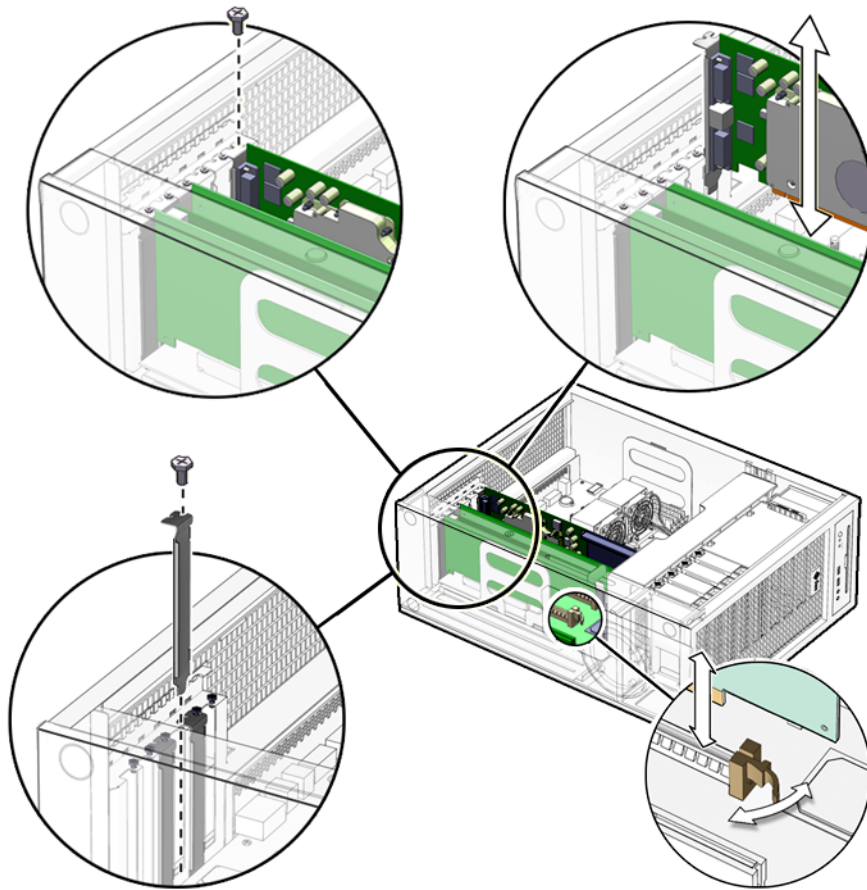
FIGURE 3-10 Installing a PCI Card

3. **Using a No. 2 Phillips screwdriver, remove the chassis filler panel from the PCI card slot and set the screw aside in a container (**FIGURE 3-10**).**

   Remove a second filler panel if needed for dual-width PCI cards.

4. **Remove the new PCI card from its antistatic container.**

   Caution – Handle the PCI card along the outside edges. Do not handle the PCI card along the contact edge. If you are installing a long PCI-E card, be sure to engage the PCI-E connector latch.

5. **Position the PCI card so that the PCI bracket aligns with the chassis rear panel slot and the PCI card edge aligns with the motherboard PCI card connector.**

6. **Insert the PCI card into the PCI card slot.**

   If you are installing a long PCI-Express card, be sure to engage the PCI-E connector latch (FIGURE 3-10).

7. **Firmly press the PCI card straight down into the PCI card slot until it is fully seated in the slot.**

8. **Use a No. 2 Phillips screwdriver to fasten the screw that secures the PCI card retainer (**FIGURE 3-10**).**

9. **Inspect the PCI card fasteners to verify that:**
   - The PCI card panel slot screws are tight.
   - The PCI cards are secure in the connectors.

10. **If you are finished working, reassemble the workstation, power on the workstation, and verify the PCI card installation.**

    Refer to "Finishing Component Replacement" on page 6-1.

    Note – Boot the system with the -r option, so that the Solaris Operating System can reconfigure itself for the new component. See "Finishing Component Replacement" on page 6-1.

3.6 Replacing the Motherboard

This section describes removal and installation of the motherboard.

⚠️ **Caution –** This procedure is intended for Sun authorized service providers only.

3.6.1 Removing the Motherboard

The motherboard, CPU, and NVRAM are a single replaceable unit.

1. **Power off the system and attach an antistatic wrist strap. Disconnect all external cables; open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **If necessary, remove the PCI cards and DIMMs (**FIGURE 3-11**).**

   Refer to:
   - "Removing the DIMMs" on page 3-7
   - "Removing a PCI Card" on page 3-14

   Set these components onto an antistatic mat (FIGURE 3-11).

3. **Remove the fan tray.**

4. **(Optional) If you want to use the same Ethernet address and system ID for the new motherboard, remove the NVRAM and place it on an antistatic mat.**

   Refer to "Removing the NVRAM" on page 3-11.

   Note – If you have software that is licensed to the HostID or Ethernet address, you should install the old NVRAM on the new motherboard.

5. **Remove all cables from the cable clips (**FIGURE 3-11**).**
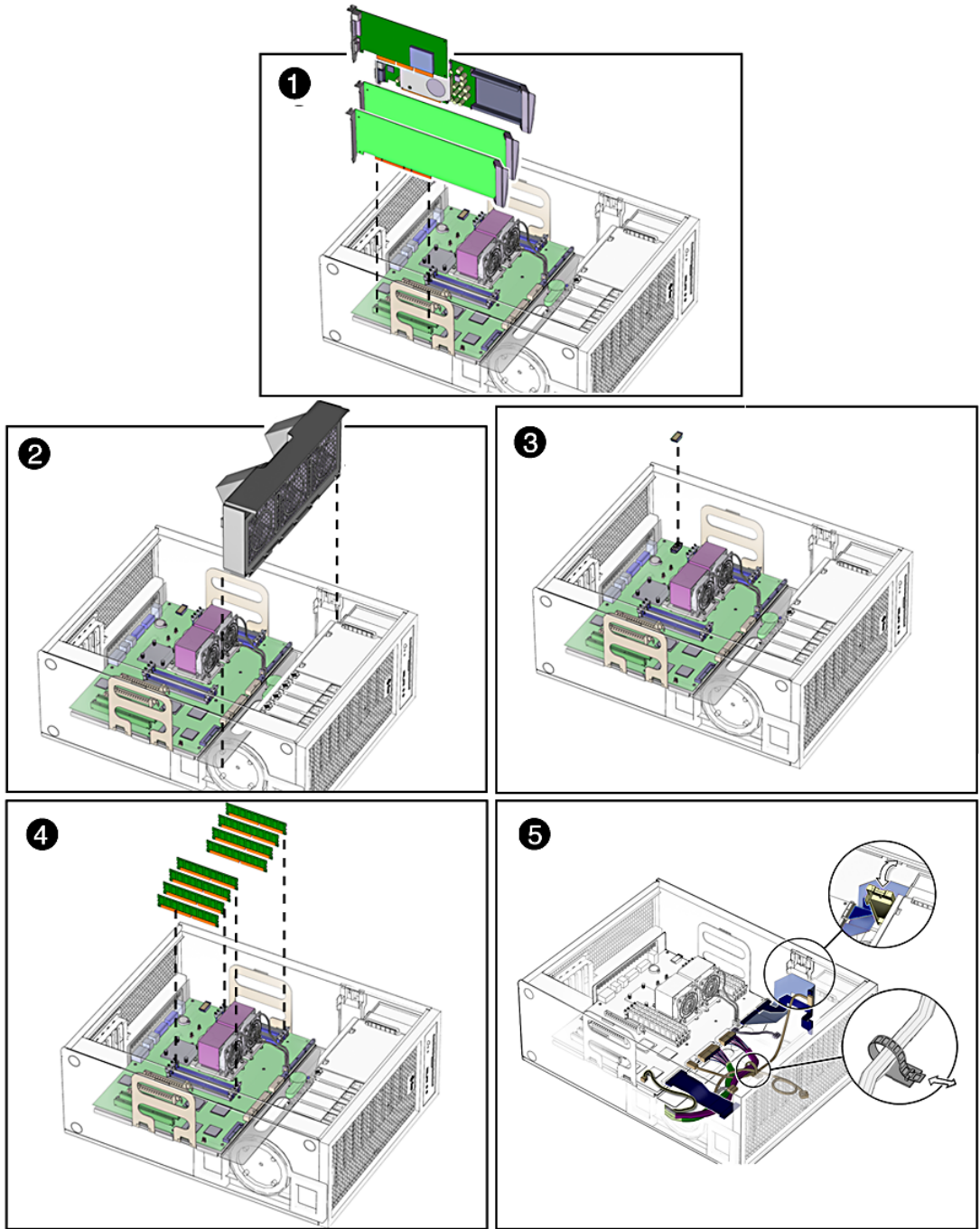
FIGURE 3-11 Removing Components from the Motherboard

6. **Disconnect the following power and signal cables from the motherboard** (FIGURE 3-12)**:**

- I/O module signal and power cable at connector J3
- I/O module USB cable at connector J36
- DVD-dual drive cable at connector J11
- Fan tray backplane cable at connector J20
- Power supply cables at connectors J22, J28, J45 (P1, P2, and P5)
- Hard drive signal cable connector J42
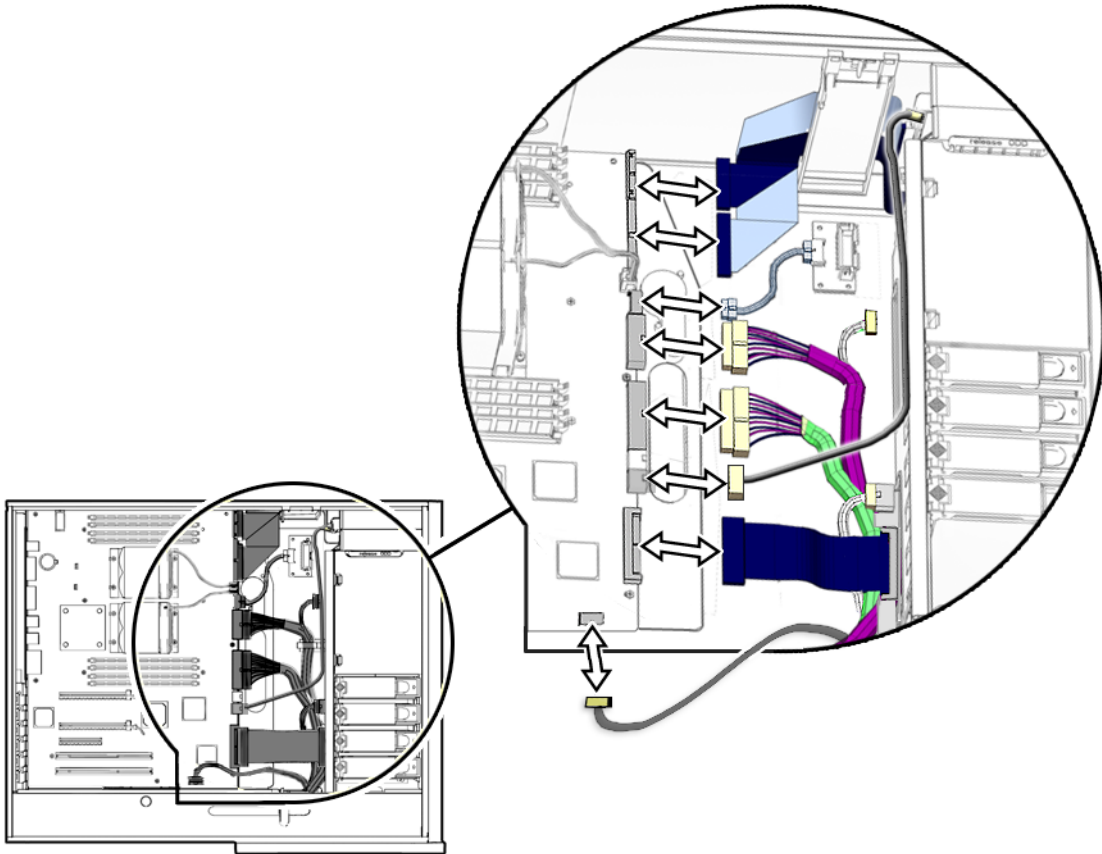
FIGURE 3-12 Disconnecting Motherboard Cables

7. **Turn the motherboard latch 90 degrees counterclockwise** (FIGURE 3-13)**.**
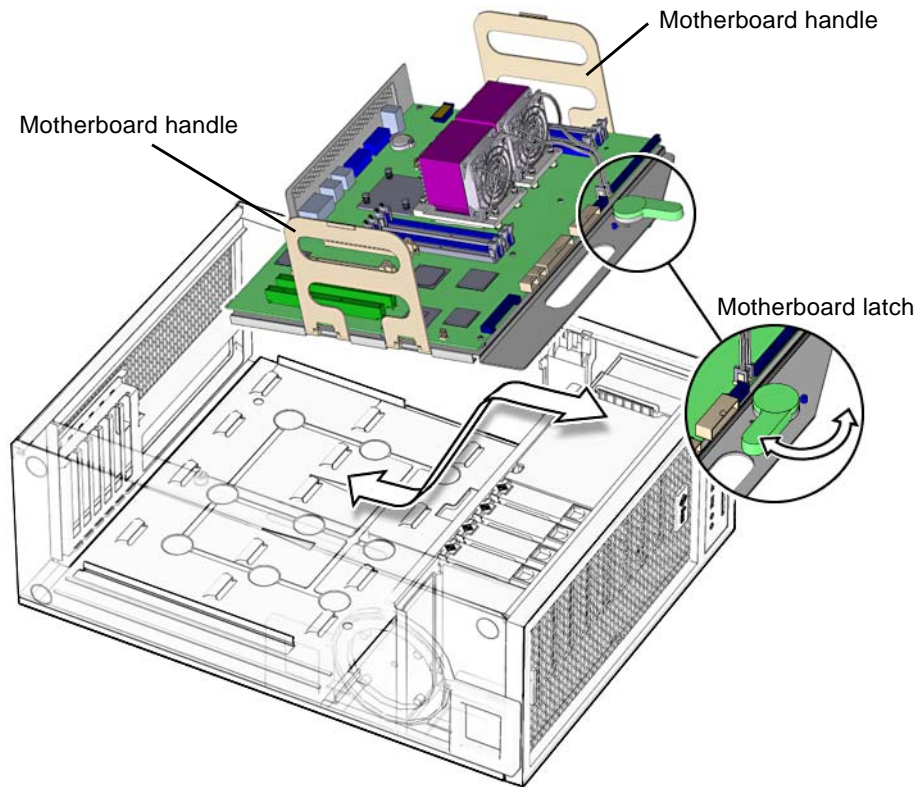
FIGURE 3-13 Releasing the Motherboard Latch

8. **Move the cables out of the way.**

9. **Using the motherboard handles, tilt the motherboard to one side and lift it until it is free of the chassis (**FIGURE 3-13**).**

10. **Set the motherboard down onto the antistatic mat.**

3.6.2   Installing the Motherboard

1. **Remove the new motherboard from its antistatic package and place it on an antistatic mat.**

2. **Move all cables out of the way.**

3. **Align the motherboard rear panel connectors with the matching holes in the rear panel (**FIGURE 3-13**).**

4. **Gently lower the motherboard while tilting it down (**FIGURE 3-13**).**

5. **Align the motherboard so that the hooks fit into the holes of the motherboard tray.**

Caution – Ensure that the hooks are located in the holes. Improper alignment can damage the motherboard.

---

6. **Turn the motherboard latch 90 degrees clockwise to secure the motherboard.**

   Ensure that the motherboard connector panel aligns with the chassis rear panel.

7. **Connect the cables to the corresponding motherboard connectors (**FIGURE 3-14**):**
   - I/O module signal and power cable at connector J3
   - I/O module USB cable at connector J36
   - DVD-dual drive connector at J11
   - Fan tray backplane cable at connector J20
   - Power supply cables at connectors J22, J28, and J45 (P1, P2, and P5)
   - Hard drive signal cable connector J42
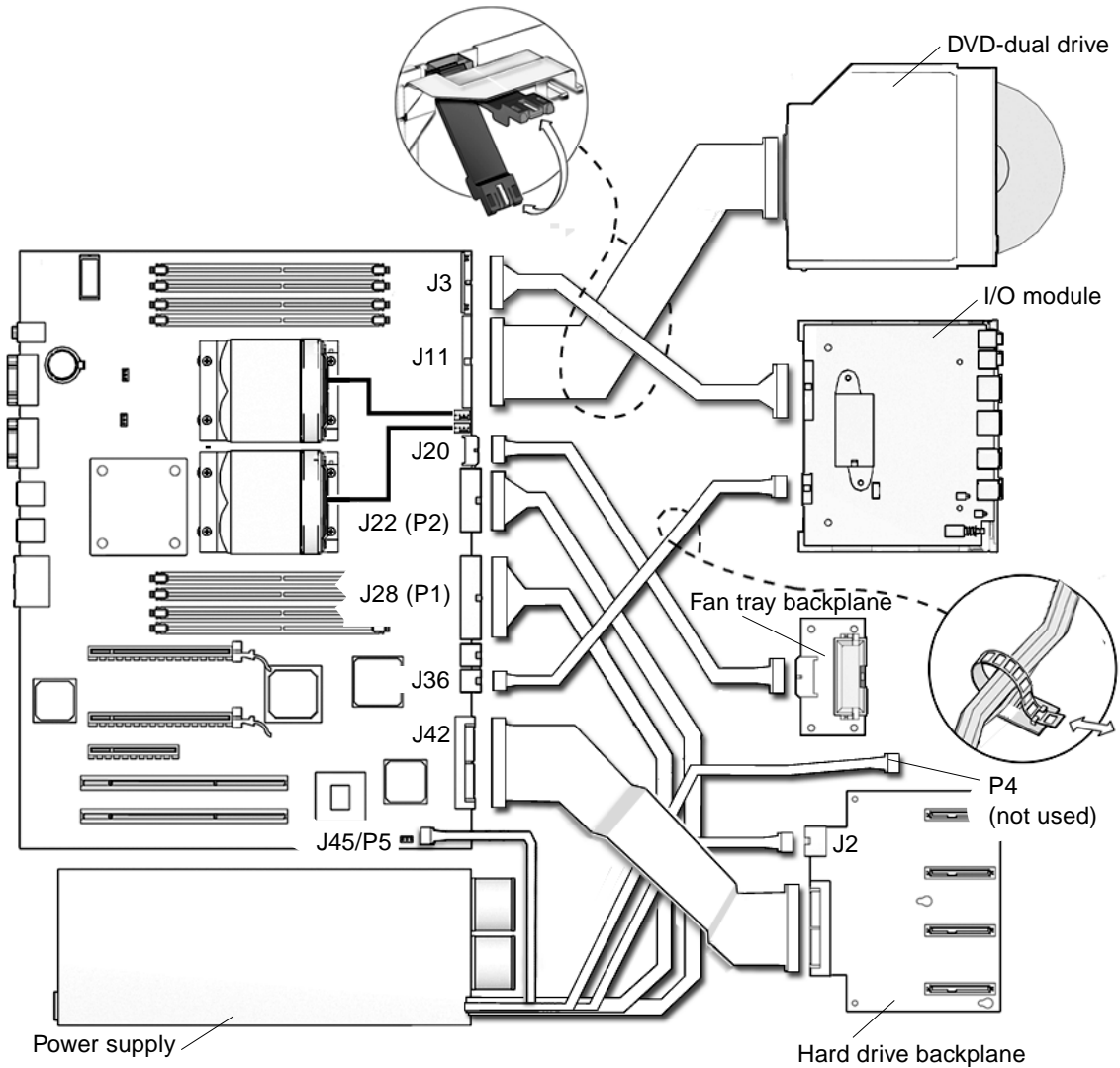
FIGURE 3-14 Reconnecting Cables to the Motherboard

8. **Secure the cables into the cable clips (**FIGURE 3-14**).**

9. **If necessary, install the old NVRAM onto the new motherboard (**FIGURE 3-15**).**

   Refer to "Replacing the NVRAM" on page 3-11.

   Note – If you have software that is licensed to the HostID or Ethernet address, you should install the old NVRAM on the new motherboard.

10. **Install the PCI cards and the DIMMs.**

   Refer to:

   - "Installing a PCI Card" on page 3-18
   - "Replacing the DIMMs" on page 3-3

11. **Inspect the motherboard to verify that:**

   - Cable connections are tight and cable clips are secured.
   - DIMMs are properly installed.
   - NVRAM is tight in the socket.
   - PCI cards are properly seated and secured.

12. **Reassemble the workstation, power on the system, and verify the motherboard installation.**

   Refer to "Finishing Component Replacement" on page 6-1.
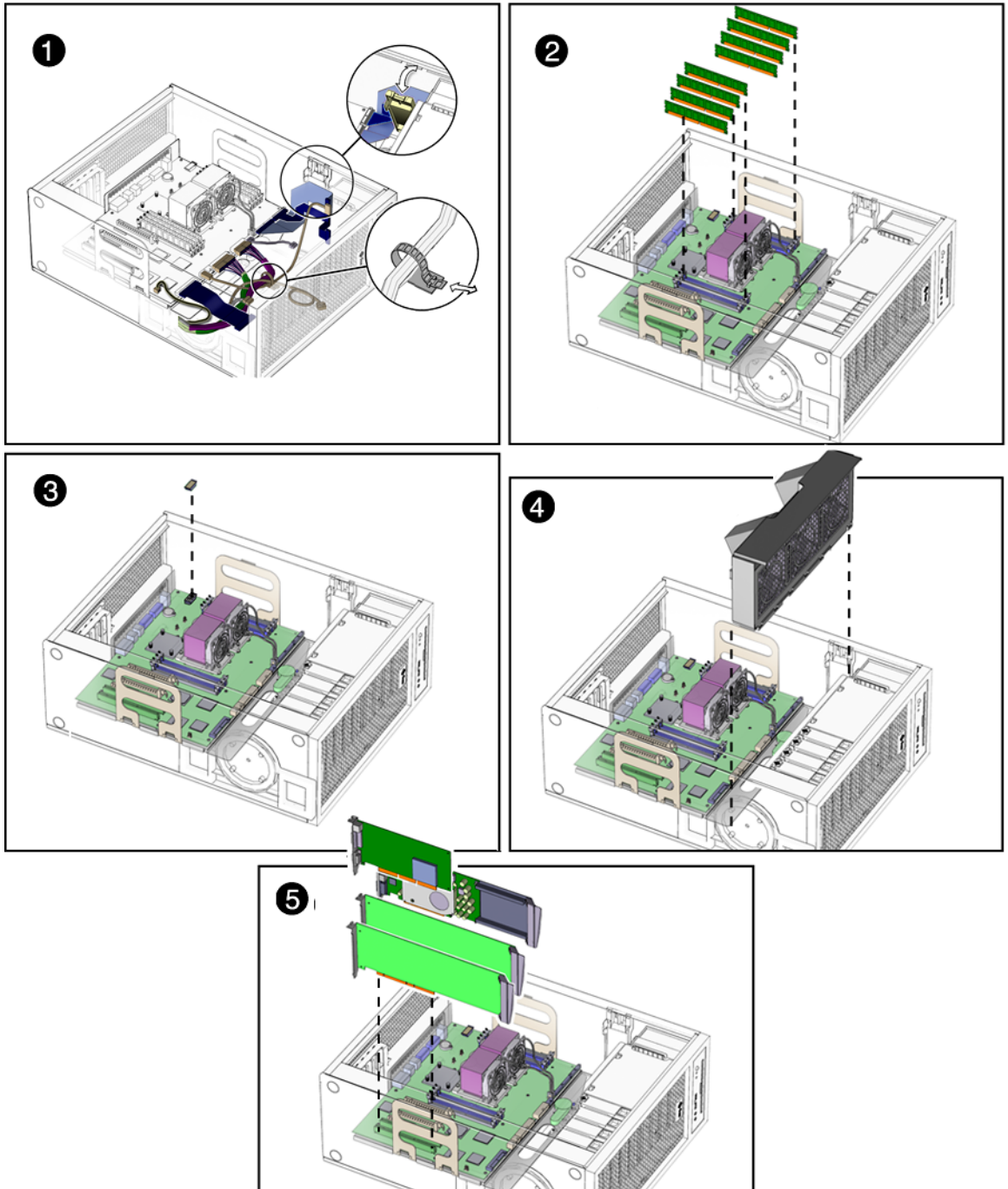
FIGURE 3-15 Installing the Motherboard and Related Components

Replacing Storage Devices

This chapter describes the removal and installation procedures for Sun Ultra 45 or Ultra 25 workstation storage devices.

The procedures described in this chapter are written for workstation service providers and system administrators.

This chapter contains the following topics:

Caution – To prevent equipment damage, review the safety information in "Preparing to Replace Components" on page 2-1 before you perform any replacement procedure. Additional cautions, warnings, and instructions are provided in the *Sun Ultra 45 and Ultra 25 Workstations Safety and Compliance Guide,* 819-2785. The document is available from: http://www.sun.com/documentation.

Caution – When servicing or removing workstation components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Then disconnect the power cord from the workstation and the wall receptacle. Following this caution equalizes all electrical potentials with the workstation.

4.1 Replacing a Hard Drive

The workstation supports up to four hard drives, either serial ATA (SATA), or serial attached SCSI (SAS). The hard drives slide into the hard drive bay and use standard Sun hard drive mounting brackets.

Note – Sun does not support mixed SAS and SATA hard drives. All four installed hard drives must be the same type.

Caution – The Sun SATA and SAS hard drive brackets are gray. To prevent damage to the connectors, do not insert any other color of hard drive into Sun Ultra 45 or Ultra 25 workstations.

The hard drives are labeled HDD0 through HDD3. The default boot drive is HDD0 (FIGURE 4-1).

TABLE 4-1 lists the hard drive specifications.

TABLE 4-1   Hard Drive Specifications

Hard Drive	Specification
SATA 100	250GB, 7,200 rpm, 3.5 inch, (gray bracket)
	80GB, 7,200 rpm, 3.5 inch, (gray bracket) for Ultra 25 workstation.
SAS	146GB, 15,000 rpm, 3.5 inch (gray bracket)

4.1.1 Removing a Hard Drive

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer To "Powering Off the Workstation" on page 2-4.

2. **Press the hard drive release button to release the hard drive handle (**FIGURE 4-1**).**

3. **Grasp the hard drive handle and pull the hard drive out of the hard drive bay.**

4. **Set the hard drive aside on an antistatic mat.**
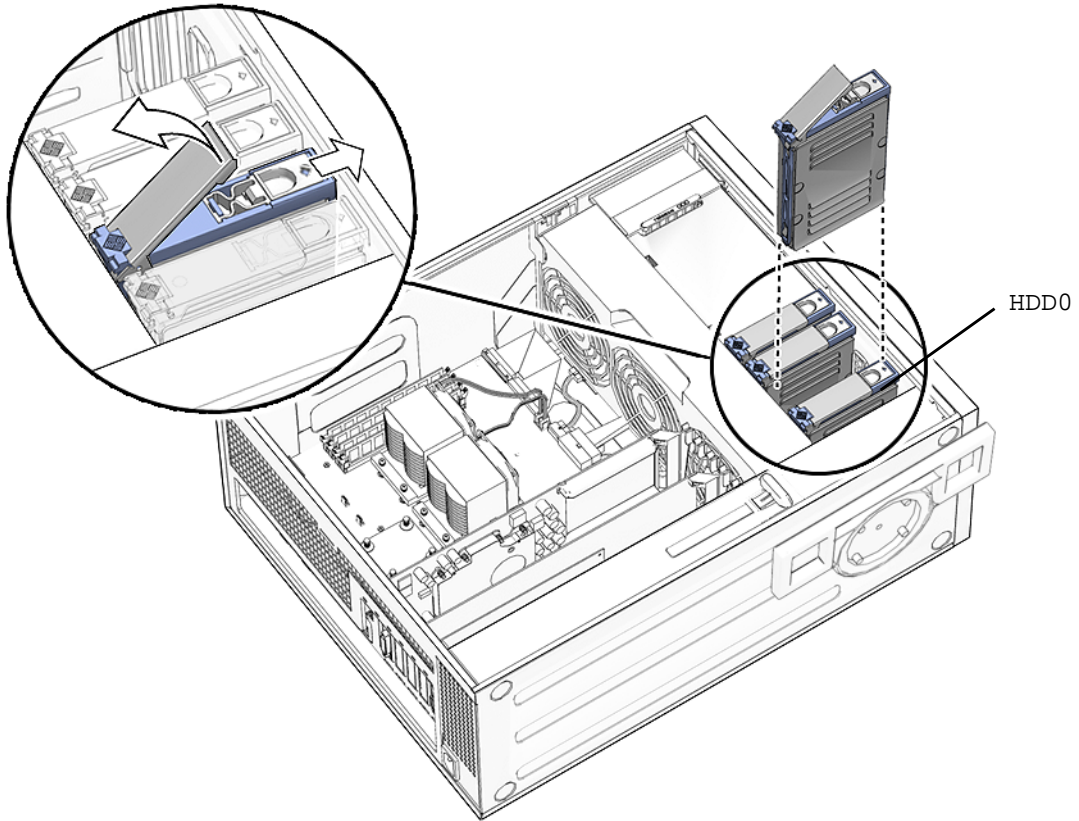
FIGURE 4-1   Removing the Hard Drive

4.1.2   Installing a Hard Drive

⚠️ **Caution –** Use proper ESD grounding technique when handling components. Wear an antistatic wrist strap and use an antistatic mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

1. Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.

Refer to "Powering Off the Workstation" on page 2-4.

Note – The default boot device is installed in HDD0 (drive 0). Be sure to install the boot disk in HDD0, unless you have changed the boot device parameters.

2. **Remove the new hard drive from its packaging.**

Caution – The Sun SATA and SAS hard drive brackets are color-coded gray. To prevent damage to the connectors, do not insert any other color of hard drive into Sun Ultra 45 or Ultra 25 workstations.

3. **Install the hard drive (FIGURE 4-1).**

4. **Slide the hard drive into the hard drive bay.**

5. **Close the latch on the hard drive until it clicks and is secure.**

6. **If you are finished working, reassemble the workstation, power on the workstation, and verify the hard drive installation.**

   See "Finishing Component Replacement" on page 6-1.

Note – Boot the system with the -r option, so that the Solaris Operating System can reconfigure itself for the new component. See "Finishing Component Replacement" on page 6-1.

4.2 Replacing the Hard Drive Backplane and Cables

This section describes removal and installation of the hard drive backplane, the signal cable, and the power cable.

4.2.1 Removing the Hard Drive Backplane and Cables

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.
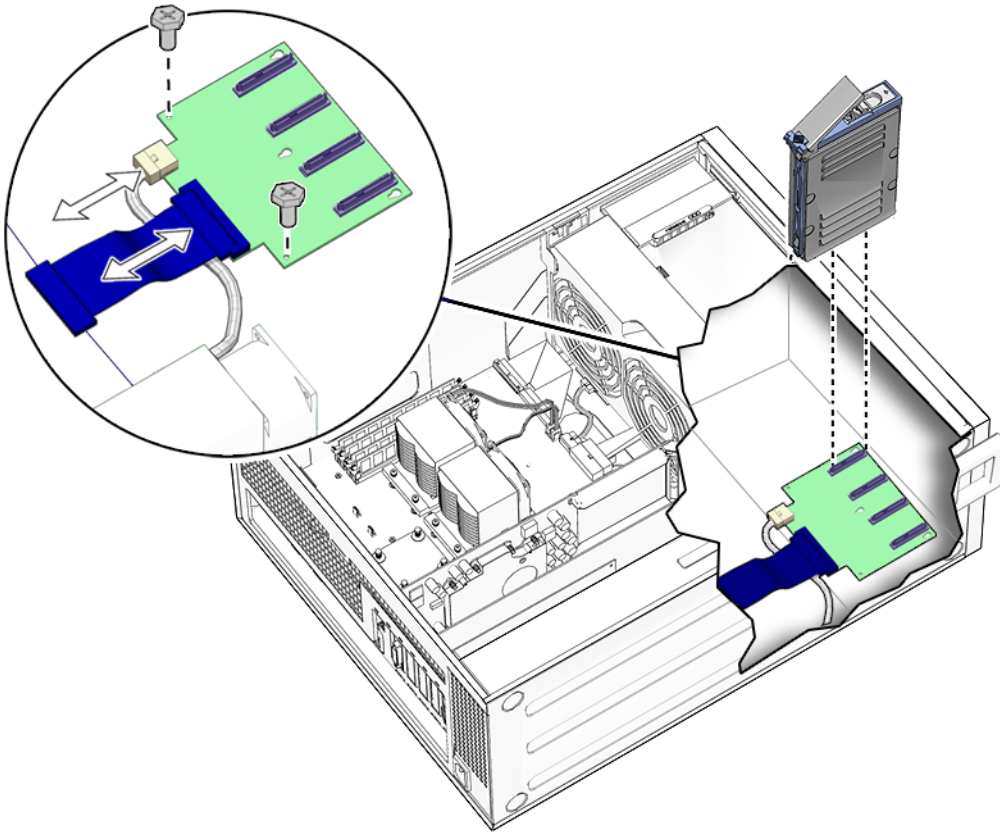
FIGURE 4-2   Disconnecting the Cables From the Hard Drive Backplane

2. **Remove all hard drives.**

   See "Replacing a Hard Drive" on page 4-2.

3. **Remove long PCI cards if they are covering the hard drive backplane cables.**

   Refer to "Removing a PCI Card" on page 3-14. Set these components onto an antistatic mat.

4. **Disconnect the cables from the following connectors**

   - Hard drive backplane signal cable from J4 of the hard drive backplane and J42 on the motherboard (FIGURE 4-2)
   - Power cable P3 from backplane connector J2

5. **Using a No. 2 Phillips screwdriver, remove the two screws from the hard drive backplane.**

4.2.2 Installing the Hard Drive Backplane and Cables

1. **Remove the new hard drive backplane and cables from the packaging.**

2. **Using a No. 2 Phillips screwdriver, replace the two screws for the hard drive backplane.**

3. **Reconnect the cables to the following connectors:**
   - Power cable P3 on backplane connector J2 (FIGURE 4-2).
   - Hard drive backplane signal cable from J4 of the hard drive backplane and J42 on the motherboard

4. **Inspect the cabling to verify that the signal and power cables are both secure at the backplane and the motherboard.**

5. **If you removed any long PCI cards, replace them.**

   Refer to "Installing a PCI Card" on page 3-18.

6. **Reassemble the workstation. Power on the system, and verify the cable installation.**

   Refer to:
   - "Reassembling the Workstation" on page 6-1
   - "Verifying Component Installation" on page 6-5

4.3 Replacing the I/O Module With the DVD-Dual Drive and Audio USB Board

This section describes removal and installation of the I/O module. The I/O module contains the DVD-dual drive, the audio USB board with speaker, USB and audio connectors, and the Power button and LED.

4.3.1 Removing the I/O Module and DVD-Dual Drive

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Open the I/O cable clip at the top of the chassis (FIGURE 4-3).**

3. **Disconnect the following cables:**

- Audio and power cable at J3 on the motherboard
- DVD cable at J11 on the motherboard
- USB cable from at J36 on the motherboard.

New cables are provided with the DVD-dual drive and the I/O module.

If you need to remove a long PCI card to access the USB cable, refer to "Removing a PCI Card" on page 3-14.

4. **Press the I/O module release button and pull the I/O module out the front of the chassis.**

Place the I/O module on an antistatic mat.

⚠️ **Caution –** Do not attempt to remove the bezel from the front of the I/O module.
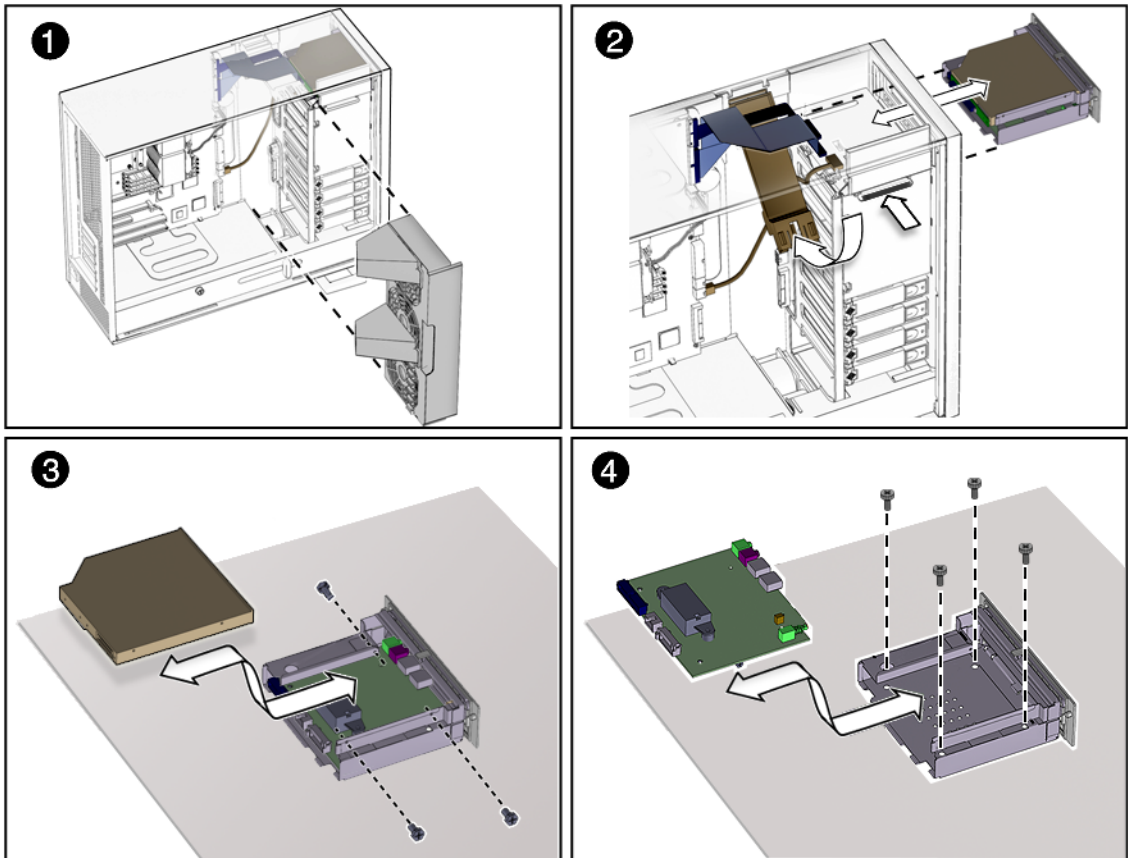
FIGURE 4-3 Removing the I/O Module With the DVD-Dual Drive and Audio USB Board

5. **If you are only replacing the DVD-dual drive:**

   a. **Using a No. 0 Phillips screwdriver, remove the screws holding the DVD-dual drive into the I/O module.**

   b. **Pull the DVD-dual drive straight out the back of the removable media bay (FIGURE 4-3).**

6. **If you are replacing the audio USB board:**

   a. **Remove the DVD-dual drive and set it aside.**

   b. **Using a No. 2 Phillips screwdriver, remove the four screws that secure the audio USB board to the I/O module.**

   c. **Pull the audio USB board straight out the back of the removable media bay (FIGURE 4-3).**

4.3.2   Installing the I/O Module and DVD-Dual Drive

1. **Remove the I/O module and DVD-dual drive assembly from the packaging.**

2. **If you are replacing the audio USB board:**

   a. **Install the new audio USB board into the removable media bay (FIGURE 4-3).**

   b. **Replace all four screws that secure the audio USB board to the removable media bay.**

3. **Install the DVD-dual drive into the I/O module with the screws (FIGURE 4-3):**

   a. **If you are using the old DVD-dual drive, screw the old drive into the I/O module.**

   b. **If you are using a new DVD-dual drive, screw the new drive into the I/O module.**

4. **Push the I/O module and DVD-dual drive into the chassis until the module clicks (FIGURE 4-3).**

5. **Connect the cables to the DVD-dual drive and the audio USB board.**

   If you removed a long PCI card, replace it now. Refer to Section 3.5.5, "Installing a PCI Card" on page 3-18.

   Note – Always use the new cables that are shipped with the DVD-dual drive or I/O module.

   ---

6. **Guide the DVD and audio/power cables through the I/O cable clip at the top of the chassis and close the clip.**

7. **Reconnect the audio and USB cables to:**
   - Audio and power cable at J3 on the motherboard and J0201 on the audio USB board (FIGURE 4-3 and FIGURE 4-4)
   - DVD cable at J11 on the motherboard and J501 on the DVD-dual drive
   - USB cable at J36 on the motherboard and J0601 on the audio USB board
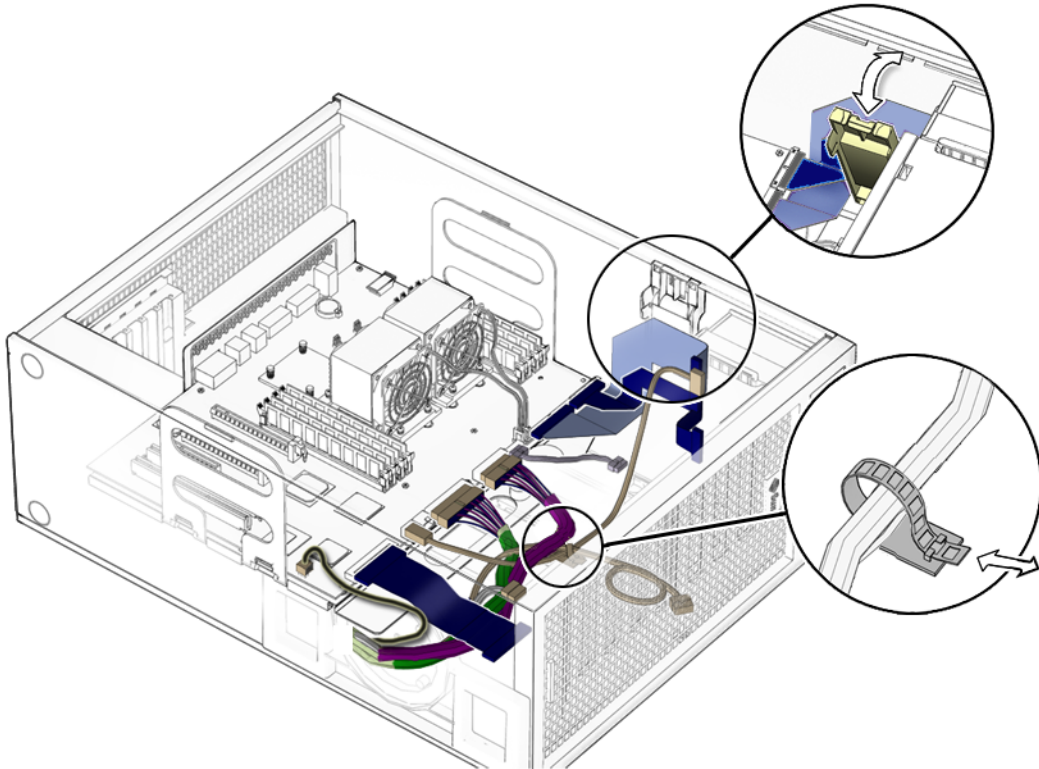
FIGURE 4-4   Securing the Audio USB Cables in the I/O Cable Clip

8. **Inspect the audio USB board cabling to verify that:**
   - The I/O cable clip is closed and locked.
   - The USB cable is secured in the cable clip on the hard drive bay.

9. **Reassemble the workstation. Power on the system, and verify the audio USB board installation.**

   Refer to "Reassembling the Workstation" on page 6-1.

Note – Boot the system with the -r option, so that the Solaris Operating System can reconfigure itself for the new component. Refer to "Finishing Component Replacement" on page 6-1.

Replacing Chassis Components

This chapter describes the removal and installation procedures for the Sun Ultra 45 or Ultra 25 workstation chassis components.

This chapter contains the following topics:

- Section 5.1, "Replacing the Fan Tray and Fan Tray Backplane" on page 5-1
- Section 5.2, "Replacing the Power Supply" on page 5-4

⚠ **Caution –** To prevent equipment damage, review the safety requirements, safety symbols, and safety precautions in "Preparing to Replace Components" on page 2-1 before you perform any replacement procedure. Additional cautions, warnings, and instructions are provided in the *Sun Ultra 45 and Ultra 25 Workstations Safety and Compliance Guide*, 819-2785. The document is available from: `http://www.sun.com/documentation`.

⚠ **Caution –** When servicing workstation components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Then disconnect the power cord from the workstation and the wall receptacle. Following this caution equalizes all electrical potentials with the workstation.

5.1   Replacing the Fan Tray and Fan Tray Backplane

This section describes removal and installation of the fan tray and fan tray backplane.

<div align="center">⚠️</div>

Caution – Do not operate the workstation without the fan tray.

5.1.1 Removing the Fan Tray

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

2. **Using the handle, pull the fan tray from the chassis and set it aside.**

Fan tray handle
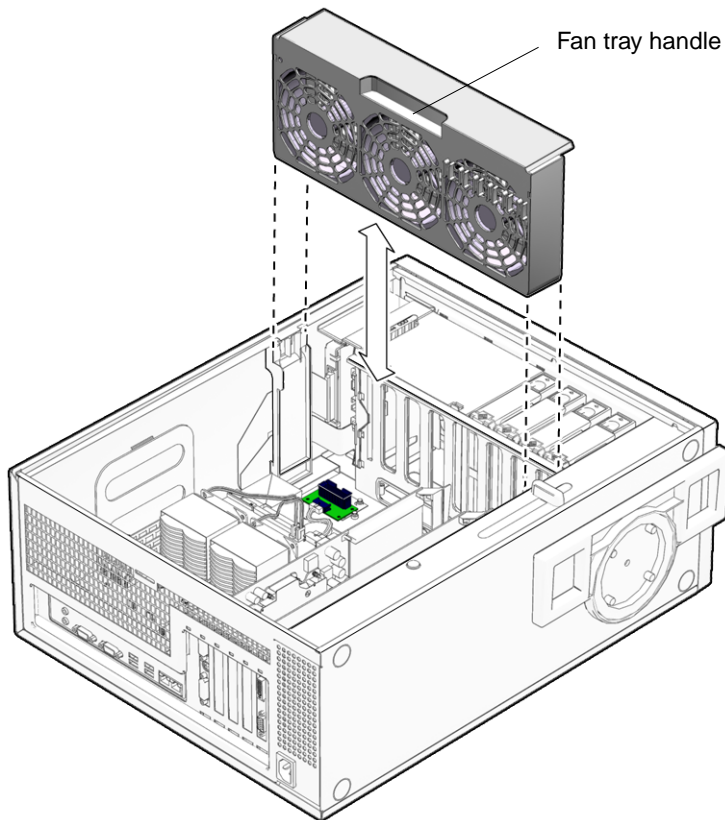
FIGURE 5-1 Removing the Fan Tray

5.1.2   Removing the Fan Tray Backplane

1. Disconnect the fan tray backplane from the motherboard at connector J20 (FIGURE 5-1).

2. Using a No. 2 Phillips screwdriver, remove the screws for the fan tray backplane.
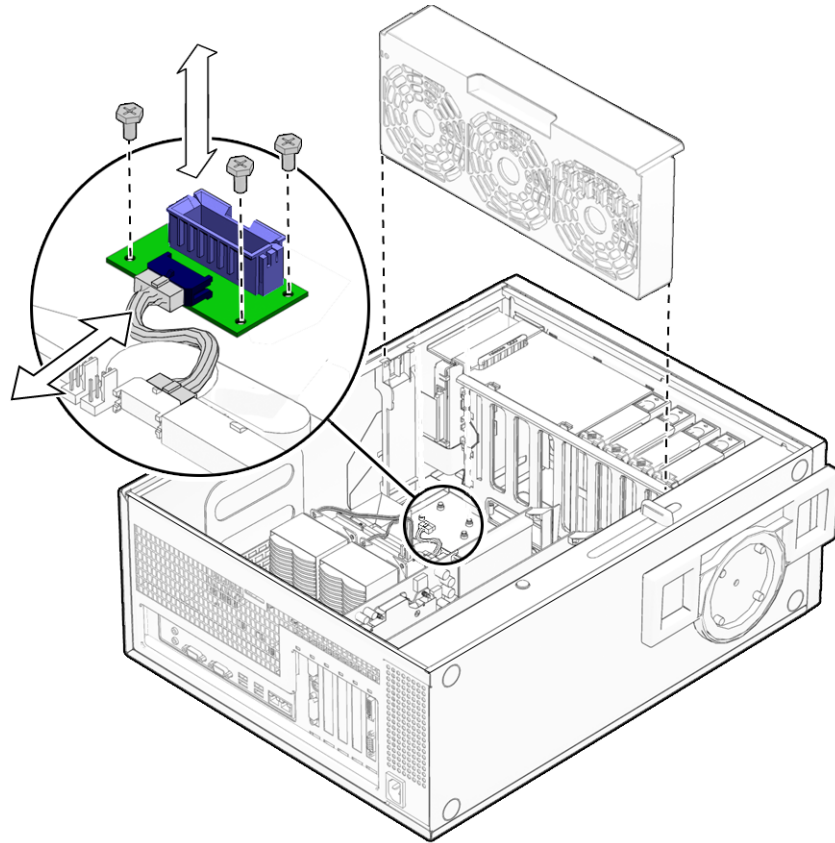
FIGURE 5-2   Removing the Fan Tray Backplane

5.1.3   Installing the Fan Tray and Fan Tray Backplane

1. Using a No. 2 Phillips screwdriver, mount the backplane to the chassis.

Do not overtighten the screws.

2. Connect the fan tray cable to the backplane and to the motherboard at connector J20.

3. **Align the fan tray in the chassis slot so that the connector is closest to the top of the chassis (**FIGURE 5-2**).**

4. **If you are finished working, reassemble the workstation and power on the workstation.**

   Refer to "Reassembling the Workstation" on page 6-1.

5.2 Replacing the Power Supply

This section describes removal and installation of the power supply.

5.2.1 Removing the Power Supply

1. **Power off the system and attach an antistatic wrist strap. Open and position the chassis, and remove the access panel.**

   Refer to "Powering Off the Workstation" on page 2-4.

1. **If necessary, remove any long PCI cards that are blocking the cables.**

   Place the PCI card on an antistatic mat.

2. **Remove the fan tray.**
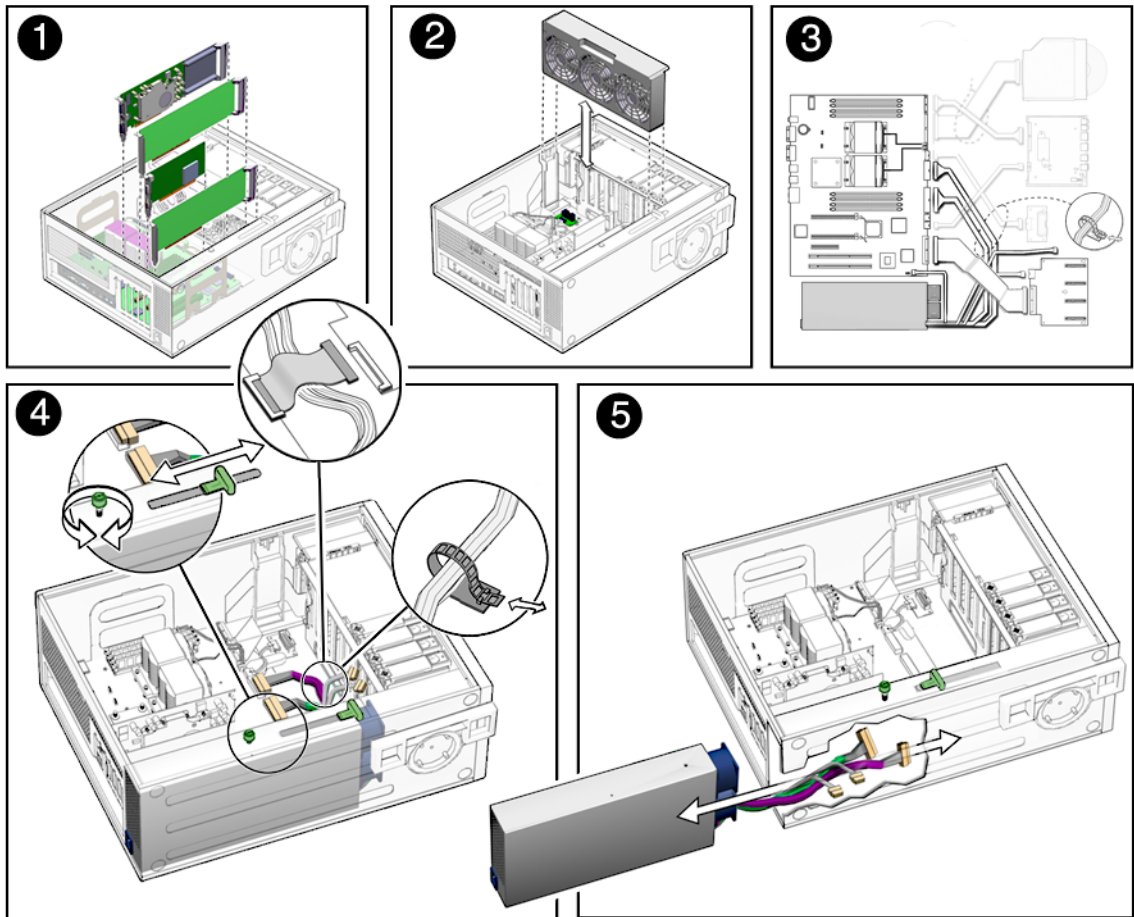
FIGURE 5-3   Removing the Power Supply

3. **Squeeze the power supply connector clip to disconnect the following cables from the motherboard (**FIGURE 5-3**).**

   - P2 power cable on the motherboard (J22)
   - P1 power cable on the motherboard at (J28)
   - P5 power supply signal cable on the motherboard (J45)

4. **Disconnect the following cables from the hard drive backplane**

   - P3 hard drive backplane power cable on the hard drive backplane (J2)
   - Hard drive signal cable to J4 on the hard drive backplane. (This cable also serves as a cable clip over other cables).

5. **Turn the captive screw that secures the power supply to the chassis (**FIGURE 5-3**).**

6. **Using the handle, push the power supply out of the back of the chassis.**

7. Guide the power cables out of the chassis as you push the power supply out the back of the chassis.

Set the power supply aside on an antistatic mat.

Proceed to "Installing the Power Supply" on page 5-6.

5.2.2 Installing the Power Supply

1. Remove the new power supply from its package.

2. Align the power supply IEC-320 connector so that the power cord socket is nearest the left rear of the chassis, when viewed from the back (FIGURE 5-4**).**
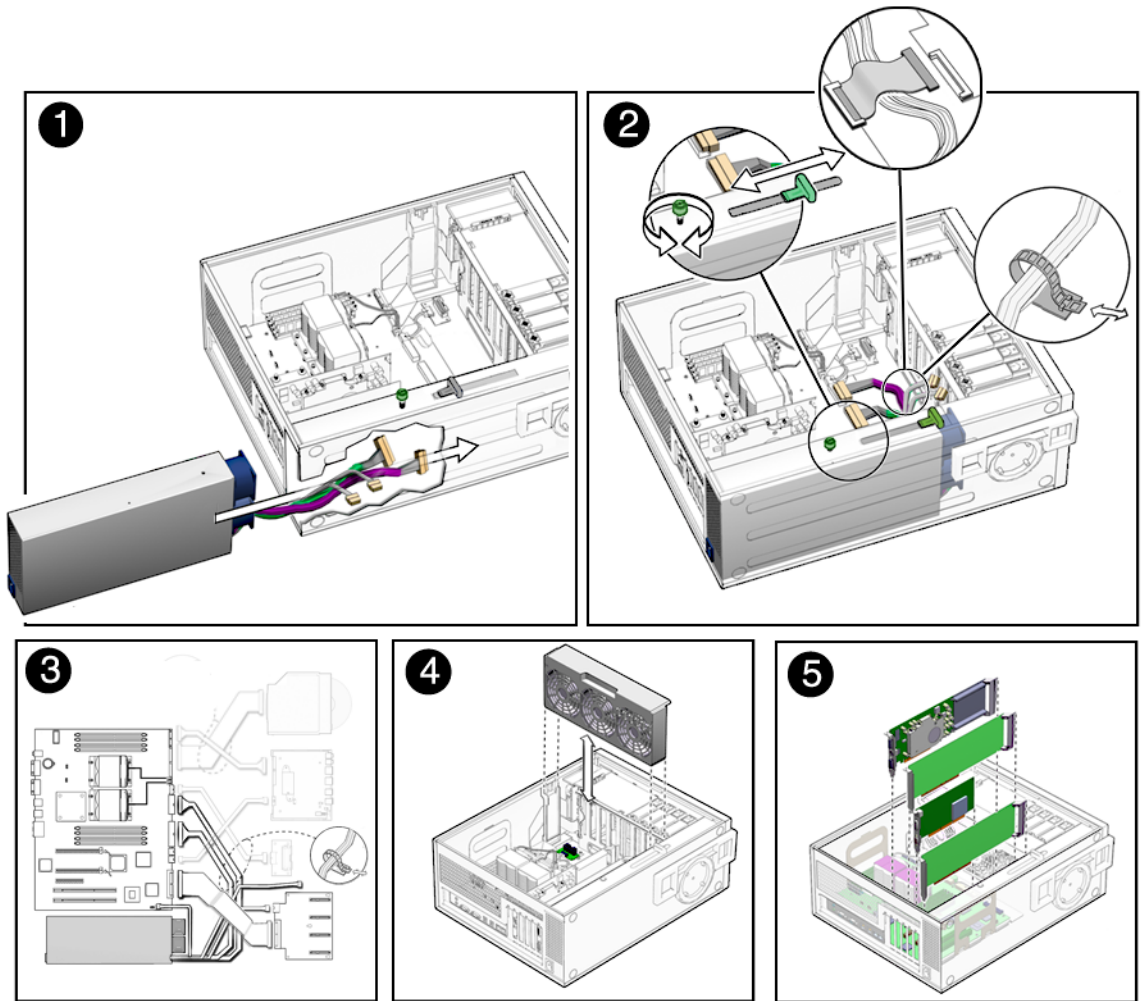
FIGURE 5-4   Installing the Power Supply

3. **Guide the cables and push the power supply into the chassis opening until the back of the power supply aligns with the back of the chassis.**

4. **Tighten the captive screw that secures the power supply to the chassis (**FIGURE 5-4**).**

5. **Connect the following cables (**FIGURE 5-5**):**
   - P1 power cable on the motherboard at (J28)
   - P2 power cable on the motherboard (J22)
   - P3 hard drive backplane power cable on the hard drive backplane (J2)
   - P5 power supply signal cable on the motherboard (J45)

■ Hard drive signal cable to J4 on the hard drive backplane. (This cable also serves as a cable clip over other cables).

DVD-dual drive

I/O module

J3

J11

J20

J22/P2

J28 (P1)

J36

J42

J45/P5

Fan tray backplane

P4
(not used)

J2

Power supply

Hard drive backplane
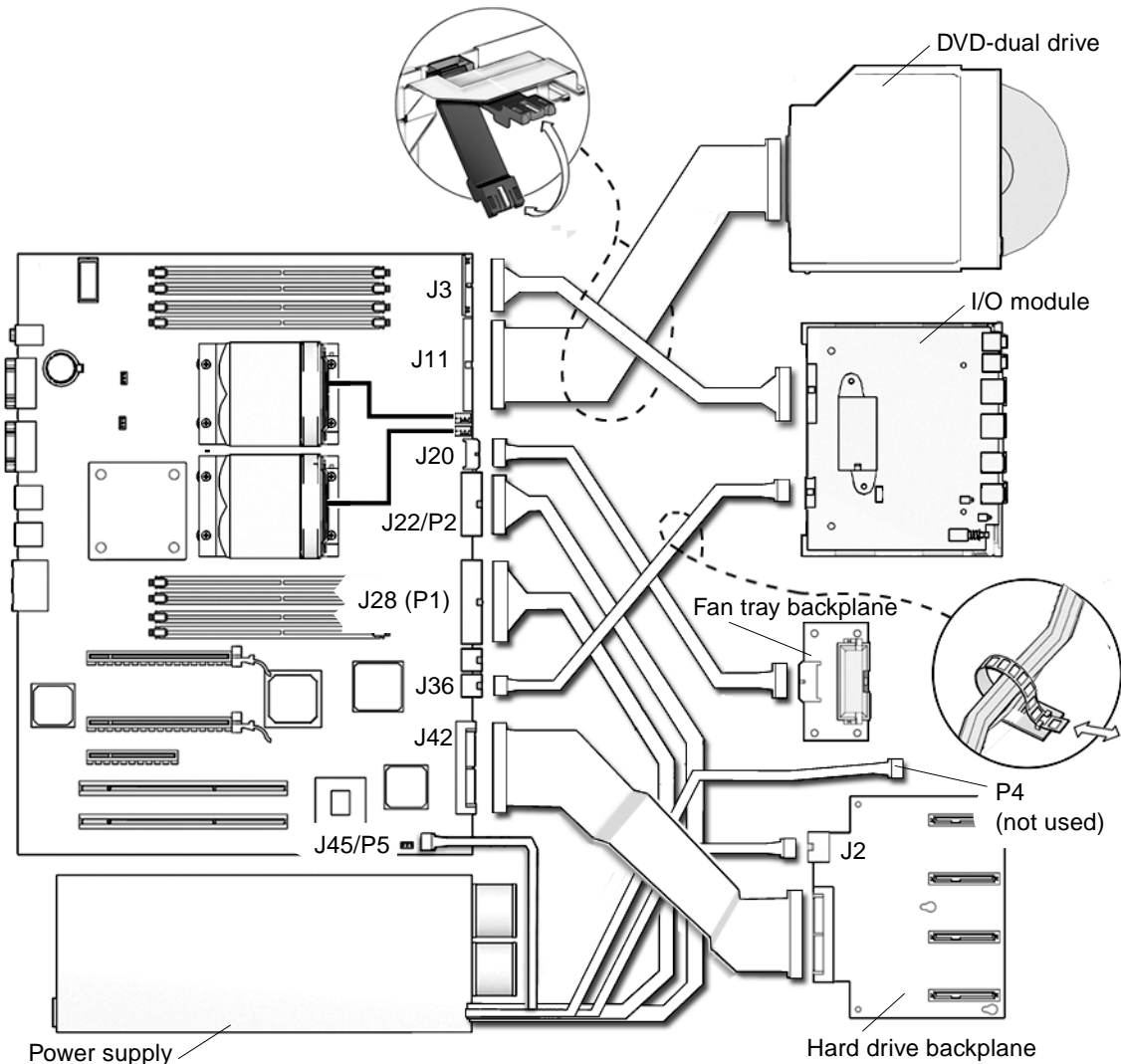
FIGURE 5-5 Power Supply Cable Connections at Motherboard and Hard Drive Backplane

6. **Inspect the power supply fasteners to verify that:**

■ The power supply push bar is seated.
■ The power supply captive screw is tight.

7. **Inspect the power supply cabling to verify that:**

- The three power supply cables are firmly connected to the motherboard at P1, P2, and P5 (J45).
- The hard drive backplane power cable is firmly connected at J4.
- The hard drive backplane signal cable is securely connected at both ends and is routed over the other cables.

8. **Install the fan tray.**

9. **If you removed any PCI cards, re-install them.**

   See Section 3.5.5, "Installing a PCI Card" on page 3-18.

10. **Reasemble the workstation. Power on the system, and verify the power supply installation.**

   Refer to "Reassembling the Workstation" on page 6-1.

Note – Boot the system with the -r option, so that the Solaris Operating System can reconfigure itself for the new component. See "Finishing Component Replacement" on page 6-1.


Finishing Component Replacement

This chapter describes how to finish the replacement of internal workstation replaceable components, close the system, and prepare it for operation. Topics covered in this chapter are:

6.1 Reassembling the Workstation

1. **Verify that you have not left any tools, loose screws, or loose components inside the system.**

2. **Replace the fan tray if you removed it (**FIGURE 6-1**).**

3. **Fit the access panel into the chassis (**FIGURE 6-1**).**

   a. **Ensure that the access panel latches are secure.**

   b. **Slide the lock block towards the back of the workstation.**

      If desired, lock the system or insert a security cable.

4. **Remove the wrist strap from the workstation and your wrist.**

5. **Pivot the support stabilizer from underneath the workstation (**FIGURE 6-3**).**

6. **Set the chassis upright.**

7. **Press in the side cover until the latches click.**
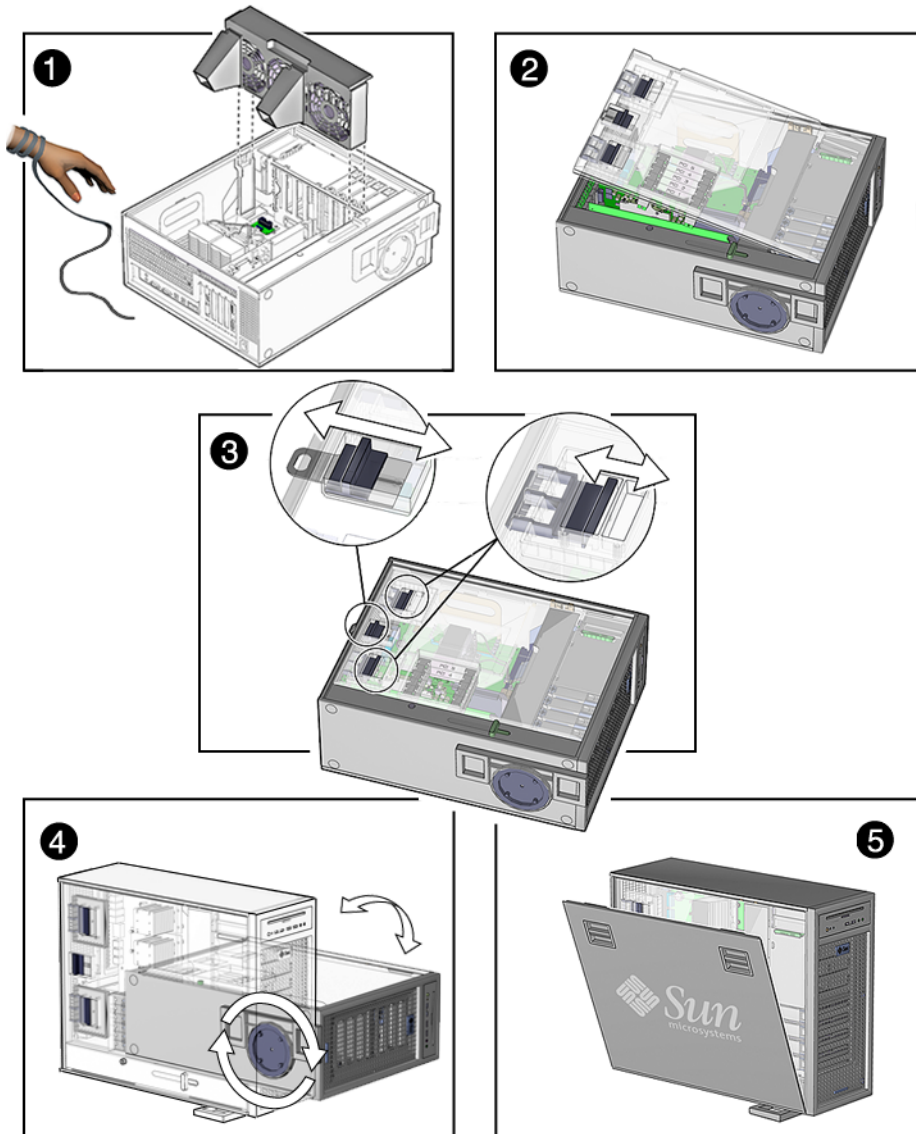
FIGURE 6-1 Reassembling the Workstation

8. **Reconnect the keyboard, mouse, monitor, network connections, and any peripherals (**FIGURE 6-2**).**

9. **Reconnect the power cord to the workstation and the power source.**
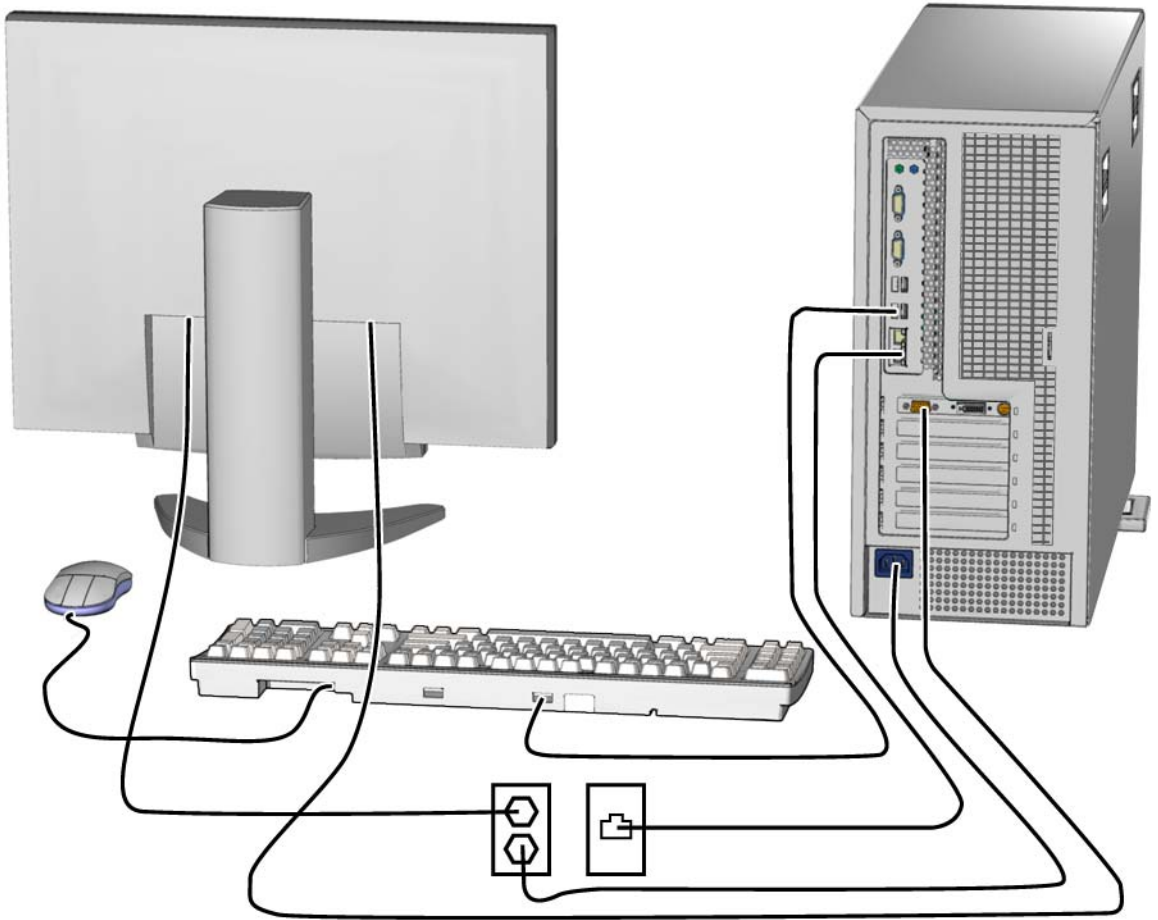
FIGURE 6-2 Reconnecting the Cables

10. Power on any connected peripherals or monitors.

> **Note –** The monitor must be powered on before the workstation so that the monitor can communicate with the graphics accelerator when the workstation powers on.

11. Power on the workstation.

Power button
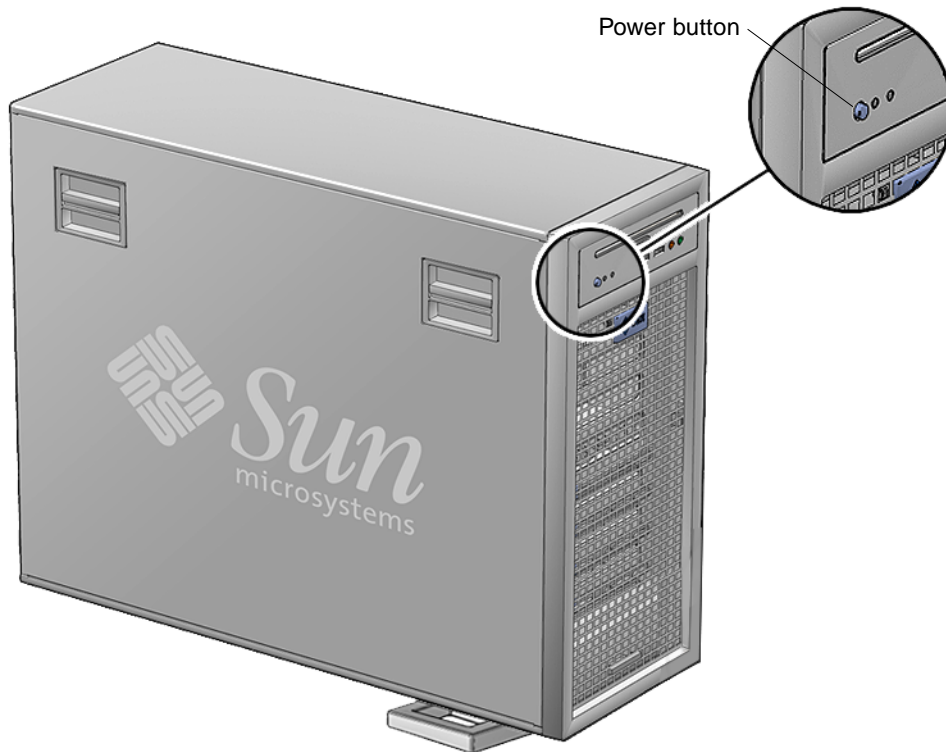
FIGURE 6-3 Powering On the Workstation

12. Select a boot source.

For most component installations you should become superuser and reboot the workstation so that the Solaris OS finds the new component.

For example:

```
# reboot -- -r
```

If you are at the ok prompt, type:

```
ok boot -r
```

6.2 Verifying Component Installation

There are several methods for verifying the installation of the new component.

6.2.1 Reconfiguring the System With `boot -r` Option

1. **Boot the system with the `-r` option, so that the Solaris OS can reconfigure itself for the new component.**

   For example:

   ```
   # boot -- -r
   ```

2. **Monitor the boot message.**

   If a warning message is displayed, refer to Section 12.4, "OpenBoot PROM Messages" on page 12-11.

3. **If the problem has not been solved, see "Diagnostics Hierarchy" on page 7-4.**

6.2.2 Verifying Configuration With POST

1. **Run POST with the `diag-switch` to true and the `diag-level` set to max.**

2. **Verify that the new device is recognized by POST.**

   Refer to "Power-On Self-Test" on page 11-1.

6.2.3 Verifying Configuration With POST and OpenBoot Diagnostics

Use OpenBoot Diagnostics to test all devices. Refer to "OpenBoot Diagnostics" on page 12-6.

6.2.4 Verifying Configuration With `prtdiag`

From a terminal window, type `prtdiag` and verify that all the correct devices are recognized by the system. Refer to "`prtdiag` Command" on page 9-8.

Diagnostics Overview

This chapter describes some diagnostic tools. This chapter contains the following topics:

- Section 7.1, "Diagnostic Tools Available" on page 7-1
- Section 7.2, "Diagnostic Tests" on page 7-2
- Section 7.3, "Power-On Sequence" on page 7-6

7.1 Diagnostic Tools Available

The *Sun Ultra 45 and Ultra 25 Workstations Service and Diagnostics Manual* uses displayed messages, system sounds, flowcharts, and firmware and software diagnostic tools to help you locate and identify workstation malfunctions.

TABLE 7-1 Diagnostic Tools Sorted by Tool Type

Diagnostic Tool	Type of Tool	What the Tool Does	How to Use the Tool
System LEDs	Hardware	Shows status of system or of a specific component.	For information on system power and Ethernet LEDs, see "LED Diagnostics" on page 8-1.
System sounds	Hardware	Single beep indicates keyboard connection when the system boots. Continuous beeping indicates a stuck key on the keyboard.	If continuous beeping, disconnect and reconnect keyboard. Inspect for stuck keys, or replace.
Solaris 10 Predictive Self-Healing	Software	Runtime diagnostics program that monitors system errors and reports any hardware needing replacement.	Use Predictive Self-Healing first to diagnose the workstation. See: "Predictive Self-Healing Overview" on page 9-1.

TABLE 7-1   Diagnostic Tools Sorted by Tool Type *(Continued)*

Diagnostic Tool	Type of Tool	What the Tool Does	How to Use the Tool
Solaris 10 Operating System	Software	Commands display system information.	Commands `iostat`, `prtdiag`, `prtconf`, `netstat`, `ping`, `ps`, and `prstat` are run with superuser privileges. See "Traditional Solaris Troubleshooting Commands" on page 9-6.
NVRAM	Firmware	Contains properties and flags to configure system and diagnostic tests.	The `setenv` command typed at the `ok` prompt or the `eeprom` command in a terminal window can configure the OpenBoot PROM for diagnostics and automatic execution of scripts. See "NVRAM" on page 10-1.
POST diagnostics	Firmware	Tests workstation core components such as CPU and memory.	Checks low-level interaction between CPU, caches, memory, JBus, and PCI bridge. Output displayed through serial port. See "Power-On Self-Test" on page 11-1.
OpenBoot Diagnostics	Firmware	Tests system motherboard and component interfaces.	Component tests are selected from menu. If component is PCI card with IEEE 1275-compliant Fcode, internal self-test is executed. See "OpenBoot Diagnostics" on page 12-6.
SunVTS	Software	Exercises and stresses workstation components.	Invoked from the Solaris Operating System. Command-line or GUI user interface. SunVTS must be installed on the system under test. See "SunVTS" on page 13-1.

7.2   Diagnostic Tests

The Predictive Self-Healing (predictive self-healing tools) is often your first and best tool for diagnostics. Use TABLE 7-2 to determine which diagnostic program to use to troubleshoot a component.

TABLE 7-2   Diagnostics Tools Sorted by Component

Component	Solaris 10 Predictive Self-Healing	POST	OpenBoot Diagnostics	SunVTS
	Diagnoses events and prescribes corrective actions.	Tests workstation core components such as CPU and memory.	Diagnoses system motherboard and component interfaces.	Exercises and stresses workstation components.
CPU	Complete diagnostics	Performs cache, MMU, CPU, and FPU tests	No testing	`cputest` `iutest` `fputest` `l1dcachetest`
Memory	Complete diagnostics	Max diag level performs tests including block memory and quick memory tests	No testing	`pmemtest` `vmemtest`
I/O bridge chip	Partial diagnostics, driver dependent	Performs several tests including register tests	No testing	No testing
Flash PROM	N/A	Verification of POST portion checksum	Yes. See "OpenBoot Diagnostics" on page 12-6.	`seepromtest`
Graphics accelerator	Partial diagnostics, driver dependent	Built-in self test (BIST) only		XVR-100 (`pfbtest`) XVR-2500 (graphics test)
PCI card	Partial diagnostics, driver dependent	Built-in self test (BIST) only	Tests available if card has IEEE 1275 self-test	See SunVTS Reference Manual

TABLE 7-2 Diagnostics Tools Sorted by Component *(Continued)*

Component	Solaris 10 Predictive Self-Healing	POST	OpenBoot Diagnostics	SunVTS
Hard drive	Complete diagnostics	No testing	Some tests available. See "OpenBoot Diagnostics" on page 12-6.	`disktest`
DVD-dual drive	Partial diagnostics, driver dependent	No testing		`cddvdrwtest` `cdtest` `dvdtest`
Network*	Partial diagnostics, driver dependent	No testing		`nettest` `netlbtest`
USB	Partial diagnostics, driver dependent	No testing		`disktest` (For USB removable media device.)
Keyboard and mouse	Partial diagnostics, driver dependent	No testing		`usbkbtest`
Serial ports*	Partial diagnostics, driver dependent	Used for POST output		`sutest`
Audio ports*	Partial diagnostics, driver dependent	No testing		`audiotest`

* More thorough test results are possible with a loopback connector, however these results are not included in this document.

7.2.1　Diagnostics Hierarchy

One approach to diagnostics is shown in FIGURE 7-1 and FIGURE 7-2.
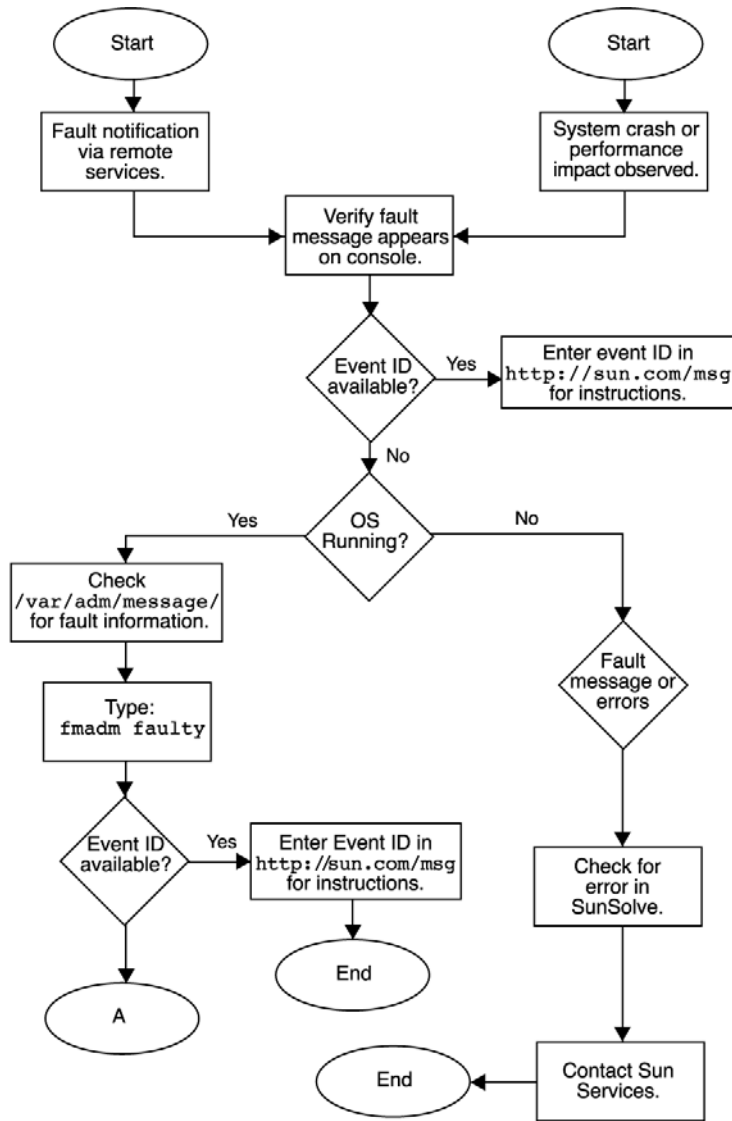
FIGURE 7-1   Diagnostic Method Flow Chart
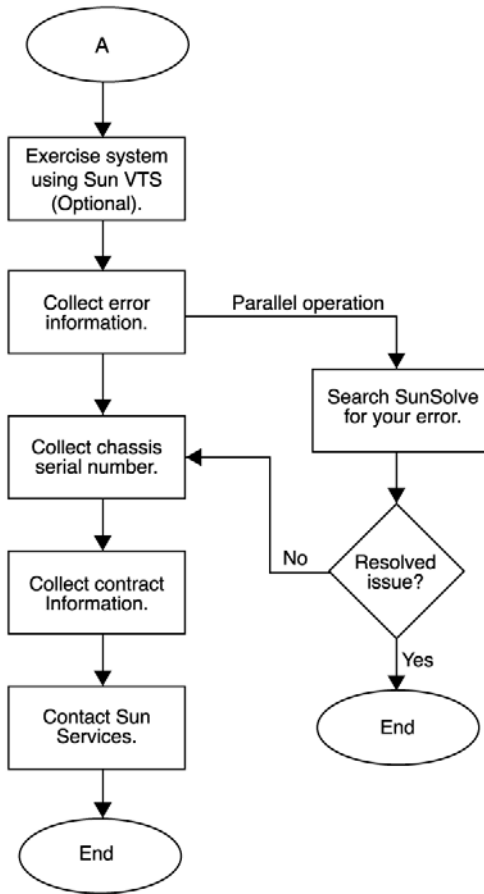
FIGURE 7-2 Diagnostics Method Flow Chart – Traditional Data Collection

7.3 Power-On Sequence

When you power on the Sun Ultra 45 or Ultra 25 workstation, a series of processes brings the workstation to a user-ready state.

The sequence of power-on events is shown below:

1. User presses the Power button.

2. OpenBoot PROM initiates system power-on reset (SPOR).

3. OpenBoot PROM initiates power-on self-test (POST) (if enabled).

4. OpenBoot PROM loads device drivers.

5. OpenBoot PROM loads workstation configuration from NVRAM.

6. OpenBoot PROM probes PCI bus.

7. OpenBoot PROM loads OpenBoot Diagnostics.

8. OpenBoot PROM loads and executes boot block.

9. Boot block loads and executes bootstrap program.

Note – If the Solaris kernel does not load, you can run diagnostics from the `ok` prompt

---

10. Bootstrap loads Solaris kernel.

11. Bus connections and hardware components are probed.

12. `init` program is loaded and executed.

13. `init` program reads `/etc/inittab`.

14. `init` program starts `rc` scripts, that read, check, and mount file systems.

15. `/etc/vfstab` file system is checked and mounted.

16. Additional `rc` script files are executed.

Basic Diagnostics

This chapter provides basic diagnostics assistance. Topics include:

8.1 LED Diagnostics

This section describes LEDs that you can use to diagnose the workstation.

TABLE 8-1   Front Panel LED States

LED	Condition	Meaning
Green	Off	Workstation is not powered on.
	On	Workstation is powered on.
	Blinking	Workstation is in low-power mode.
Amber (Yellow)	Not functional	Not functional

TABLE 8-2   Twisted-Pair Ethernet LED Status

LED	Status
Green - Link	When illuminated, a 10/100/1000 Mbps link exists.
Amber - Activity	When flashing, indicates transmit or receive activity.

8.2 Audio Diagnostics

If the workstation beeps continuously, the keyboard has a bad connection or there is a stuck key on the keyboard. To resolve the problem:

- Inspect for a stuck key on the keyboard and release the stuck key.
- Disconnect and reconnect the keyboard.
- Replace the keyboard.

8.3 Display Diagnostics

Error messages displayed on the monitor are generated from the Solaris OS or the OpenBoot PROM. See the following sections:

- See "Predictive Self-Healing Overview" on page 9-1.
- See "OpenBoot PROM Messages" on page 12-11.

If you experience any other monitor problems, see the documentation for the graphics accelerator that is installed in your system. For example:

Sun XVR-2500 Graphics Accelerator Installation and User's Guide, 817-7517

The graphics accelerator documentation is available at this web site.

```
http://www.sun.com/documentation/
```

Solaris 10 Predictive Self-Healing and Solaris Diagnostics

This chapter provides information about the following topics:

9.1   Predictive Self-Healing Overview

Always access the following web site first to interpret faults and obtain information on a fault:

```
http://www.sun.com/msg/
```

The web site directs you to provide the message ID that your system displayed. The web site then provides knowledge articles about the fault and corrective action to resolve the fault. The fault information and documentation at this web site is updated regularly.

You can find more detailed descriptions of Solaris 10 Predictive Self-Healing at the web site below:

```
http://www.sun.com/bigadmin/features/articles/selfheal.html
```

9.2 Predictive Self-Healing Tools

In Solaris 10, the fault manager runs in the background. The fault manager performs the following functions:

- Receives telemetry information about problems detected by the system software.
- Diagnoses the problems.
- Initiates pro-active self-healing activities. For example, the fault manager can disable faulty components.

TABLE 9-1 shows a typical message generated when a fault occurs on your system. The message appears on your console and is recorded in the `/var/adm/messages` file.

Note – The message in TABLE 9-1 indicates that the fault has already been diagnosed. Any corrective action that the system can perform has already taken place. If your workstation is still running, it continues to run.

TABLE 9-1   System Generated Predictive Self-Healing Message

Output Displayed	Description
`Nov 1 16:30:20 dt88-292 EVENT-TIME: Tue Nov 1 16:30:20 PST 2005`	`EVENT-TIME`: the time stamp of the diagnosis.
`Nov 1 16:30:20 dt88-292 PLATFORM: SUNW,A70, CSN: -, HOSTNAME: dt88-292`	`PLATFORM`: A description of the system encountering the problem
`Nov 1 16:30:20 dt88-292 SOURCE: eft, REV: 1.13`	`SOURCE`: Information on the Diagnosis Engine used to determine the fault
`Nov 1 16:30:20 dt88-292 EVENT-ID: afc7e660-d609-4b2f-86b8-ae7c6b8d50c4`	`EVENT-ID`: The Universally Unique event ID (UUID) for this fault
`Nov 1 16:30:20 dt88-292 DESC:` `Nov 1 16:30:20 dt88-292 A problem was detected in the PCI-Express subsystem`	`DESC`: A basic description of the failure
`Nov 1 16:30:20 dt88-292  Refer to http://sun.com/msg/SUN4-8000-0Y for more information.`	`WEBSITE`: Where to find specific information and actions for this fault
`Nov 1 16:30:20 dt88-292 AUTO-RESPONSE: One or more device instances may be disabled`	`AUTO-RESPONSE`: What, if anything, the system did to alleviate any follow-on issues

TABLE 9-1   System Generated Predictive Self-Healing Message

Output Displayed	Description
`Nov 1 16:30:20 dt88-292 IMPACT: Loss of services provided by the device instances associated with this fault`	IMPACT: A description of what that response may have done
`Nov 1 16:30:20 dt88-292 REC-ACTION: Schedule a repair procedure to replace the affected device. Use Nov 1 16:30:20 dt88-292 fmdump -v -u EVENT_ID to identify the device or contact Sun for support.`	REC-ACTION: A short description of what the system administrator should do

9.3   Using the Predictive Self-Healing Commands

For complete information about Predictive Self-Healing commands, refer to the Solaris 10 man pages. This section describes some details of the following commands:

- `fmdump`
- `fmadm`
- `fmstat`

9.3.1   Using the `fmdump` Command

After the message in TABLE 9-1 is displayed, you may desire more information about the fault. The `fmdump` command can be used to display the contents of any log files associated with the Solaris Fault Manager.

The `fmdump` command produces output similar to TABLE 9-1. This example assumes there is only one fault.

```
# fmdump
TIME UUID SUNW-MSG-ID
Nov 02 10:04:15.4911 0ee65618-2218-4997-c0dc-b5c410ed8ec2 SUN4-8000-0Y
```

9.3.1.1 `fmdump -V` Command

You can obtain more detail by using the `-V` option.

```
# fmdump -V -u  0ee65618-2218-4997-c0dc-b5c410ed8ec2
TIME                    UUID                                SUNW-MSG-ID
Nov 02 10:04:15.4911 0ee65618-2218-4997-c0dc-b5c410ed8ec2  SUN4-8000-0Y
100% fault.io.fire.asic
FRU: hc://product-id=SUNW,A70/motherboard=0
rsrc: hc:///motherboard=0/hostbridge=0/pciexrc=0
```

At least three lines of new output are delivered to the user with the `-V` option.

- The first line is a summary of information you have seen before in the console message but includes the timestamp, the UUID, and the Message-ID.
- The second line is a declaration of the certainty of the diagnosis. In this case we are 100% sure the failure is in the ASIC described. If the diagnosis may involve multiple components, you may see two lines here with 50% in each (for example)
- The FRU line declares the part which needs to be replaced to return the system to a fully operational state.
- The `rsrc` line describes what component was taken out of service as a result of this fault.

9.3.1.2 `fmdump -e` Command

To get information of the errors which caused this failure, you can use the `-e` option.

```
# fmdump -e
TIME                    CLASS
Nov 02 10:04:14.3008 ereport.io.fire.jbc.mb_per
```

9.3.2 Using the `fmadm faulty` Command

The `fmadm faulty` command can be used by administrators and service personnel to view and modify system configuration parameters that are maintained by the Solaris Fault Manager. The `fmadm faulty` command is primarily used to determine the status of a component involved in a fault.

```
# fmadm faulty
STATE       RESOURCE / UUID
-------- --------------------------------------------------------------
degraded dev:////pci@1e,600000
           0ee65618-2218-4997-c0dc-b5c410ed8ec2
```

The PCI device is degraded and is associated with the same UUID as seen above. You may also see "faulted" states.

9.3.2.1   fmadm config Command

The fmadm config command output shows you the version numbers of the diagnosis engines in use by your system, as well as their current state. You can check these versions against information on the SunSolve web site to determine if you are running the latest diagnostic engines.

```
# fmadm config
MODULE              VERSION  STATUS   DESCRIPTION
cpumem-diagnosis    1.5      active   UltraSPARC-III/IV CPU/Memory Diagnosis
cpumem-retire       1.0      active   CPU/Memory Retire Agent
eft                 1.13     active   eft diagnosis engine
fmd-self-diagnosis  1.0      active   Fault Manager Self-Diagnosis
io-retire           1.0      active   I/O Retire Agent
syslog-msgs         1.0      active   Syslog Messaging Agent
```

9.3.3   Using the fmstat Command

The fmstat command can report statistics associated with the Solaris Fault Manager. The fmstat command shows information about DE performance. In the example below, the eft DE (also seen in the console output) has received an event which it accepted. A case is "opened" for that event and a diagnosis is performed to "solve" the cause for the failure.

```
# fmstat
module          ev_recv ev_acpt wait svc_t   %w  %b  open solve  memsz bufsz
cpumem-diagnosis  0        0     0.0  0.0     0   0   0    0       3.0   K0
cpumem-retire     0        0     0.0  0.0     0   0   0    0       0     0
eft               1        1     0.0  1191.8  0   0   1    1       3.3M  11K
fmd-self-diagnosis 0       0     0.0  0.0     0   0   0    0       0     0
io-retire         1        0     0.0  32.4    0   0   0    0       37b   0
syslog-msgs       1        0     0.0  0.5     0   0   0    0       32b   0
```

9.4 Determining Which Diagnostics Tools to Use

When a failure occurs, a message is often displayed on the monitor. Use the flowcharts in FIGURE 7-1 and FIGURE 7-2 to find the correct methods for diagnosing system problems with Predictive Self-Healing tools, OpenBoot PROM, OpenBoot Diagnostics, or other Solaris commands.

9.5 Traditional Solaris Troubleshooting Commands

These superuser commands can help you determine if you have issues in your workstation, in the network, or within another system that you are networking with.

The following commands are described in this section:

- "iostat Command" on page 9-7
- "prtdiag Command" on page 9-8
- "prtconf Command" on page 9-9
- "netstat Command" on page 9-11
- "ping Command" on page 9-12
- "ps Command" on page 9-13
- "prstat Command" on page 9-15

Most of these commands are located in the /usr/bin or /usr/sbin directories.

9.5.1 `iostat` Command

The `iostat` command iteratively reports terminal, drive, and tape I/O activity, as well as CPU utilization.

9.5.1.1 Options

TABLE 9-2 describes options for the `iostat` command and how those options can help troubleshoot the Sun Ultra 45 or Ultra 25 workstation.

TABLE 9-2   Options for `iostat`

Option	Description	How It Can Help
No option	Reports status of local I/O devices.	A quick three-line output of device status.
-c	Reports the percentage of time the system has spent in user mode, in system mode, waiting for I/O, and idling.	Quick report of CPU status.
-e	Displays device error summary statistics. The total errors, hard errors, soft errors, and transport errors are displayed.	Provides a short table with accumulated errors. Identifies suspect I/O devices.
-E	Displays all device error statistics.	Provides information about devices: manufacturer, model number, serial number, size, and errors.
-n	Displays names in descriptive format.	Descriptive format helps identify devices.
-x	For each drive, reports extended drive statistics. The output is in tabular form.	Similar to the -e option, but provides rate information. This helps identify poor performance of internal devices and other I/O devices across the network.

The following example shows output for one `iostat` command.

```
# iostat -En
c0t0d0    Soft Errors: 0 Hard Errors: 0 Transport Errors: 0
Model: ST3120026A    Revision: 8.01   Serial No: 3JT4H4C2
Size: 120.03GB <120031641600 bytes>
Media Error: 0 Device Not Ready: 0  No Device: 0 Recoverable: 0
Illegal Request: 0
c0t2d0    Soft Errors: 0 Hard Errors: 0 Transport Errors: 0
Vendor: LITE-ON  Product: COMBO SOHC-4832K Revision: O3K1
Serial No:
Size: 0.00GB <0 bytes>
Media Error: 0 Device Not Ready: 0 No Device: 0 Recoverable: 0
Illegal Request: 0 Predictive Failure Analysis: 0
```

9.5.2   prtdiag Command

The prtdiag command displays configuration and diagnostic information for a system. The diagnostic information identifies any failed component in the system.

The prtdiag command is located in the /usr/platform/*platform-name*/sbin/ directory.

Note – The prtdiag command might indicate a slot number different than that identified elsewhere in this document. This is normal.

9.5.2.1   Options

TABLE 9-3 describes options for the prtdiag command and how those options can help troubleshoot the Sun Ultra 45 or Ultra 25 workstation.

TABLE 9-3   Options for prtdiag

Option	Description	How It Can Help
No option	Lists system components.	Identifies CPU timing and PCI cards installed.
-v	Verbose mode. Displays the time of the most recent AC power failure, the most recent hardware fatal error information, and (if applicable) environmental status.	Provides the same information as no option. Additionally lists fan status, temperatures, ASIC, and PROM revisions.

The following example shows output for the `prtdiag` command in verbose mode.

```
# /usr/platform/sun4u/sbin/prtdiag -v
System Configuration: Sun Microsystems  sun4u Sun Ultra 45 or Ultra 25 workstation
System clock frequency: 160 MHZ
Memory size: 1GB


. . .


========================== Environmental Status ===========================
Fan Speeds:
-------------------------------------------
Location       Sensor         Status  Speed
-------------------------------------------
F2             CPU            okay    3183rpm
F1             Intake         okay    2280rpm
F0             Outtake        okay    2280rpm

Temperature sensors:
-------------------------------------------------------------------------
Location       Sensor        Temperature  Lo    LoWarn  HiWarn   Hi   Status
-------------------------------------------------------------------------
MB/0           Die              68C       -10C    0C      95C   100C  okay
MB             Ambient          37C       -10C    0C      70C    75C  okay
MB             Ambient          30C       -11C    0C      60C    70C  okay


============================= HW Revisions ===============================
ASIC Revisions:
-----------------------------------------------------------------
Path                   Device        Status          Revision
-----------------------------------------------------------------
/pci@1e,600000         pci108e,a801  okay                4
/pci@1f,700000         pci108e,a801  okay                4

System PROM revisions:
----------------------
OBP 4.16.3 2004/11/05 18:29 Sun Ultra 45
OBDIAG 4.16.3 2004/11/05 18:31
```

9.5.3   `prtconf` Command

Similar to the `show-devs` command run at the `ok` prompt, the `prtconf` command displays the devices that are configured for the Sun Ultra 45 or Ultra 25 workstation.

The `prtconf` command identifies hardware that is recognized by the Solaris OS. If hardware is not suspected of being bad, yet software applications are having trouble with the hardware, the `prtconf` command can indicate if the Solaris software recognizes the hardware and if a driver for the hardware is loaded.

9.5.3.1　Options

TABLE 9-4 describes options for the prtconf command and how those options can help troubleshoot the Sun Ultra 45 or Ultra 25 workstation.

TABLE 9-4　Options for prtconf

Option	Description	How It Can Help
No option	Displays the device tree of devices recognized by the OS.	If a hardware device is recognized, then it is probably functioning properly. If the message "(driver not attached)" is displayed for the device or for a sub-device, then the driver for the device is corrupt or missing.
-D	Similar to the output of no option, however the device driver is listed.	Lists the driver needed or used by the OS to enable the device.
-p	Similar to the output of no option, yet is abbreviated.	Reports a brief list of the devices.
-V	Displays the version and date of the OpenBoot PROM firmware.	Provides a quick check of firmware version.

The following example shows output for the prtconf command.

```
# prtconf
System Configuration:  Sun Microsystems  sun4u
Memory size: 1024 Megabytes
System Peripherals (Software Nodes):

SUNW,Sun Ultra 45
    packages (driver not attached)
        SUNW,builtin-drivers (driver not attached)
        deblocker (driver not attached)
        disk-label (driver not attached)
        terminal-emulator (driver not attached)
        dropins (driver not attached)
        kbd-translator (driver not attached)
        obp-tftp (driver not attached)
        SUNW,i2c-ram-device (driver not attached)
        SUNW,fru-device (driver not attached)
        SUNW,asr (driver not attached)
        ufs-file-system (driver not attached)
    chosen (driver not attached)
    openprom (driver not attached)
        client-services (driver not attached)
    options, instance #0
    aliases (driver not attached)
. . .
```

9.5.4 netstat Command

The netstat command displays the network status.

9.5.4.1 Options

TABLE 9-5 describes options for the netstat command and how those options can help troubleshoot the Sun Ultra 45 or Ultra 25 workstation.

TABLE 9-5   Options for netstat

Option	Description	How It Can Help
-i	Displays the interface state, including packets in/out, error in/out, collisions, and queue.	Provides a quick overview of the system's network status.
-i *interval*	Providing a trailing number with the -i option repeats the netstat command every interval seconds.	Identifies intermittent or long-duration network events. By piping netstat output to a file, overnight activity can be viewed all at once.
-p	Displays the media table.	Provides Media Access Controller (MAC) address for hosts on the subnet.
-r	Displays the routing table.	Provides routing information.
-n	Replaces host names with IP addresses.	Used when an address is more useful than a host name.

The following example shows output for the netstat -p command.

```
# netstat -p

Net to Media Table: IPv4
Device   IP Address                   Mask         Flags   Phys Addr
------- -------------------- --------------- ----- ---------------
bge0    phatair-46               255.255.255.255         08:00:20:92:4a:47
bge0    ns-umpk27-02-46          255.255.255.255         08:00:20:93:fb:99
bge0    moreair-46               255.255.255.255         08:00:20:8a:e5:03
bge0    fermpk28a-46             255.255.255.255         00:00:0c:07:ac:2e
bge0    fermpk28as-46            255.255.255.255         00:50:e2:61:d8:00
bge0    kayakr                   255.255.255.255         08:00:20:d1:83:c7
bge0    matlock                  255.255.255.255 SP      00:03:ba:27:01:48
bge0    toronto2                 255.255.255.255         08:00:20:b6:15:b5
bge0    tocknett                 255.255.255.255         08:00:20:7c:f5:94
bge0    mpk28-lobby              255.255.255.255         08:00:20:a6:d5:c8
bge0    efyinisedeg              255.255.255.255         08:00:20:8d:6a:80
bge0    froggy                   255.255.255.255         08:00:20:73:70:44
bge0    d-mpk28-46-245           255.255.255.255         00:10:60:24:0e:00
bge0    224.0.0.0                240.0.0.0       SM      01:00:5e:00:00:00
```

9.5.5   ping Command

The ping command sends ICMP ECHO_REQUEST packets to network hosts.
Depending on how the ping command is configured, the output displayed can
identify troublesome network links or nodes. The destination host is specified in the
variable *hostname*.

9.5.5.1   Options

TABLE 9-6 describes options for the ping command and how those options can help
troubleshoot the Sun Ultra 45 or Ultra 25 workstation.

TABLE 9-6   Options for ping

Option	Description	How It Can Help
hostname	The probe packet is sent to *hostname* and returned.	Verifies that a host is active on the network.
-g *hostname*	Forces the probe packet to route through a specified gateway.	By identifying different routes to the target host, those individual routes can be tested for quality.

TABLE 9-6 Options for ping *(Continued)*

Option	Description	How It Can Help
-i *interface*	Designates which interface to send and receive the probe packet through.	Enables a simple check of secondary network interfaces.
-n	Replaces host names with IP addresses.	Used when an address is more beneficial than a host name.
-s	Pings continuously in one-second intervals. Ctrl-C aborts. Upon abort, statistics are displayed.	Helps identify intermittent or long-duration network events. By piping ping output to a file, activity overnight can later be viewed at once.
-svR	Displays the route the probe packet followed in one second intervals.	Indicates probe packet route and number of hops. Comparing multiple routes can identify bottlenecks.

The following example shows output for the ping -s command.

```
# ping -s teddybear
PING teddybear: 56 data bytes
64 bytes from teddybear (192.146.77.140): icmp_seq=0. time=1.
ms
64 bytes from teddybear (192.146.77.140): icmp_seq=1. time=0.
ms
64 bytes from teddybear (192.146.77.140): icmp_seq=2. time=0.
ms
^C
----teddybear PING Statistics----
3 packets transmitted, 3 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/0/1
```

9.5.6   ps Command

The ps command lists the status of system processes. Using options and rearranging the command output can assist in determining the Sun Ultra 45 or Ultra 25 workstation resource allocation.

9.5.6.1 Options

TABLE 9-7 describes options for the `ps` command and how those options can help troubleshoot the Sun Ultra 45 or Ultra 25 workstation.

TABLE 9-7 Options for `ps`

Option	Description	How It Can Help
-e	Displays information for every process.	Identifies the process ID and the executable.
-f	Generates a full listing.	Provides the following process information: user ID, parent process ID, system time when executed, and the path to the executable.
-o *option*	Enables configurable output. The pid, pcpu, pmem, and comm options display process ID, percent CPU consumption, percent memory consumption, and the responsible executable, respectively.	Provides only most important information. Knowing the percentage of resource consumption helps identify processes that are affecting system performance and might be hung.

The following example shows output for one `ps` command.

```
# ps -eo pcpu,pid,comm|sort -rn
 1.4 100317 /usr/openwin/bin/Xsun
 0.9 100460 dtwm
 0.1 100677 ps
 0.1 100600 ksh
 0.1 100591 /usr/dt/bin/dtterm
 0.1 100462 /usr/dt/bin/sdtperfmeter
 0.1 100333 mibiisa
%CPU    PID COMMAND
 0.0 100652 /bin/csh
 . . .
```

Note – When using `sort` with the `-r` option, the column headings are printed so that the value in the first column is equal to zero.

9.5.7 `prstat` Command

The `prstat` utility iteratively examines all active processes on the system and reports statistics based on the selected output mode and sort order. The `prstat` command provides output similar to the `ps` command.

9.5.7.1 Options

TABLE 9-8 describes options for the `prstat` command and how those options can help troubleshoot the Sun Ultra 45 or Ultra 25 workstation.

TABLE 9-8   Options for `prstat`

Option	Description	How It Can Help
No option	Displays a sorted list of the top processes that are consuming the most CPU resources. List is limited to the height of the terminal window and the total number of processes. Output is automatically updated every five seconds. Ctrl-C aborts.	Output identifies process ID, user ID, memory used, state, CPU consumption, and command name.
−n *number*	Limits output to number of lines.	Limits amount of data displayed and identifies primary resource consumers.
−s *key*	Permits sorting list by key parameter.	Useful keys are `cpu` (default), `time`, and `size`.
−v	Verbose mode.	Displays additional parameters.

The following example shows output for the `prstat` command.

```
# prstat -n 5 -s size
 PID     USERNAME    SIZE     RSS STATE   PRI  NICE TIME    CPU    PROCESS/NLWP
100524  mm39236      28M     21M sleep    48    0   0:00.26 0.3%   maker6X.exe/1
100317  root         28M     69M sleep    59    0   0:00.26 0.7%   Xsun/1
100460  mm39236      11M   8760K sleep    59    0   0:00.03 0.0%   dtwm/8
100453  mm39236    8664K   4928K sleep    48    0   0:00.00 0.0%   dtsession/4
100591  mm39236    7616K   5448K sleep    49    0   0:00.02 0.1%   dtterm/1
Total: 65 processes, 159 lwps, load averages: 0.03, 0.02, 0.04
```

NVRAM

The Sun Ultra 45 and Ultra 25 workstation motherboards use a nonvolatile random access memory module (NVRAM) that stores parameters used for configuring system startup (FIGURE 10-1). The NVRAM module uses a SEEPROM chip.

The workstation system configuration parameters are stored in NVRAM. These NVRAM parameters contain values that determine the startup configuration of your workstation. You can modify or reset the parameter values by using commands from the ok prompt, or the eeprom command from a terminal window, or by using key commands.
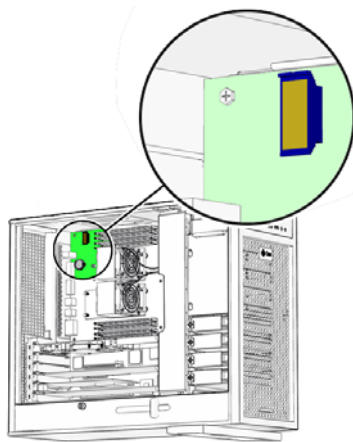
FIGURE 10-1 NVRAM on Motherboard

This chapter contains information about the following topics:

- Section 10.1, "Obtaining the ok Prompt" on page 10-2
- Section 10.2, "Changing NVRAM Configuration Parameter Values" on page 10-3
- Section 10.3, "Setting NVRAM Security Mode" on page 10-7
- Section 10.4, "eeprom Command" on page 10-9
- Section 10.5, "Key Commands" on page 10-9

10.1 Obtaining the `ok` Prompt

When a Sun Ultra 45 or Ultra 25 workstation is put into run level state 0, the `ok` prompt is displayed. At the `ok` prompt, you can make changes to the NVRAM and conduct OpenBoot PROM tests (POST and OpenBoot Diagnostics). TABLE 10-1 lists methods for obtaining the `ok` prompt, listed from most preferred to least desirable.

⚠ **Caution –** The Stop-A key sequence causes a system abort which loses the system state and might corrupt file systems. Method 1 is the preferred procedure.

TABLE 10-1 Methods for Obtaining the `ok` Prompt

Method	Situation	Procedure
1	Operating system is functioning normally. You have superuser access.	1. Save all data and close all active applications. 2. Become superuser of the system. 3. Type: # **init 0**
2	Operating system is functioning normally. You do not have superuser access.	1. Save all data and close all active applications. 2. Momentarily press and release the front panel Power button. 3. Select Shutdown from the Power Off window (if a GUI is displayed). In a few moments, the system powers off. 4. Momentarily press and release the front panel Power button to power the system back on. 5. When the Power LED flashes, press the Power button twice quickly.
3	System is off.	1. Momentarily press and release the front panel Power button to power the system back on. 2. When the Power LED flashes, press the Power button twice quickly.
4	Operating system is not functioning normally. You can log in as superuser remotely.	Type: # **init 0**
5	System has just been powered on.	When the Power LED flashes, press the Power button twice quickly.
6	No other alternatives are available.	Press the Stop and A keys simultaneously. The Stop-A key sequence causes a system abort that loses the system state and might corrupt file systems.

If you are obtaining the ok prompt to run OpenBoot PROM diagnostics, see "OpenBoot PROM" on page 12-1.

If you are obtaining the ok prompt to view or change NVRAM configurations, see "Changing NVRAM Configuration Parameter Values" on page 10-3.

10.2 Changing NVRAM Configuration Parameter Values

The NVRAM configuration parameter values set the startup behavior of the Sun Ultra 45 or Ultra 25 workstation. Changes made to the variables typically survive power cycling and if not configured properly, might have an adverse affect. Use discretion when changing or resetting NVRAM configuration parameter values.

10.2.1 Displaying and Changing Parameter Values

Use the commands listed in TABLE 10-2 to view and modify NVRAM configuration parameter values.

TABLE 10-2   NVRAM Parameter Configuration Commands

Command	Description
printenv *parameter*	Displays the current value for the *parameter.*
	If no parameter is provided, all parameters, their current value, and their default value are displayed.
setenv *parameter value*	Sets *parameter* to *value*. Values are typically textual or numeric. Changes made with the setenv command are permanent, but require a reset or power cycle to take affect.
set-default *parameter*	Resets the *parameter* to the default value.
set-defaults	Resets all parameters to their default values.
reset-all	Initiates a warm boot where most NVRAM configuration parameters are read by OpenBoot PROM. With power cycling or a cold boot, all NVRAM configuration parameters are read by the OpenBoot PROM.
password	Sets the security-password.

You can display your system's current and default parameter values by typing
printenv at the ok prompt. For example:

```
ok printenv
Variable Name            Value                          Default Value

asr-policy               normal                         normal
test-args
diag-passes              1                              1
local-mac-address?       true                           true
fcode-debug?             false                          false
scsi-initiator-id        7                              7
oem-logo                                                No default
oem-logo?                false                          false
oem-banner                                              No default
oem-banner?              false                          false
ansi-terminal?           true                           true
screen-#columns          80                             80
screen-#rows             34                             34
ttyb-rts-dtr-off         false                          false
ttyb-ignore-cd           true                           true
ttya-rts-dtr-off         false                          false
ttya-ignore-cd           true                           true
ttyb-mode                9600,8,n,1,-                   9600,8,n,1,-
ttya-mode                9600,8,n,1,-                   9600,8,n,1,-
output-device            screen                         screen
input-device             keyboard                       keyboard
auto-boot-on-error?      false                          false
error-reset-recovery     sync                           sync
load-base                16384                          16384
auto-boot?               true                           true
boot-command             boot                           boot
diag-file
diag-device              net                            net
boot-file
boot-device              disk net                       disk net
use-nvramrc?             false                          false
nvramrc
security-mode            none                           No default
security-password                                       No default
security-#badlogins      0                              No default
verbosity                min                            min
diag-trigger             none                           none
service-mode?            false                          false
diag-script              normal                         normal
diag-level               max                            max
diag-switch?             false                          false
```

To change a parameter value, use the setenv command. For example:

```
ok setenv diag-switch? true
```

This example enables diagnostics.

Note – Parameters that end with a question mark (?) can only be set true or false.

10.2.2 Configuration Parameter Default Values

Typing set-defaults resets all parameters to their default values. TABLE 10-3 lists the NVRAM configuration parameters, the default values, and a description.

TABLE 10-3 NVRAM Configuration Parameter Default Values

Parameter	Default Value	Description
asr-policy	normal	Reserved.
test-args		Arguments that configure OpenBoot Diagnostics.
diag-passes	1	Number of passes that diagnostics are to make before continuing to boot.
local-mac-address?	true	Value of true means to use the MAC address within the motherboard.
fcode-debug?	false	Value of false disables debugging of Fcode.
scsi-initiator-id	7	Identifying number of any SCSI host bus adapter.
oem-logo	no default	Bitmap of a custom OEM logo.
oem-logo?	false	Value of false disables use of a custom logo.
oem-banner	no default	Text of a custom OEM banner.
oem-banner?	false	Value of false disables use of a custom banner.
ansi-terminal?	true	Value of true enables the terminal emulator to interpret ANSI escape sequences.
screen-#columns	80	Number of character columns displayed on the console.
screen-#rows	34	Number of character rows displayed on the console.
ttyb-rts-dtr-off	false	Value of false disables hardware handshaking for ttyb
ttyb-ignore-cd	true	Value of true ignores carrier detect for ttyb.

TABLE 10-3 NVRAM Configuration Parameter Default Values *(Continued)*

Parameter	Default Value	Description
ttya-rts-dtr-off	false	Value of `false` disables hardware handshaking for `ttya`.
ttya-ignore-cd	true	Value of `true` ignores carrier detect for `ttya`.
ttyb-mode	9600,8,n,1,-	Communication parameters for `ttyb`: 9600 baud, 8 data bits, no parity, 1 stop bit, no handshaking.
ttya-mode	9600,8,n,1,-	Communication parameters for `ttya`: 9600 baud, 8 data bits, no parity, 1 stop bit, no handshaking
output-device	screen	Device alias of the console output display. `screen` is aliased to the first graphics accelerator found in probe order.
input-device	keyboard	Device alias of the console input device.
auto-boot-on-error?	false	Value of `false` disables autoboot upon error.
error-reset-recovery	sync	Command to be executed upon recovery from an error.
load-base	16384	Decimal address of the start of the client program.
auto-boot?	true	Value of `true` enables the system to boot the Solaris OS without intervention.
boot-command	boot	String that is aliased to the action of booting the system.
diag-file		Path and filename of the diagnostics file.
diag-device	net	Device alias of the hardware that has the diagnostics file.
boot-file		Path and filename of the boot file.
boot-device	disk net	Device alias of the hardware that has the boot file. Aliases may be separated by a space, and are checked in left to right order.
use-nvramrc?	false	Value of `false` disables use of the information in the `nvramrc` space.
nvramrc		Storage space for special conditions and variables used for booting the system.
security-mode	No default	Firmware security level.
security-password	No default	Firmware security password.
security-#badlogins	No default	Number of failed security password attempts.
verbosity	min	Value of `min` provides almost no output during diagnostics.
diag-trigger	none	Reserved.
service-mode?	false	Reserved.
diag-script	none	Name of the diagnostics script.

TABLE 10-3   NVRAM Configuration Parameter Default Values *(Continued)*

Parameter	Default Value	Description
diag-level	max	Value of max enables enhanced diagnostics.
diag-switch?	false	Value of false disables diagnostics under the OpenBoot PROM.
network-boot-arguments	none	Arguments used by the PROM for booting the network.

More information about the NVRAM configuration parameters is available from the eeprom man page.

10.3   Setting NVRAM Security Mode

You can restrict the set of operations that users can perform. When the security-mode parameter is set to either full or command, only users with the security-password may bypass the enforcement policy. TABLE 10-4 lists the different security modes and their conditions.

TABLE 10-4   security-mode Values and Their Enforcement Policy

Value	Enforcement Policy
full	All commands except go require the security-password.
command	All commands except boot (without arguments) and go require the security-password.
none	All commands are available, no password is required.

⚠ **Caution** – You must set the security password before setting the security mode. Forgetting the password or configuring security mode before the password requires a call to customer support to make the system bootable.

To configure security mode:

1. **Obtain the ok prompt.**

   See "Obtaining the ok Prompt" on page 10-2.

2. **Set the security password with one of the following methods:**

- Type:

```
ok password
New password (8 characters max)
Retype new password:
ok
```

- Or, type:

```
ok setenv security-password password
security-password =
ok
```

This is the only instance in which the security password is ever displayed.

3. **Set the security mode to `full` or `command`:**

```
ok setenv security-mode full
security-mode =      full
ok
```

4. **Enable the security mode:**

```
ok reset-all
```

Upon reset, the `ok` prompt appears as a > symbol and the password is required. For example:

```
> printenv
Firmware Password:
```

After supplying the correct password, the command is run. If an incorrect password is supplied, the user is required to wait for 10 seconds until authorization can be re-attempted. For example:

```
> printenv
Firmware Password:
Sorry.  Waiting 10 seconds.

>
```

10.4 `eeprom` Command

It is possible to display and change NVRAM configuration parameters from the Solaris OS by using the `eeprom` command. The `eeprom` command is executed by superuser in the form of:

```
# eeprom parameter=value
```

If no parameter is specified, the `eeprom` command displays only the current NVRAM configuration parameter values, similar to the `printenv` command. For example:

```
# eeprom
asr-policy=normal
test-args: data not available.
diag-passes=1.
.
.
.
diag-script=normal
diag-level=max
diag-switch?=false
```

To enable diagnostics, use the `eeprom` command in this example:

```
# eeprom diag-switch?=true
```

The `eeprom` command requires a system reboot for the changes to take effect. For more information, refer to the `eeprom` man page.

10.5 Key Commands

This section describes how to use your USB keyboard to abort or reset NVRAM by using the Stop-A or Stop-N equivalent commands:

- "Stop-A Key Sequence" on page 10-10
- "Stop-N Equivalent Key Sequence Procedure" on page 10-10

Before powering on the workstation, ensure that the keyboard and mouse are connected to the rear panel USB ports.

Note – The Stop-A and Stop-N key sequences are sometimes referred to as "OpenBoot Emergency Procedures."

10.5.1 Stop-A Key Sequence

⚠ **Caution –** Using the Stop-A key sequence while the Solaris OS is running causes a system halt. The system state is lost, file systems are not synchronized, and data might be lost or corrupted.

Use the Stop-A key sequence to abort an OpenBoot process. To issue the Stop-A key sequence for the Sun Ultra 45 or Ultra 25 workstation, press both the Stop and A keys (Stop-A) immediately after powering on the workstation. Hold both keys down until the workstation beeps.

Note – Using Stop-A does not enable the workstation to perform a core dump. The information from a core dump could be useful if the Solaris Operating System has crashed.

10.5.2 Stop-N Equivalent Key Sequence Procedure

For older Sun systems, issuing the Stop-N key sequence upon startup resets workstation configuration variables. The Sun Ultra 45 and Ultra 25 workstations use a Sun Type-7 USB keyboard. It is not possible to issue a Stop-N key sequence with a USB keyboard. By the time the USB keyboard driver is loaded, the interval to use the Stop-N key sequence has expired. Instead, use the following procedure to reset your workstation configuration variables. This procedure puts the Sun Ultra 45 or Ultra 25 workstation into a Safe NVRAM mode.

10.5.2.1 Resetting the NVRAM Temporarily

1. **Power on the workstation and wait until the front panel Power button LED begins to flash.**

2. **Quickly press the front panel Power button twice (similar to the way you would double-click a mouse).**

Note – Once the Power button LED stops flashing and stays lit, pressing the Power button again powers off the system.

A screen similar to the following is displayed to indicate that you have successfully reset NVRAM contents to the default values and the system is in Safe NVRAM mode. If a screen similar to the following screen is not displayed, allow the system to boot, shut down the system, and repeat Steps 1 and 2.

```
Sun Ultra 45, Keyboard Present
OpenBoot 4.21.x, 1024 MB memory installed, Serial #53463596.
Ethernet address 0:3:ba:2f:ca:2c, Host ID: 832fca2c.

Safe NVRAM mode, the following nvram configuration variables have
been overridden:
  'diag-switch?' is true
  'use-nvramrc?' is false
  'input-device', 'output-device' are defaulted
  'ttya-mode', 'ttyb-mode' are defaulted

These changes are temporary and the original values will be
restored
after the next hardware or software reset.

ok
```

While the workstation is in the Safe NVRAM mode, some of the NVRAM configuration parameters are reset to their default values. The reset parameters include those parameters that are more likely to cause problems, such as TTYA settings. However, these default NVRAM settings are reset only for one power cycle and are not permanent. If you change configuration parameters while in Safe NVRAM mode, those changes are permanent and do survive a reset.

TABLE 10-5 lists the configuration parameters that are reset to default values, and describes those values.

TABLE 10-5   Stop-N Equivalent Configuration Parameters

Parameter	Stop-N Equivalent Value	Description
diag-switch?	true	Workstation runs in diagnostic mode.
use-nvramrc?	false	Do not use the contents of nvramrc.
input-device	keyboard	Console input device.

TABLE 10-5   Stop-N Equivalent Configuration Parameters *(Continued)*

Parameter	Stop-N Equivalent Value	Description
output-device	screen	Console output device.
ttya-mode	9600,8,n,1,-	TTYA port default settings. See "Setting Up for POST" on page 11-16.
ttyb-mode	9600,8,n,1,-	TTYB port default settings. See "Setting Up for POST" on page 11-16.

10.5.2.2   Resetting the NVRAM Permanently

When the ok prompt is displayed, typing set-defaults discards any customized NVRAM values and permanently restores the default values for all NVRAM configuration parameters. See TABLE 10-3 for NVRAM configuration parameter default values.

10.5.2.3   Workstation Power Cycling

Use one of the following two methods to perform a workstation power cycle by shutting down and immediately restarting the workstation:

- System reboot. A system reboot shuts down any running applications and the operating system, then restarts the operating system. A system reboot does not take to the workstation to a standby power state.

- Shutdown and power on. Powering off the workstation shuts down any running applications and the operating system, and takes the workstation to a standby (power-off) state. To restart the workstation, you must manually press the Power button, which initiates the boot process.

Power-On Self-Test

This chapter describes the Sun Ultra 45 and Ultra 25 workstation power-on self-test (POST). Topics covered are:

11.1 POST Overview

Power-on self-test (POST) performs tests on workstation core components such as CPU and memory. POST checks low-level interaction between the CPU, caches, memory, JBus, and the I/O bridge chip.

Typing the post command from the ok prompt initiates tests that check the CPU, I/O bridge chip, and memory modules. The output of the post command is directed to the serial port of the system under test. An external display device and a Tip connection are required to view this output. Tip connections are described in "Configuring an External Display Device" on page 11-17.

11.1.1 Configuring POST Output

The post command uses two variables to determine its output. The command syntax is:

```
ok post level verbosity
```

where:

- *level* is min or max
- *verbosity* is min, normal, or max

TABLE 11-1 describes the diagnostic levels.

TABLE 11-1 POST Diagnostic Levels

POST Diagnostic Level	Output
min	Testing of CPU, cache, some memory, and I/O bridge chip.
max	Same tests as min, with additional extensive memory testing.

TABLE 11-2 describes the output verbosity.

TABLE 11-2 POST Output Verbosity

POST Output Verbosity	Output
min	Only Executing Power On Self Test is displayed. (The system executes the test but there is no other output on the display for several minutes.)
normal	POST banner and major test groups are indicated.
max	Each step of POST is identified.

11.2 post Command

The post command enables you to override NVRAM settings and execute POST on demand with different diagnostic levels and output verbosity. For example:

```
ok post level verbosity
```

where:

- *level* is min or max
- *verbosity* is min, normal, or max

If no diagnostic level or output verbosity is provided, the post command uses the NVRAM settings for diag-level and verbosity. See "Changing NVRAM Configuration Parameter Values" on page 10-3 for more information about these parameters.

11.2.1 Diagnostic Levels

You can set the following diagnostic levels with POST.

- `post min normal`
- `post min min`
- `post min max`
- `post max normal`
- `post max min`
- `post max max`

TABLE 11-3 summarizes the tests performed at `min` and `max` diagnostic levels.

TABLE 11-3 Tests Performed at `min` and `max` Diagnostic Levels

`min` **Level**	`max` **Level**
• Initializes critical CPU resources • CPU tests • I^{2}C devices read • CPU memory • CPU DIMMs interconnect checks • Internal cache tests • CPU memory scrub • I/O bridge chip tests	Same as `min` level, but with extended memory tests.

11.2.2 Output Verbosity

TABLE 11-4 describes the output seen when output verbosity is set to `min`, `normal`, and `max`.

TABLE 11-4 Output Seen at `min`, `normal`, and `max` Output Verbosity

`min` **Verbosity**	`normal` **Verbosity**	`max` **Verbosity**
Only the following text is displayed: `Executing Power On Self Test`	• POST banner is displayed. • Major test groups are indicated.	Each step of POST is identified.

Samples of POST output at different diagnostic levels and output verbosities are provided in "POST Output" on page 11-4.

11.3 POST Output

The contents of the POST output depends on the values of the diagnostic level and output verbosity. For the examples in this section, the Sun Ultra 45 or Ultra 25 workstation was configured with a single CPU and two 1-GByte DIMMs in slots 0 and 1.

Note – The `0>` that precedes the output text is the CPU identifier and indicates that the output is from POST. The `1>` indicates CPU 1. If you do not see these characters, the output is from the OpenBoot PROM.

11.3.1 `post min normal`

The following is the output of POST with `min` diagnostic level and `normal` output verbosity. The duration of POST was 90 seconds. The left column of the table is the output. The right column describes what is happening. If the POST output from your system does not match the output in the left column, use the information in the right column to help diagnose the problem.

TABLE 11-5 `post min normal` Output Comparison

Output Displayed	What Is Happening
ok **post min normal**	User initiates POST from the OpenBoot PROM `ok` prompt.
reset reason: 0000.0000.0000.0001 Fire TLU-A OE Error status: 0003.0100.0000.0100 @(#)OBP 4.21.x 2005/09/28 16:12 Sun Ultra 45 or Ultra 25 workstation Clearing TLBs Executing Power On Self Test Q0>	OpenBoot PROM prepares to run POST.
0>@(#) Sun Ultra 45 POST 4.21.x 2005/10/13 16:57	POST build version and date is displayed.
/dat/fw/common-source/firmware_re/post/post-build-4.21.x/Ultra/Ultra45/integrated (firmware_re)	POST build path is displayed.

TABLE 11-5 `post min normal` Output Comparison *(Continued)*

Output Displayed	What Is Happening

`0>Copyright © 2005 Sun Microsystems, Inc. All rights`
`reserved`
`  SUN PROPRIETARY/CONFIDENTIAL.`
`  Use is subject to license terms.`
	Copyright and license are displayed.

`0>OBP->POST Call with %o0=00000800.01012000.`
`0>Diag level set to MIN.`
`0>Verbosity level set to NORMAL.`
	CPU0 is acknowledged and POST configuration is identified.

`0>Start Selftest.....`	Testing is started.
`0>CPUs present in system: 0` `0>Test CPU(s)....Done`	CPU is identified and tested.
`0>Interrupt Crosscall....Done`	Interrupt handlers are set up and checked.
`0>Init Memory....Done` `0>Test Memory....Done`	Memory is initialized, phase-locked loops (PLL) are reset, and memory is re-initialized and tested.
`0>IO-Bridge Tests....Done`	I/O bridge is tested.

`0>INFO:`
`0>      POST Passed all devices.`
`0>`
`0>POST: Return to OBP.`
	POST has passed successfully and returns control to the OpenBoot PROM.

11.3.2 `post max max`

The following section contains the output of POST with `max` diagnostic level and `max` output verbosity. The duration of POST was four minutes, 30 seconds. The left column is the output. The right column describes what is happening. If the POST output from your system does not match the output in the left column, use the information in the right column to help diagnose the problem.

Error messages are reported when they are found. Examples of POST messages are shown in "Analyzing POST Messages" on page 11-14.

TABLE 11-6 `post max max` Output Comparison

Output Displayed	What Is Happening
`ok `**`post max max`**	User initiates POST from OpenBoot PROM `ok` prompt.

TABLE 11-6 `post max max` Output Comparison *(Continued)*

Output Displayed	What Is Happening

`reset reason: 0000.0000.0000.0001`
`Fire TLU-A OE Error status: 0003.0100.0000.0100`
`@(#)OBP 4.21.x 2005/09/28 16:12 Sun Ultra 45`
`Clearing TLBs`
`Executing Power On Self Test`
`Q0>`
	OpenBoot PROM prepares to run POST.

`0>@(#) Sun Ultra 45 POST 4.21.x 2005/11/05 19:58`	POST build version and date is displayed.
`/dat/fw/common-source/firmware_re/post/post-build-` `4.21.0/Ultra/Ultra45/integrated  (firmware_re)`	POST build path is displayed.

`0>Copyright © 2005 Sun Microsystems, Inc. All rights`
`reserved`
`  SUN PROPRIETARY/CONFIDENTIAL.`
`  Use is subject to license terms.`
	Copyright and license are displayed.

`0>Soft Power-on RST thru SW`
`0>OBP->POST Call with %o0=00001000.01014000.`
`0>Diag level set to MAX.`
`0>Verbosity level set to MAX.`
`0>MFG scrpt mode set NORM`
`0>I/O port set to TTYA.`
	CPU0 is acknowledged and POST configuration is read from register.

`0>Start Selftest.....`
`0>CPUs present in system: 0`
`0>Test CPU(s).....`
`0>Initialize I2C Controller`
`0>Init CPU`
`0>DMMU`
`0>DMMU TLB DATA RAM Access`
`0>DMMU TLB TAGS Access`
`0>IMMU Registers Access`
`0>IMMU TLB DATA RAM Access`
`0>IMMU TLB TAGS Access`
`0>Init mmu regs`
	CPU, I^2C controller, data memory management unit (DMMU), and instruction memory management unit (IMMU) are initialized.

`0>Setup L2 Cache`
`0>L2 Cache Control = 00000000.00f04400`
`0>      Size = 00000000.00100000...`
`0>L2 Cache Tags Test`
`0>Scrub and Setup L2 Cache`
	L2 cache is set up and scrubbed (data values set to defaults).

`0>Setup and Enable DMMU` `0>Setup DMMU Miss Handler`	DMMU is set up.
`0>Test  Mailbox` `0>Scrub Mailbox`	Mailbox region is checked and initialized in L2 cache.

TABLE 11-6 `post max max` Output Comparison *(Continued)*

Output Displayed	What Is Happening
`0>CPU Tick and Tick Compare Registers Test`	Operation of TICK registers is verified.
`0>CPU Stick and Stick Compare Registers Test`	Operation of STICK registers is verified.
`0>Set Timing`	Motherboard timing is to be configured.
`0> UltraSPARC[TM] IIIi, Version 3.4`	CPU version is identified.
`0>Interrupt Crosscall.....` `0>Setup Int Handlers`	Interrupt handlers are set up.
`0>MB:   Part-Dash-Rev#:  3753279-02-0C  Serial#:` `000225`	Motherboard part number and serial number is read from FRU ID.

`0>CPU0 DIMM 0:`
`0>Part#: 18VDDF12872Y-335D3 Serial#:  71fe1ec9 Date`
`Code:  0506  Rev#:  0300`
`0>CPU0 DIMM 1:`
`0>Part#: 18VDDF12872Y-335D3 Serial#:  71fe1e32 Date`
`Code:  0506  Rev#:  0300`
	DIMM part numbers, serial numbers, date codes, and revisions are read from the DIMM's internal firmware.

`0>Set CPU/System Speed`
`0>MCR Timing index = 00000000.00000007`
`0>..`
	Jumpers for CPU and JBus frequency are read.

`0>Init Memory.....`	Memory is initialized.
`0>Probe Dimms`	Presence of DIMMs is checked.
`0>Init Mem Controller Regs`	Memory controller registers are initialized.
`0>Set JBUS config reg`	JBus configuration register is set.
`0>IO-Bridge unit 1 init test` `0>Clear TLU loopback for PCI-E`	I/O bridge chip is initialized.

`0>Do PLL reset`
`0>Setting timing to 8:1 12:1, system frequency 200`
`MHz, CPU frequency 1600 MHz`
	Phase-locked loop (PLL) is reset for the selected frequencies.

`ø0>Soft Power-on RST thru SW`	Soft reset.

TABLE 11-6 `post max max` Output Comparison *(Continued)*

Output Displayed	What Is Happening
0>PLL Reset..... 0>Initialize I2C Controller 0>Init CPU 0>Init mmu regs 0>Setup L2 Cache 0>L2 Cache Control = 00000000.00f04400 0> Size = 00000000.00100000... 0>Setup and Enable DMMU 0>Setup DMMU Miss Handler 0>Scrub Mailbox	Initializations and setups are repeated.
0>Timing is 8:1 12:1, sys 200 MHz, CPU 1600 MHz, mem 133 MHz.	New timing ratios and frequencies are displayed.
0> UltraSPARC[TM] IIIi, Version 3.4 0>Init Memory..... 0>Probe Dimms 0>Init Mem Controller Sequence 0>Clear TLU loopback for PCI-E	Repeated initialization continues.
0>Test Memory..... 0>Select Bank Config 0>Probe and Setup Memory 0>INFO: 2048MB Bank 0, Dimm Type X4 0>INFO: No memory detected in Bank 1 0>INFO: No memory detected in Bank 2 0>INFO: No memory detected in Bank 3 0> 0>Test Memory..... 0>Select Bank Config 0>Probe and Setup Memory 0>INFO: 2048MB Bank 0, Dimm Type X4 0>INFO: No memory detected in Bank 1 0>INFO: No memory detected in Bank 2 0>INFO: No memory detected in Bank 3 0>	Memory is probed.
0>Data Bitwalk on Master	CPU data pins are tested.
0> Test Bank 0.	Where found, memory is tested.
0>Address Bitwalk on Master 0>Addr walk mem test on CPU 0 Bank 0: 00000000.00000000 to 00000000.80000000.	CPU address pins are tested.
0>Set Mailbox	Mailbox region is set in memory.
0>Final mc1 is 1000000a.1e581c61	Memory control register1 is set.

TABLE 11-6 `post max max` Output Comparison *(Continued)*

Output Displayed	What Is Happening
`0>Setup Final DMMU Entries`	Memory is allocated for POST.
`0>Post Image Region Scrub`	Allocated memory is scrubbed clean.
`0>Run POST from Memory`	POST is transferred from ROM to RAM memory. POST is executed from memory from this point forward.

`0>Verifying checksum on copied image.`
`0>The Memory's CHECKSUM value is f482.`
`0>The Memory's Content Size value is 8c57a.`
`0>Success...  Checksum on Memory Validated.`
	Copied data is verified.

`0>Test CPU Caches.....`	CPU internal caches are tested.

`0>I-Cache RAM Test`
`0>I-Cache Tag RAM`
`0>I-Cache Valid/Predict TAGS Test`
`0>I-Cache Snoop Tag Field`
`0>I-Cache Branch Predict Array Test`
	Instruction cache is tested.

`0>Branch Prediction Initialization`
`0>D-Cache RAM`
`0>D-Cache Tags`
`0>D-Cache Micro Tags`
`0>D-Cache SnoopTags Test`
`0>W-Cache RAM`
`0>W-Cache Tags`
`0>W-Cache Valid bit Test`
`0>W-Cache Bank valid bit Test`
`0>W-Cache SnoopTAGS Test`
	Data and write caches are tested.

`0>P-Cache RAM`
`0>P-Cache Tags`
`0>P-Cache SnoopTags Test`
`0>P-Cache Status Data Test`
	Prefetch cache is tested.

`0>8k DMMU TLB 0 Data`
`0>8k DMMU TLB 1 Data`
`0>8k DMMU TLB 0 Tags`
`0>8k DMMU TLB 1 Tags`
`0>8k IMMU TLB Data`
`0>8k IMMU TLB Tags`
	Translation look-aside buffers (TLB) are tested for data and instruction buffers.

`0>FPU Registers and Data Path` `0>FPU Move Registers`	Floating point unit (FPU) is checked.
`0>FSR Read/Write`	FPU status register is checked.

TABLE 11-6 `post max max` Output Comparison *(Continued)*

Output Displayed	What Is Happening
0>FPU Block Register Test 0>FPU Branch Instructions 0>FPU Functional Test	Additional FPU testing is performed.
0>Scrub Memory	Memory is set to zero.
0>Flush Caches	Caches are set to zero.
0>Functional CPU Tests..... 0>L2-Cache Functional 0>L2-Cache Stress 0>IMMU Functional 0>DMMU Functional 0>I-Cache Functional 0>I-Cache Parity Functional 0>I-Cache Parity Tag 0>I-Cache Snoop Parity Tag 0>D-Cache Functional 0>D-Cache Parity Functional 0>D-Cache Parity Tag Test 0>W-Cache Functional 0>Graphics Functional 0>CPU Superscalar Dispatch 0>SPARC Atomic Instruction Test 0>Non SPARC Atomic Instruction Test 0>SOFTINT Register and Interrupt Test 0>Branch Memory Test 0>Fast ECC test 0>System ECC test	CPU functional checks are executed.
0>XBus SRAM	On-board SRAM is checked.
0>IO-Bridge Quick Read 0>	

TABLE 11-6 `post max max` Output Comparison *(Continued)*

Output Displayed	What Is Happening
```0>--- ------------ 0>--------- IO-Bridge Quick Read Only of CSR and ID - --------- 0>--- ------------ 0>fire 1 JBUSID 00000400.0f000000 = 0> fc000002.f03dda23 0>--- ------------ 0>fire 1 JBUSCSR 00000400.0f410000 = 0> 00000ff5.13cb6000 0>--- ------------```	
```0>IO-Bridge unit 1 jbus perf test 0>IO-Bridge unit 1 int init test 0>IO-Bridge unit 1 msi init test 0>IO-Bridge unit 1 ilu init test 0>IO-Bridge unit 1 tlu init test 0>IO-Bridge unit 1 lpu init test 0>IO-Bridge unit 1 link train port A 0>IO-Bridge unit 1 link train port B 0>IO-Bridge unit 1 interrupt test```	I/O bridge is checked and PCI-E links are trained.
```0>IO-Bridge unit 1 Config MB bridges 0>Config port A, bus 2 dev 0 func 0, tag IOBD/PCI- SWITCH 0>Config port A, bus 3 dev 1 func 0, tag IOBD/PCIE-IO 0>Config port A, bus 4 dev 0 func 0, tag IOBD/PCIE- IO-DEVICES 0>Config port A, bus 3 dev 2 func 0, tag IOBD/GBE 0>Config port A, bus 3 dev 3 func 0, tag IOBD/PCIE2 0>Config port A, bus 3 dev 8 func 0, tag IOBD/PCIE1 0>Config port A, bus 3 dev 9 func 0, tag IOBD/PCI- BRIDGE 0>Config port A, bus 9 dev 0 func 0, tag IOBD/PCI- BRIDGE PORT0-SAS 0>Config port A, bus 9 dev 0 func 2, tag IOBD/PCI- BRIDGE PORT1-slot0 0>```	On-board PCI bridges and switches are configured.

TABLE 11-6 `post max max` Output Comparison *(Continued)*

Output Displayed	What Is Happening

`0>IO-Bridge unit 1 PCI id test`
`0>    INFO:10 count read passed for IOBD/PCI-SWITCH!`
`Last read VID:10b5|DID:8532`
`0>     INFO:10 count read passed for IOBD/PCIE-IO!`
`Last read VID:10b9|DID:5249`
`0>    INFO:10 count read passed for IOBD/GBE! Last`
`read VID:1166|DID:103`
`0>    INFO:10 count read passed for IOBD/PCI-BRIDGE!`
`Last read VID:8086|DID:341`
`0>     INFO:10 count read passed for IOBD/SASHBA!`
`Last read VID:1000|DID:50`
	The PCI IDs of the on-board devices are checked.

`0>Print Mem Config`	Memory configuration is to be displayed.
`0>Caches : Icache is ON, Dcache is ON, Wcache is ON,` `Pcache is ON.`	Cache status is displayed.

`0>Memory interleave set to 0`
`0> Bank 0 2048MB : 00000000.00000000 ->`
`00000000.7fffffff.`
	The amount of memory installed is displayed.

`0>Block Memory`	Memory is checked by block memory tests.

`0>Test 2141192192 bytes on bank 0....`
`0>0% Done...`
`0>2% Done...`
`...`
`0>98% Done...`
`0>99% Done...`
	Memory is checked in bank0.

`0>INFO:`
`0>     POST Passed all devices.`
`0>`
`0>POST: Return to OBP.`
	POST has passed successfully and returns control to the OpenBoot PROM.

Error messages are reported when they are found. Examples of POST messages are shown in "Analyzing POST Messages" on page 11-14.

11.3.3 `post min min`

The following is the output of POST with `min` diagnostic level and `min` output verbosity. The duration of POST was 90 seconds.

```
ok post min min

Executing Power On Self Test

Configuring system memory & CPU(s)

Probing system devices
Probing memory
Probing I/O buses

Sun Ultra 45, Keyboard present
Copyright 1998-2005 Sun Microsystems, Inc.  All rights reserved.
OpenBoot 4.21.x, 1024 MB memory installed, Serial #53463596.
Ethernet address 0:3:ba:2f:ca:2c, Host ID: 832fca2c.
```

POST conducted the tests. No output was provided. Error messages are reported when they are found. Examples of POST messages are shown in "Analyzing POST Messages" on page 11-14.

11.3.4 `post max min`

The following is the output of POST with `max` diagnostic level and `min` output verbosity. The duration of POST was 120 seconds.

```
ok post max min

Executing Power On Self Test
```

No output other than error messages is displayed. Examples of POST messages are shown in "Analyzing POST Messages" on page 11-14.

11.4   Analyzing POST Messages

POST has three categories of messages:

- "Error Messages" on page 11-14
- "Warning Messages" on page 11-15
- "Info Messages" on page 11-16

11.4.1   Error Messages

When an error occurs during POST, an error message is displayed. The error message is bounded by the text ERROR and END_ERROR. Several error messages might be displayed at different times during the POST process for any single error condition.

The following error examples were caused by a defective 1-GByte DIMM in the slot labeled DIMM0. The first error message occurred when the DIMMs were probed:

```
0>ERROR: TEST = Probe and Setup Memory
0>H/W under test = CPU0 Memory
0>Repair Instructions: Replace items in order listed by 'H/W under
test' above
0>MSG = ERROR:   miscompare on mem test!
                 Address: 00000000.00000000
                 Expected: a5a5a5a5.a5a5a5a5
                 Observed: a5a6a5a5.a5a5a5a5
0>END_ERROR
```

At address 00000000.00000000, there was a test pattern mismatch. A string of a5a6a5a5 was observed when a string of a5a5a5a5 was expected.

The second error message identified where the fault was located:

```
0>ERROR: TEST = Probe and Setup Memory
0>H/W under test = CPU0: Bank 0  DIMM0, Motherboard
0>Repair Instructions: Replace items in order listed by 'H/W under
test' above
0>MSG = Pin 72 failed on CPU0: Bank 0  DIMM0, Motherboard
0>END_ERROR
```

The DIMM in slot DIMM0 was at fault. Several other error messages were displayed, and a summary was provided:

```
0>ERROR:
0>      POST top level status has the following failures:
0>              CPU0: Bank 0  DIMM0, Motherboard
0>              CPU0: Bank 1  DIMM0, Motherboard
0>END_ERROR
```

The DIMM in slot DIMM0 should be replaced. Because memory works in pairs, POST disables both slots DIMM0 and DIMM1. POST returns system status and control back to the OpenBoot PROM which then displays messages regarding the results of POST.

For example:

```
Power On Selftest Failed.
   CPU: 0 cause: CPU0: Bank 0  DIMM0, Motherboard
ERROR: CPU0 has 2048/4096MB of memory disabled

ERROR: POST failed
```

Because of the error, two DIMM slots have been disabled (bank0), so only half of the original memory (2048/4096MBytes) is available for use.

Note – If only two DIMMs were installed and this set of errors occurred, the system would have beeped three times and powered off.

11.4.2   Warning Messages

Warning messages have a structure similar to error messages, however the messages are bounded by the text WARNING and END_WARNING. Warning messages do not contain a Repair Instructions line.

The following warning message example indicates that there is a DIMM size mismatch in slots DIMM0 and DIMM1:

```
0>WARNING: TEST = Probe and Setup Memory
0>H/W under test = CPU0 Memory
0>MSG = DIMM size does not match for Dimm set 0, Dimm0=
00000000.40000000, Dimm1=00000000.20000000
0>END_WARNING
```

DIMM0 is a 1-GByte DIMM and DIMM1 is a 512-MByte DIMM.

11.4.3 Info Messages

Info messages are simple and are only preceded by the text, INFO. Info messages provide noncritical facts, as seen in this example:

```
0>Probe and Setup Memory
0>INFO: 1024MB Bank 0, Dimm Type X4
0>INFO: 1024MB Bank 1, Dimm Type X4
0>INFO: 1024MB Bank 2, Dimm Type X4
0>INFO: 1024MB Bank 3, Dimm Type X4
```

These info messages indicate that a 1-GByte DIMM is installed into each DIMM connector.

11.5 Setting Up for POST

To execute POST and view its output, you must perform the procedures in the following sections.

11.5.1 Verifying the Baud Rate

Ensure that the communication parameters are correct. Use one of the following procedures:

11.5.1.1 OpenBoot PROM Level Procedure

● **From the** ok **prompt of the system to run POST, type:**

```
ok setenv ttya-mode=9600,8,n,1,-
```

11.5.1.2 Solaris OS Level Procedure

● **As superuser in a terminal window of the system to run POST, type:**

```
# eeprom ttya-mode=9600,8,n,1,-
```

11.5.2 Obtaining the ok Prompt

1. **Save all work in progress and close any open applications.**

2. **As superuser in a terminal window of the system to run POST, type:**

```
# init 0
```

11.5.3 Configuring an External Display Device

POST directs its output to serial port 1 (TTYA) of the system being tested. You can view this output by connecting a serial terminal or a second system running a Tip connection through a terminal window.

11.5.3.1 Configuring a Serial Terminal

You can view POST output through any VT-100 RS-232 compatible serial terminal. The terminal connects to the Sun Ultra 45 or Ultra 25 workstation at the TTYA port:
|O|O| TTY A

The serial ports are DB-9 F connectors. Use a straight-through cable and connect to the serial terminal's DCE port. Configure the serial terminal to the communication parameters listed in TABLE 11-7.

TABLE 11-7   Serial Terminal Communication Parameters

Parameter	Value
Baud	9600
Data bits	8
Parity	None
Stop bits	1
Handshaking	None
Duplex	Full

If a DCE port is not available, then use a crossover cable as illustrated in FIGURE 11-1.

11.5.3.2   Configuring a Second System

Instead of a serial terminal, you can use a second system running a Tip connection through a terminal window.

The second system must have a serial port capable of RS-232 communications. Use a crossover cable (null-modem cable) with the Tip connection.

FIGURE 11-1 shows the wiring for a crossover cable. If your system does not have a DB-9 F connector at the serial port, adapters are available from most computer supply stores or from your Sun Microsystems sales representative.

The following URL provides part numbers for adapters and other Sun cables. You must be a registered SunSolve user to access this URL.

```
http://sunsolve.sun.com/handbook_pub/Devices/Cables/cables_ext_d
ata.html
```
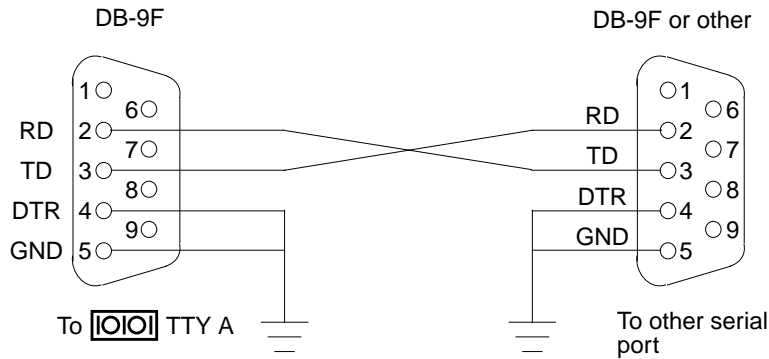
FIGURE 11-1 Crossover Cable Wiring Diagram

11.5.3.3 Making a Tip Connection

Making a Tip connection requires configuring the serial port of the second system and using the `tip` command. The following procedure configures for serial port 1, or ▣ TTY A.

1. **As superuser of the second system, edit the** `/etc/remote` **file.**

2. **Replace the** `hardwire` **property with the following:**

```
hardwire:\
        :dv=/dev/term/a:br#9600:el=^C^S^Q^U^D:ie=%$:oe=^D:
```

3. **Ensure that the communication parameters are correct. Type:**

```
# eeprom ttya-mode=9600,8,n,1,-
```

11.5.3.4 Managing Tip Connections

"Serial Ports" on page C-8 contains the following topics:

- Configuring for an alternate Break key sequence on the server.
- Filtering the Tip connection through a network terminal concentrator.
- Disabling the keyboard abort on the server.
- Disabling the Tip connection on the server.
- Permanently Disabling the Keyboard Abort or Configuring an Alternate Break Key Sequence on the Server

11.5.4 Running POST

1. **Attach the crossover cable to the system being tested and then to the serial terminal or second system.**

2. **Start the Tip connection. Type:**

```
# tip hardwire
```

3. **Press the Return key several times to synchronize the handshaking between the two systems.**

   You should see the ok prompt.

4. **Type the post command.**

   For example:

```
ok post min max
```

   POST is run. See "POST Output" on page 11-4 for examples of POST output.

Note – POST execution can be aborted by pressing the Ctrl-X keys of the serial terminal or second system. POST then returns control to the OpenBoot PROM.

11.6 Disabling Diagnostics and Auto Boot

Use one of the following procedures to ensure that the diagnostics are turned *off* and that the system *does not* auto boot.

11.6.0.1 OpenBoot PROM Level Procedure

● **From the ok prompt of the system to run POST, type:**

```
ok setenv diag-switch? false
ok setenv auto-boot? false
```

11.6.0.2   Solaris OS Level Procedure

● **As superuser in a terminal window of the system to run POST, type:**

```
# eeprom diag-switch?=false
# eeprom auto-boot?=false
```

OpenBoot PROM

This chapter discusses troubleshooting the Sun Ultra 45 or Ultra 25 workstation using the OpenBoot PROM firmware. Topics covered are:

- Section 12.1, "OpenBoot PROM Overview" on page 12-1
- Section 12.2, "OpenBoot PROM Utilities" on page 12-2
- Section 12.3, "OpenBoot Diagnostics" on page 12-6
- Section 12.4, "OpenBoot PROM Messages" on page 12-11

12.1 OpenBoot PROM Overview

OpenBoot PROM is the core software installed on the Sun Ultra 45 and Ultra 25 workstation motherboard. This software enables the Sun Ultra 45 and Ultra 25 workstation to load an operating system. The operating system can be loaded from an installed hard drive, the DVD-dual drive, the network, or from some external boot device. Because the OpenBoot PROM software resides within the NVRAM, it is called *firmware*.

The OpenBoot PROM plays a major role in starting the Sun Ultra 45 or Ultra 25 workstation (For details see: "Power-On Sequence" on page 7-6.) If an error occurs during that process, a message is usually displayed. You can use OpenBoot Diagnostics tools to help diagnose system problems.

The OpenBoot PROM also has a collection of in-depth testing programs, available from the `obdiag` prompt. These testing programs are described in "OpenBoot Diagnostics" on page 12-6.

12.2 OpenBoot PROM Utilities

In an idle state, OpenBoot PROM can provide information from basic utilities:

To use the OpenBoot PROM utilities you must first obtain the ok prompt. See "Obtaining the ok Prompt" on page 10-2.

12.2.1 show-devs Utility

The show-devs utility displays the devices installed in the Sun Ultra 45 or Ultra 25 workstation recognized by the OpenBoot PROM. For example:

```
ok show-devs
/i2c@1f,464000
/pci@1f,700000
/pci@1e,600000
/memory-controller@0,0
/SUNW,UltraSPARC-IIIi@0,0
. . .
/packages/kbd-translator
/packages/dropins
/packages/terminal-emulator
/packages/disk-label
/packages/deblocker
/packages/SUNW,builtin-drivers
```

If an installed device is missing from the list, check the slot or cable connections of the device.

12.2.2 `watch-net` Utility

The `watch-net` utility displays packet activity on the primary network connection. For example:

```
ok watch-net
100 Mbps FDX Link up
Looking for Ethernet Packets.
'.' is a Good Packet.  'X' is a Bad Packet.
Type any key to stop.
........
```

- If no periods (.) are displayed, no network activity is detected. Check the Ethernet cable.
- If an X is displayed, the network connection has too many collisions or packets are being corrupted or dropped. Check the overall network status.

12.2.3 `probe-scsi` Utility

The `probe-scsi` utility displays the manufacturer and model of devices attached to the SCSI bus. For example:

```
{1} ok probe-scsi
Target 0
  Unit 0   Disk HITACHI DK32EJ14NSUN146GPQ0B    286739329 Blocks, 140009 MB
```

If no information regarding an installed device is displayed, check the cable connections inside of the Sun Ultra 45 or Ultra 25 workstation chassis.

12.2.4   `probe-ide` Utility

The Sun Ultra 45 or Ultra 25 workstation DVD-dual drive is controlled by the IDE bus. The `probe-ide` utility displays the manufacturer and model of devices attached to the IDE buses. For example:

```
ok probe-ide
Device 0  ( Primary Master )
        Removable ATAPI Model: DV-W28SL

  Device 1  ( Primary Slave )
         Not Present

  Device 2  ( Secondary Master )
         Not Present

  Device 3  ( Secondary Slave )
         Not Present
```

If no information regarding an installed device is displayed, check the cable connections inside of the Sun Ultra 45 chassis.

12.2.5   `banner` Utility

The `banner` utility displays the banner seen during system startup. The banner includes:

- System model
- Firmware version
- Installed memory
- Serial number
- Ethernet address
- Host ID

For example:

```
ok banner
Sun Ultra 45, Keyboard present
Copyright 1998-2004 Sun Microsystems, Inc. All rights reserved.
OpenBoot 4.21.x, 1024 MB memory installed, Serial #53463596.
Ethernet address 0:3:ba:2f:ca:2c, Host ID: 832fca2c
```

If the banner displays information that is suspect, there might be a problem with the memory, NVRAM, or the motherboard flash PROM.

12.2.6   `watch-clock` Utility

The `watch-clock` utility displays a seconds counter updated in one-second intervals. For example:

```
ok watch-clock
Watching the 'seconds' register of the real time clock chip.
It should be 'ticking' once a second.
Type any key to stop.
14
```

If the seconds values do not change, or are longer or shorter than one second in duration, there is a problem with the real-time clock chip on the motherboard.

12.2.7   `date` Utility

The `date` utility displays the current date and time stored in the real-time clock. For example:

```
ok date
11/27/2005 21:32:20 GMT
```

If the real-time clock loses accuracy or the date or time is incorrect after a power cycle, replace the battery.

12.2.8   `.version` Utility

The `.version` utility displays the software version of:

- OpenBoot PROM
- OpenBoot Diagnostics
- POST

For example:

```
ok .version
Release 4.21.x created 2005/11/05 18:29
OBP 4.21.x 2005/11/05 18:29 Sun Ultra 45 or Ultra 25 workstation
OBDIAG 4.21.x 2005/11/05 18:31
POST 4.21.x 2005/11/05 19:58
```

12.3 OpenBoot Diagnostics

The OpenBoot PROM software has a suite of tests that can help you diagnose problems with the motherboard components and system interfaces to peripherals. The OpenBoot Diagnostics tests are generalized and function at a low level. The tests help you narrow down a problem to a specific component.

12.3.1 Starting OpenBoot Diagnostics

OpenBoot Diagnostics is started either from the console of the system under test or remotely through an external display device. To run OpenBoot Diagnostics remotely, see "Configuring an External Display Device" on page 11-17. An advantage of running OpenBoot Diagnostics through a Tip connection is that long output can be scrolled and saved.

1. **Obtain the** ok **prompt.**

   See "Obtaining the ok Prompt" on page 10-2.

2. **Set the** auto-boot? **property to** false**. Type:**

   ```
   ok setenv auto-boot? false
   ```

3. **Reset the system. Type:**

   ```
   ok reset-all
   ```

   The system restarts and the ok prompt is displayed again.

4. **Set the** diag-switch? **property to** true**. Type:**

   ```
   ok setenv diag-switch? true
   ```

5. **Start OpenBoot Diagnostics. Type:**

   ```
   ok obdiag
   ```

12.3.2   `obdiag` Menu

Once started, OpenBoot Diagnostics polls the system for device nodes. If the device has a self-test, the device function can be verified. Some cards may not support self-test. When the poll is finished, OpenBoot Diagnostics lists a menu of the tests that can be executed. For example:

```
 _____
|                             o b d i a g                             |
|_____ _____ _____|
|                      |                      |                      |
|                      |                      |                      |
| 1 SUNW,XVR-100@2     | 2 env-monitor@3,0    | 3 flashprom@0,0      |
| 4 serial@2,0         | 5 serial@2,80        |                      |
|_____|_____|_____|
| Commands: test test-all except help what setenv set-default exit   |
|_____|
|                                                                     |
| diag-passes=1 diag-level=max test-args=                             |
|_____|
```

The diagnostics displayed are dynamic. If a device node is not recognized, it is not listed in the menu. For example, if the Sun XVR-100 graphics accelerator were removed from the system, the Sun XVR-100 graphics accelerator test would not be available, and all remaining tests would shift location and be renumbered. For example:

```
 _____
|                             o b d i a g                             |
|_____ _____ _____|
|                      |                      |                      |
|                      |                      |                      |
| 1 env-monitor@3,0    | 2 flashprom@0,0      | 3 serial@2,0         |
| 4 serial@2,80        |                      |                      |
|_____|_____|_____|
| Commands: test test-all except help what setenv set-default exit   |
|_____|
|                                                                     |
| diag-passes=1 diag-level=max test-args=                             |
|_____|
```

12.3.2.1 Interpreting OpenBoot Diagnostics Tests

TABLE 12-1 lists some OpenBoot Diagnostics tests, the test purpose, and describes possible problems and resolutions. The test numbers in TABLE 12-1 match the test numbers in the first OpenBoot Diagnostics menu in "OpenBoot Diagnostics" on page 12-6.

TABLE 12-1 OpenBoot Diagnostics Test Usage

OpenBoot Diagnostics Test	Purpose	What Error Results Might Mean and What to Do
SUNW,XVR-100@2 (Test 1)	Tests the display and memory of the respective graphics accelerator.	Graphics accelerator is not properly seated into PCI slot or graphics memory is bad. Reseat the graphics accelerator in the PCI slot or replace it.
env-monitor (Test 2)	Tests environmental controller.	Problem with fan or other temperature controls. Check fan tray backplane connector.
flashprom@2,0 (Test 3)	Checks headers and checksums.	Problem with flash PROM on motherboard. Check the motherboard and replace if necessary.
serial@2,0 (Test 4)	Tests the secondary or primary serial port at different baud rates.	Problem with the device connected to the serial port or I/O subsystem chip. If no problem with the device, check the motherboard.

12.3.3 Configuring OpenBoot Diagnostics

OpenBoot Diagnostics is configurable. For the simplest testing, follow this procedure.

1. **At the** obdiag **prompt, set the diagnostic passes to 1. Type:**

```
obdiag> setenv diag-passes 1
```

2. **Set the diagnostic level to maximum. Type:**

```
obdiag> setenv diag-level max
```

3. **Set the diagnostics to be verbose and display subtest names during test execution. Type:**

```
obdiag> setenv test-args verbose,subtests
```

These settings are stored in the NVRAM test-args parameter and survive power cycling.

Note – The help command provides additional information for configuring OpenBoot Diagnostics.

```
obdiag> help
```

12.3.4   Initiating a Test

Select a test by typing test and the diagnostic's corresponding number listed in the menu and press Return. Using the previous examples, you would type:

```
obdiag> test 2
```

12.3.5   Test Output

When OpenBoot Diagnostics runs a test, output is displayed.

The following is a successful flashprom test.

```
obdiag> test 2
Hit the spacebar to interrupt testing
Testing /ebus@1f,464000/env-monitor@3,0 ...............................
passed
Pass:1 (of 1) Errors:0 (of 0) Tests Failed:0 Elapsed Time: 0:0:0:0

Hit any key to return to the main menu
```

If a test detects an error, an error message is displayed. The following is an example of a serial loopback test with no connector.

```
obdiag> setenv test-args loopback; test 4
test-args =              loopback
Hit the spacebar to interrupt testing
Testing /ebus@1f,464000/serial@2,0 >> Test-port will execute
external-loopback test

   ERROR   : Timeout receiving a character
   DEVICE  : /ebus@1f,464000/serial@2,0
   SUBTEST : selftest:external-loopback
   MACHINE : Sun Ultra 45
   SERIAL# : 68050714
   DATE    : 12/07/2005 23:08:47  GMT
   CONTR0LS: diag-level=max test-args=loopback

Error: /ebus@1f,464000/serial@2,0 selftest failed, return code = 1
Selftest at /ebus@1f,464000/serial@2,0 (errors=1) .....................
failed
Pass:1 (of 1) Errors:1 (of 1) Tests Failed:1 Elapsed Time: 0:0:0:19

Hit any key to return to the main menu
```

The following test is a sample of a serial port test.

```
obdiag> test 4
Hit the spacebar to interrupt testing
Testing /ebus@1f,464000/serial@2,0 ...................................
passed
Pass:1 (of 1) Errors:0 (of 0) Tests Failed:0 Elapsed Time: 0:0:0:18

Hit any key to return to the main menu
serial port test.
```

12.4 OpenBoot PROM Messages

TABLE 12-2 lists some common fault messages or *portions* of fault messages displayed by the OpenBoot PROM, their meanings, and actions that you can take to resolve the message condition.

TABLE 12-2 OpenBoot PROM Messages and Their Meaning

Message	Meaning	Action
`The date is displayed as:` `01/01/2000 00:00:00 GMT`	The battery has drained.	Replace the battery. See "Replacing the Battery" on page 3-9.
`Can't open boot device`	The device specified for boot is unavailable.	• For hard drive, check internal connections. Drive might be corrupted. • For DVD-dual drive, check that disc is bootable. Check internal connections. • For network, check network connections. Check boot server.
`Can't run OBDIAG from the device tree node or with the active instance`	Attempt to run OpenBoot Diagnostics from a selected device node.	Type: ok **unselect-dev**
`NOTICE - CPUx Banky DIMMs are from different vendors.`	Each DIMM in a pair is from a different manufacturer.	Install DIMMs in identical pairs. See "Replacing the DIMMs" on page 3-3.
`NOTICE - CPUx Banky DIMMs have different architectures and will not be used.`	Each DIMM in a pair has a different architecture. The DIMMs are not used.	Install DIMMs in identical pairs. See "Replacing the DIMMs" on page 3-3.
`Searching for self-test methods .` `. . Rejecting alloc-mem!`	OpenBoot Diagnostics failed to start. Some devices might be tied to other processes.	Type: ok **unselect-dev**
`Starting XVR-2500 self-test`	Sun XVR-2500 PROM error.	Type: ok **show-devs**
`Timeout waiting for ARP/RARP packet`	Network connection problem.	Check network connection.

SunVTS

This chapter describes using the SunVTS software to troubleshoot problems with the Sun Ultra 45 or Ultra 25 workstation. Topics include:

13.1   SunVTS Overview

The Sun validation test suite software, SunVTS, is a comprehensive software diagnostic package that tests and validates hardware by verifying the connectivity and functionality of most hardware components. SunVTS is a system exerciser that you can use to check for intermittent or long-term failures.

SunVTS software executes multiple diagnostic tests from a GUI that provides test configuration and status monitoring. The SunVTS interface can run on one workstation to display a SunVTS test session of another workstation on the network.

13.2   Installing SunVTS

The SunVTS software is preinstalled on your Sun Ultra 45 or Ultra 25 workstation hard drive. Use only SunVTS 6.1 or subsequent compatible versions.

You can find the latest revisions of SunVTS software on the web at:

```
http://www.sun.com/oem/products/vts/
```

The web site can also provide you with installation instructions.

13.3   SunVTS Documentation

Detailed SunVTS information can be found in the following documents:

- *SunVTS 6.1 User's Guide,* 819-2361 describes how to install, configure, and run the SunVTS diagnostic software.
- *SunVTS Quick Reference Card,* 819-2365, provides an overview of how to use the SunVTS GUI.
- *SunVTS 6.1 Release Notes,* 819-2363, provides updates to the SunVTS documents.
- *SunVTS Test Reference Manual for SPARC Platforms,* 819-2362, provides details about each SPARC SunVTS test.
- *Sun VTS Reference Manual,* 819-2364, provides the SunVTS man pages

The SunVTS documentation is available at:

`http://www.sun.com/documentation/`

Power Management

This chapter discusses power management. Topics include:

- Section A.1, "Power Management Overview" on page A-1
- Section A.2, "Using Dtpower" on page A-2
- Section A.3, "Modifying Power Management" on page A-3

A.1   Power Management Overview

To conserve power and to comply with the Energy Star program, mandated by US Environmental Protection Agency, the Sun Ultra 45 or Ultra 25 workstation power management features are enabled by default.

Note – The Sun Ultra 25 workstation meets or exceeds Energy Star guidelines in operation only when using the Java™ Desktop System (Java DS) windowing system, not while running the Common Desktop Environment (CDE) windowing system.

If you are currently using CDE, you can switch to the Java Desktop System by logging out from a CDE session, then logging back in after selecting Java Desktop System.

The Dtpower application reads and writes the Dtpower configuration to the /etc/power.conf file. You can change power management settings in the Dtpower application or you can make changes by editing the power.conf file. The Dtpower application is easier to use. Editing the power.conf file allows more control over power management than the Dtpower application provides.

This chapter provides some basic power management instructions. More detailed information is in the following documentation:

- *Solaris Common Desktop Environment: User's Guide* at:

  `http://docs.sun.com/app/docs/doc/806-4743/6jdq6q2li?a=view`

  or:

  `http://www.sun.com/documentation/`
- `power.conf` (1M) man pages

A.2   Using Dtpower

Dtpower has two preconfigured power management modes: minimal and standard. There is also a mode for customizing the settings. TABLE A-1 provides information about the different modes.

TABLE A-1   Dtpower Power Management Modes

Mode	Power Management
Minimal	Only the displays go into low-power mode.
Standard	All devices go into low-power mode.
Customized	Allows user to customize settings for displays and disks.
Disabled	No power management for any device.

Before you configure power management, consider the way that you use the Sun Ultra 45 or Ultra 25 workstation. For example: is the workstation used as a server? If so, use only minimal power management, or none at all.

The `power.conf` application provides greater controls on power management, such as managing multiple disk drives and other devices. For more information see the `power.conf` (1M) man pages.

A.3 Modifying Power Management

1. **Open a terminal window and type the following command:**

```
% dtpower &
```

The Dtpower window is displayed.

2. **From the Current Power Saving Scheme pulldown menu, select Customized, Minimal, or Standard.**

   - If you selected Minimal or Standard, select OK.

     The application exits and you are finished.

   - If you want to customize a minimal or standard mode, select Customized and elect More.

     The window expands. Continue with the remaining steps.

3. **Select the Device Idle Time Before Power Saving Starts time.**

   For Example:

   "15 Min" means that after 15 minutes of inactivity, all power-managed devices will go to low-power mode. "Always On" disables power management for the selected device.

4. **Set the Override Device Idle Time for displays or drives.**

5. **Click OK to close the application.**

A.3.1 Activating the Workstation From Low-Power Mode

If all devices are in low-power mode, the green LED on the front panel flashes. If any single device is powered up, the LED will stop flashing.

To reactivate the Sun Ultra 45 or Ultra 25 workstation from low-power mode, press the spacebar on the keyboard or move the mouse. If you are connected remotely, any system activity that you initiate can bring the workstation out of low-power mode.

Product Specifications

This appendix discusses the various specifications of the Sun Ultra 45 or Ultra 25 workstation. Topics covered are:

- Section B.1, "Physical Specifications" on page B-1
- Section B.2, "Electrical Specifications" on page B-3
- Section B.3, "Acoustic Specifications" on page B-3
- Section B.4, "Environmental Requirements" on page B-4
- Section B.5, "Shock and Vibration Specifications" on page B-4

B.1 Physical Specifications

The physical specifications of the Sun Ultra 45 or Ultra 25 workstation are shown in TABLE B-1, FIGURE B-1, and FIGURE B-2.

TABLE B-1 Exterior Dimensions

Length	Width	Height	Weight
22.407 in.	8.07 in.	17.520 in.	50 – 58 lbs
569.15 mm	205 mm	445 mm	22.67 – 26.30 kgs

If the Sun Ultra 45 or Ultra 25 workstation is placed in an enclosure, be sure to allow adequate airflow from front to rear.
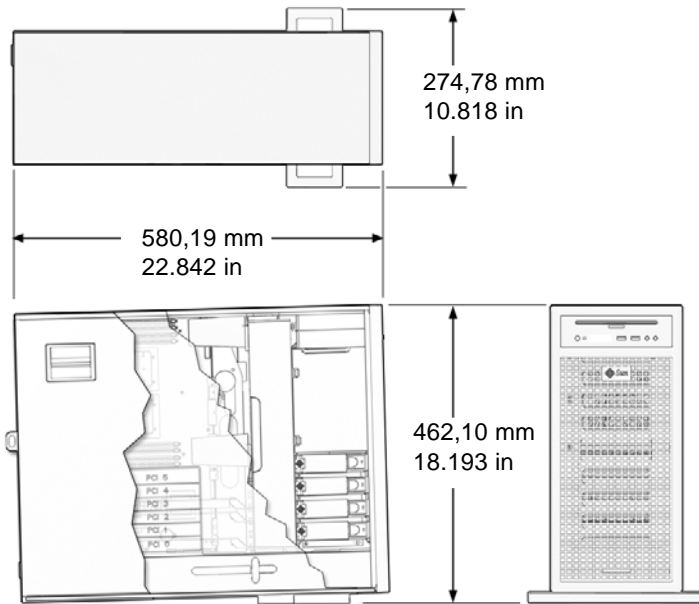
FIGURE B-1 Workstation Dimensions With Stabilizer Open

274,78 mm
10.818 in

580,19 mm
22.842 in

462,10 mm
18.193 in
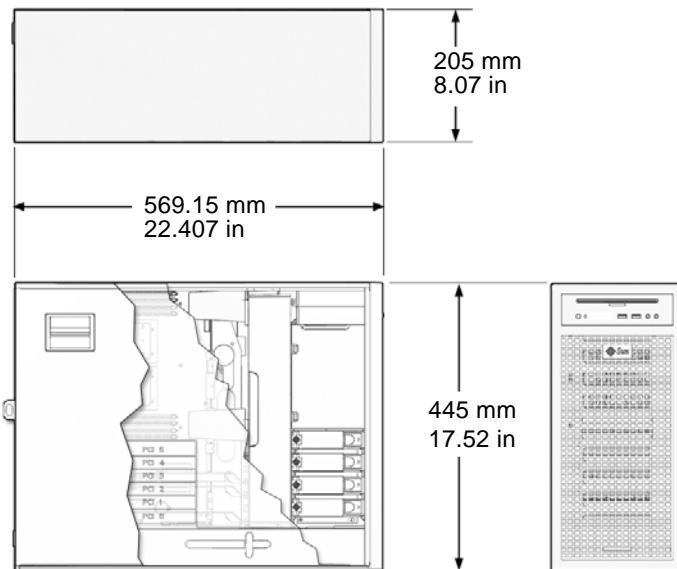
FIGURE B-2 Workstation Dimensions Without Stabilizer

205 mm
8.07 in

569.15 mm
22.407 in

445 mm
17.52 in

B.2 Electrical Specifications

TABLE B-2 lists electrical specifications for the Sun Ultra 45 or Ultra 25 workstation.

TABLE B-2 Electrical Specifications

Maximum AC Input	Voltage	Current	Frequency
Range 1	100 VAC	12 amps	50 – 60 Hz
Range 2	110 – 127 VAC	10 amps	50 – 60 Hz
Range 3	200 – 240 VAC	6 amps	50 – 60 Hz

TABLE B-3 lists the power supply specifications.

TABLE B-3 Power Supply Specifications

Specification	Value
Input Voltage	100 – 127 VAC, 200 – 240 VAC
Frequency	50 – 60 Hz
Current	6.4 amps @ 100 VAC, 3.2 Amps at 200 VAC
Wattage	630 W input (Power supply rated at 1,000 W maximum)

B.3 Acoustic Specifications

TABLE B-4 lists acoustic specifications for the Sun Ultra 45 or Ultra 25 workstation.

TABLE B-4 Declared Noise Emissions: ISO 9296

Specification	Operating	Idling
LWAd (1B=10db)	5.0 B	4.5 B
LpAm (by standard position)	42 dBA	38 dBA

B.4 Environmental Requirements

TABLE B-5 lists environmental requirements for the Sun Ultra 45 or Ultra 25 workstation.

TABLE B-5   Environmental Requirements

Specification	Operating	Nonoperating
Temperature	32 F to 104 F (0 C to 40 C)	-40 to 158 F (-40 C to 70 C)
Humidity	10% to 90% RH noncondensing, 27 C max wet bulb	93% RH noncondensing
Altitude	10,000 ft (~3 km)	40,000 ft (~12 km)

B.5 Shock and Vibration Specifications

TABLE B-6 lists vibration specifications for the Sun Ultra 45 or Ultra 25 workstation.

TABLE B-6   Shock and Vibration Values

Constraint	Operating	Nonoperating
Shock	5 G's, 11 msec, half-sine	30 G's, 11 msec, half-sine
Vibration	0.2 G's, 5 to 500 Hz swept-sine	1.0 G's, 5 to 500 Hz swept-sine
Handling Drop	N/A	100 mm

Functional Description

This appendix describes the inner workings of the Sun Ultra 45 or Ultra 25 workstation. Topic include:

- Section C.1, "Hardware Architecture" on page C-1
- Section C.2, "Motherboard" on page C-5
- Section C.3, "Serial Ports" on page C-8

C.1 Hardware Architecture

This section provides an overview of the Sun Ultra 45 or Ultra 25 workstation.

C.1.1 Motherboard Layout Diagram

FIGURE C-1 shows the layout of the Sun Ultra 45 motherboard, including connector and jumper locations.

Note – The Sun Ultra 25 workstation motherboard has one CPU (CPU0) and one bank of four DIMM slots. Other aspects of the Sun Ultra 25 are the same as the Sun Ultra 45 workstation.
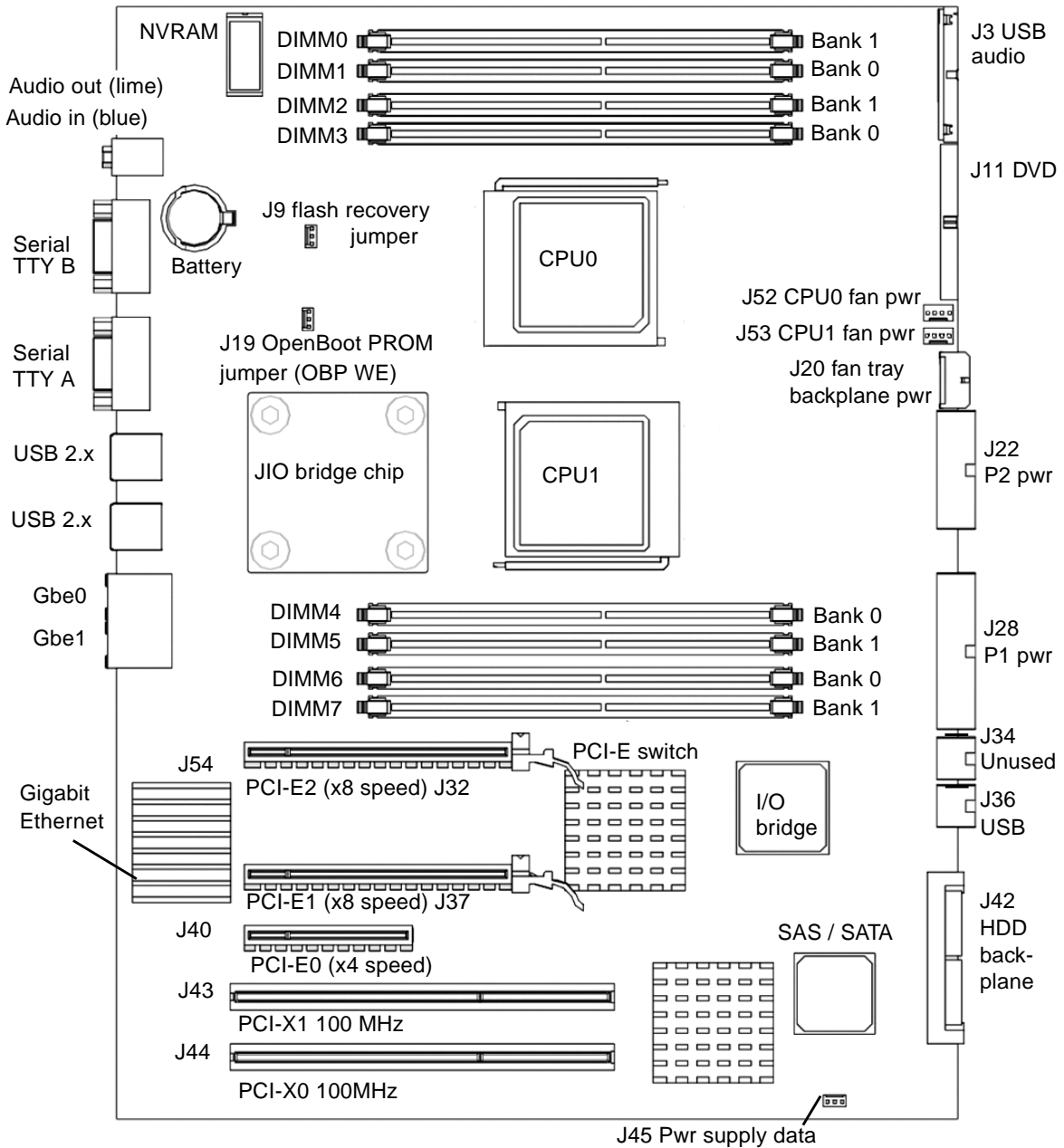
FIGURE C-1 Sun Ultra 45 Motherboard Diagram

C.1.2 System Block Diagram

shows the Sun Ultra 45 workstation system diagram.
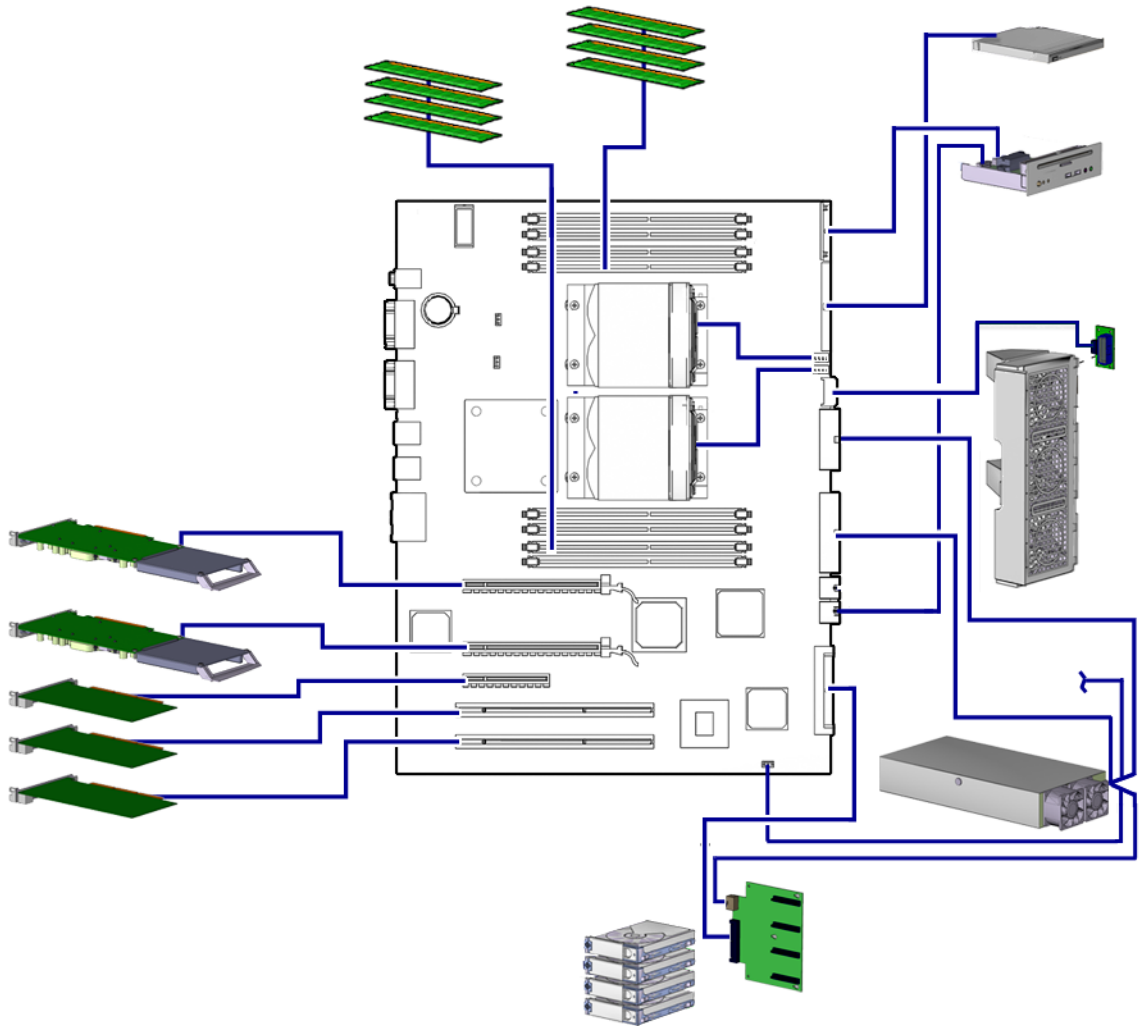
FIGURE C-2   Sun Ultra 45 Workstation System Diagram

> **Note –** The Sun Ultra 25 workstation motherboard has one CPU (`CPU0`) and one bank of four DIMM slots. Other aspects of the Sun Ultra 25 are the same as the Sun Ultra 45 workstation.

C.1.3　Component Overview

This section describes some primary motherboard components.

C.1.3.1　CPU

- UltraSPARC IIIi 1.6-GHz CPU for the Sun Ultra 45, UltraSPARC IIIi 1.34-GHz CPU for the Sun Ultra 25.
- Integrated L1 caches (data, instruction, prefetch, and write)
- Integrated 1-Mbyte L2 data cache
- System bus – I/O bridge, JBus frequency up to 200 MHz.

C.1.3.2　Memory Subsystem

- Integrated DDR-1 SDRAM 266-MHz memory controller
- Memory – up to eight DDR-1 SDRAM 266-MHz registered DIMMs, (four per CPU) for the Sun Ultra 45, up to four DDR-1 SDRAM 266-MHz registered DIMMs, (four per CPU) for the Sun Ultra 25.
- 16 GBytes for dual CPU, 8 GBytes of memory for single CPU

C.1.3.3　I/O Bridge Chip

- Sun Microsystems I/O bridge ASIC
- JBus
    - 200-MHz bandwidth
    - 128-bit wide MUX address and data bus
- Dual PCI buses
    - PCI-X compliant
    - 8 x 64-byte I/O cache each bus
    - Fully associative I/O memory management unit on each bus
    - PCI-E 2 long connector is 16 lane capable, running 8 lanes
    - PCI-E 1 long connector is 16 lane capable, running 8 lanes
    - PCI-E 0 short connector is 8 lane capable, running at 4 lanes

C.1.3.4　I/O Subsystem

- UltraDMA ATA 133 controller
- AC-97 compliant audio interface
- USB 2.x interface

C.1.3.5 Gigabit Ethernet

- 10/100/1000BASE-T Ethernet LAN controller
- Integrated MAC and PHY

TABLE C-1 describes the behavior of the Ethernet status LEDs.

TABLE C-1 Twisted-Pair Ethernet LED Status

LED	Status
Green - Link	When illuminated, a link exists.
Amber - Activity	When flashing, indicates transmit or receive activity.

C.2 Motherboard

This section describes more details about the motherboard and some components.

C.2.1 Motherboard Block Diagram

FIGURE C-3 shows the block diagram for the Sun Ultra 45 motherboard.

Note – The Sun Ultra 25 workstation motherboard has one CPU (CPU0) and one bank of four DIMM slots. Other aspects of the Sun Ultra 25 are the same as the Sun Ultra 45 workstation.
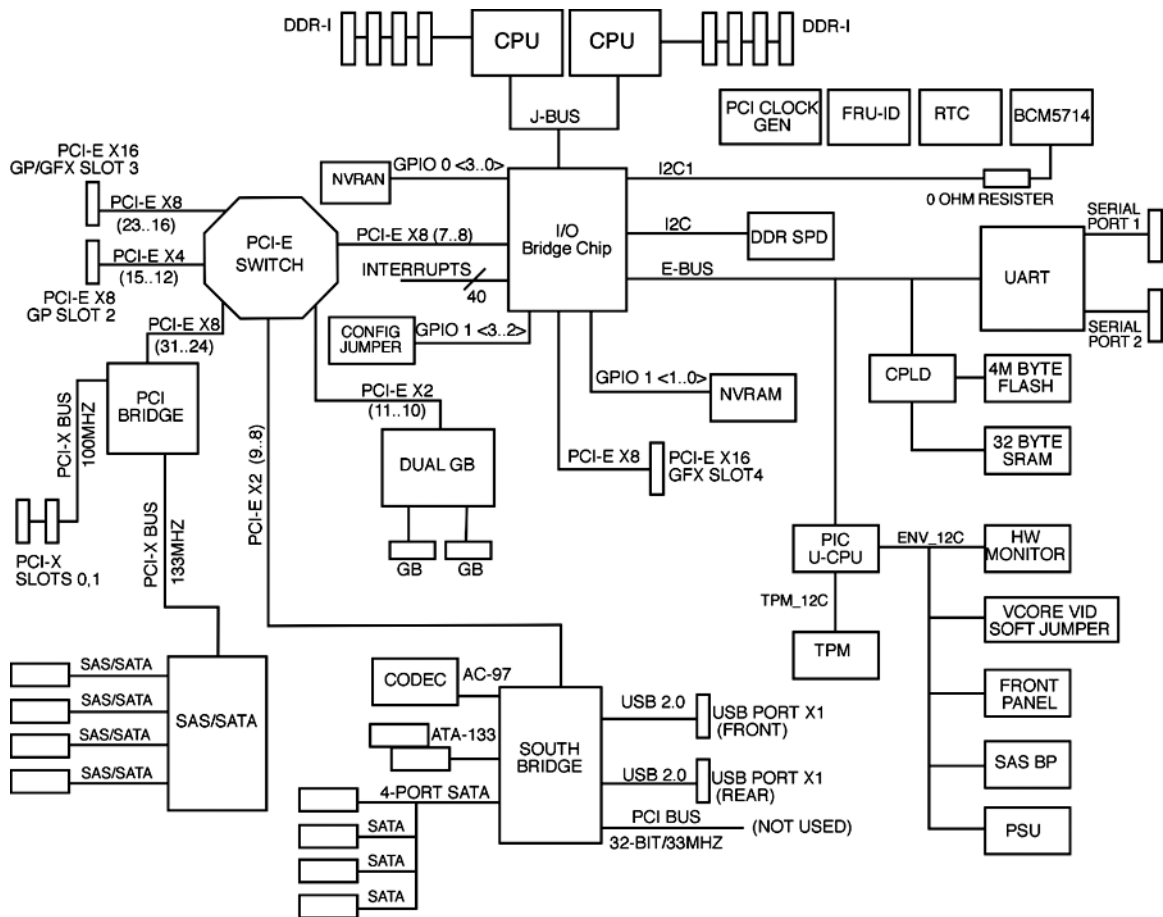
FIGURE C-3 Sun Ultra 45 Motherboard Block Diagram

C.2.2   CPU Description

The UltraSPARC IIIi processor is a high-performance, highly integrated superscalar processor. It is capable of sustained execution of four instructions per cycle, even with conditional branches and cache misses. Instructions are issued in program order to multiple functional units, and executed in parallel. Instructions from two basic blocks are issued in the same group to further increase the number of instructions executed per cycle.

The UltraSPARC IIIi CPU supports full implementation of the 64-bit SPARC-V9 architecture, a 64-bit virtual address space, and a 43-bit physical address space. The core instruction set includes graphics instructions that provide the most common

operations used for two-dimensional image processing, two and three-dimensional graphics, image compression algorithms, and parallel operations on pixel data with 8- and 16-bit components.

C.2.3 Memory Controller

The memory system consists of the memory control unit (MCU) in the CPU, and two physical banks (B0 and B1) of DDR-1 synchronous DRAM memory. Only registered DIMMS are supported.

Clock buffering with a PLL is provided on the DIMMs. Each physical bank consists of two 128-bit DDR-1 SDRAM DIMMs. These two DIMMs share an 8-byte data bus and an ECC data bus. Both physical banks share an address/control bus. Since each DIMM could be dual sided (upper and lower banks), there are maximum of four data loads per physical bank. The cache line is split across the two physical banks. Both banks are controlled by the memory controller.

Note – DIMMs must always be installed in pairs.

A memory controller sends requests in the pipeline, using 16 memory banks in the Sun Ultra 45 when fully loaded, and 8 memory banks in the Sun Ultra 25 when fully loaded.
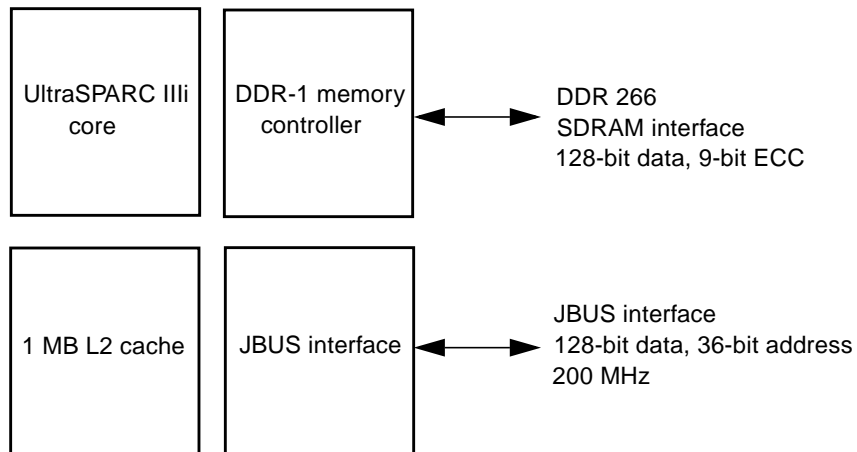
FIGURE C-4   UltraSPARC IIIi Chip Architecture

C.3 Serial Ports

The Sun Ultra 45 or Ultra 25 workstation has two serial ports.

When powering off, the Sun Ultra 45 or Ultra 25 workstation sends a Break signal out the serial ports. This break could interfere with a workstation-controlled server if the server is operating through a Tip connection. Five solutions are available:

■ Configure for an alternate Break key sequence on the server.
■ Filter the Tip connection through a network terminal concentrator.
■ Disable the keyboard abort on the server.
■ Disable the Tip connection on the server.
■ Permanently Disable the Keyboard Abort or Configure an Alternate Break Key Sequence on the Server

C.3.1 Configuring for an Alternate Break Key Sequence on the Server

As superuser, open a terminal window and configure the alternate Break key sequence. Type:

```
# kbd -a alternate
```

To invoke a keyboard abort, type Return, ~, Ctrl-B.

Note – You must reconfigure the alternate Break key sequence after a server power cycle.

C.3.2 Filtering the Tip Connection Through a Network Terminal Concentrator

The network terminal concentrator acts as a proxy between the Sun Ultra 45 or Ultra 25 workstation and the server under Tip control. The network terminal concentrator communicates with the host Sun Ultra 45 or Ultra 25 workstation through the Telnet

protocol. If the workstation sends the BREAK signal, it is ignored by the network terminal concentrator. Additionally, the concentrator does not send the BREAK signal upon powering off.

C.3.3   Disabling the Keyboard Abort on the Server

This procedure configures the server to ignore the BREAK signal.

● **As superuser, open a terminal window and disable the keyboard abort. Type:**

```
# kbd -a disable
```

● **To re-enable keyboard abort, type:**

```
# kbd -a enable
```

Note – You must reconfigure the keyboard abort after a server power cycle.

C.3.4   Disabling the Tip Connection on the Server

● **To disable the Tip connection, turn the server key switch to the lock position.**

This action prevents any serial communication with the server. To re-establish serial communications, turn the key to the unlock position.

C.3.5 Permanently Disabling the Keyboard Abort or Configuring an Alternate Break Key Sequence on the Server

1. As superuser, edit the `/etc/default/kbd` **file.**

■ To disable the keyboard abort, uncomment this line:

```
#KEYBOARD_ABORT=disable
```

■ To configure the alternate BREAK key sequence, uncomment this line:

```
#KEYBOARD_ABORT=alternate
```

2. Save the file.

3. Reinitialize the kbd **drivers. Type:**

```
# kbd -i
```

Glossary

A

address	(1) A number used by system software to identify a data storage location.
	(2) In networking, a unique code that identifies a node to the network.
ASIC	Application-specific integrated circuit.
ATA	Advanced Technology Attachment. See also SATA.

B

bank	A bank can be: (1) Interleaving within a single device on a DDR1 SDRAM.
	(2) A pair of adjacent DIMMs. See interleaving.
BGA	Ball grid array.
boot	The process of reading initial software into the computer.
bus	A set of conductors that connect various functional units within a computer.

C

cache A smaller, faster accessible set of memory used to speed up operations of CPUs, storage, and networking components. Typically found within the component it serves.

CDE Common Desktop Environment.

CD-ROM Compact disc read-only memory. A CD-ROM drive reads data recorded on the CD-ROM optical disc.

CD-RW Rewritable compact disc.

CODEC (1) Coder/decoder. A CODEC uses analog-to-digital conversion and digital-to-analog conversion in the same chip.

(2) Compression/decompression. An algorithm or computer program for reducing byte consumption in large files and programs.

D

DDC2 Display data channel version 2. DDC2 is the I^{2}C interface used to communicate with the monitor. This interface is the same for both the HD15 and DVI-I connectors.

DDR-1 SDRAM Double data rate synchronous dynamic random access memory.

default A preset value that is assumed to be correct unless changed by the user.

DIMM Dual inline memory module. A printed circuit card that contains dynamic random access memory chips. See Registered DIMM.

DMA Direct memory access. The transfer of data directly into memory without supervision of the processor. The data is passed on the bus directly between the memory and another device.

DRAM Dynamic random-access memory. A read/write dynamic memory in which the data can be read or written in approximately the same amount of time for any memory location.

drive rails Mounting hardware used to secure hard drives and other peripherals inside the workstation.

D-TLB Data translation look-aside buffer.

DVD-dual Optical drive that can read and write DVDs and CDs.

DVD-ROM   Digital versatile disc read-only memory.

E

ECC   Error checking and correction. The detection and correction of all single-bit errors, plus the detection of double-bit and some multiple-bit errors.

ECP   Extended capabilities port.

EEPROM   Electrically erasable programmable read only memory.

EMI   Electromagnetic interference. An electrical characteristic that directly or indirectly contributes to a degradation in performance of an electronic system.

EPIC-7   Texas Instruments Inc. 0.13 micron chip fabrication process.

ESD   Electrostatic discharge.

Ethernet   A type of network hardware that provides communication between systems connected directly together by transceiver taps, transceiver cables, and various cable types such as coaxial, twisted-pair, and fiber-optic.

F

flash PROM   Flash programmable read-only memory.

FPU   Floating-point unit. A device (board or integrated circuit) that performs floating-point calculations.

G

Gbit   (Gb) Gigabit. 1024 megabits. Commonly used term in Ethernet: Gigabit Ethernet.

Gbyte   (GB) Gigabyte. A gigabyte is 1024 megabytes. Usually refers to data transfer speeds or the capacity of a storage device.

GHz   Gigahertz. One billion cycles per second.

GUI   Graphical user interface.

I

I²C Inter-integrated circuit. A chip-to-chip serial bus.

IChip2 Interrupt concentrator chip.

IEEE Institute of Electrical and Electronics Engineers, Inc. The organization establishes standards for some computers and electrical components.

IEEE 1394 A high-speed communications protocol.

I/O Input/output.

I-TLB Instruction translation look-aside buffer.

J

JIO The input/output bridge chip that uses the Jbus architecture.

JBus The system bus developed for the UltraSPARC IIIi series of processors.

K

Kbyte (KB) Kilobyte. 1024 bytes of data.

L

L2 cache Level 2 cache.

LAN Local area network.

leaf Any node (location in a tree structure) that is farthest from the primary node.

LED Light-emitting diode.

M

MAC Media access controller. See also PHY.

Mbit (Mb) Megabit. 1,048,576 bits.

MByte (MB) Megabyte. One million bytes.

Mbps Megabits per second.

MCU Memory controller unit.

MHz Megahertz. One million cycles per second.

MII Media independent interface.

MUX Multiplex, multiplexer. A multiplexer merges information from multiple signals to a single channel.

N

node An addressable point on a network.

NVRAM Nonvolatile random access memory. Stores system variables used by the boot PROM. Contains the system host ID number and Ethernet address. NVRAM retains the data when the workstation is powered off.

O

OpenBoot PROM OpenBoot PROM contains the PROM monitor program, a command interpreter used for booting, resetting, low-level configuration, and simple test procedures. OpenBoot software initially boots the system to a state in which the system can further load an operating system.

OpenGL OpenGL is an application programming interface (API) for developing portable, interactive 2D and 3D graphics applications.

P

PCI	Peripheral component interconnect. A high-performance 32- or 64-bit-wide bus with multiplexed address and data lines.
PCI-Express	Peripheral Component Interconnect Express. A scalable I/O serial bus technology with greater bandwidth than PCI and PCI-X.
PCI-X	An improvement to the PCI bus.
peripheral	Removable media assembly. A device such as a smart card reader, CD-ROM drive, DVD-ROM drive, 4-mm tape drive, or a diskette drive.
PHY	Physical access layer. Part of the digital-to-analog connection between the MAC and the physical Ethernet wire.
PID	Process ID.
POR	Power-on reset.
POST	Power-on self-test. A series of tests that verify motherboard components are operating properly. Now initiated with the `post` command.
PROM	Programmable read-only memory. After the PROM has been programmed, it cannot be reprogrammed. See flash PROM.

R

registered DIMM	A DIMM that includes a register buffer.
RISC	Reduced instruction set computer. A computer using the RISC architecture.

S

SAS	Serial attached SCSI.
SATA	Serial ATA.
SCSI	Small computer system interface.
SDR	Single data rate.

SDRAM	Synchronous DRAM.
SEEPROM	Serial electrically erasable programmable read only memory.
SMBus	System management bus. The SMBus protocol is a subset of the I^{2}C protocol.
smart card	A card used for user authentication or storing individual user preferences.
snoop	A search for the latest data in memory.
Southbridge	A highly integrated system I/O chip. One of three I/O subsystem bridge chips.
SPOR	System power-on reset.
SPP	Standard parallel port.
SRAM	Static random access memory.
SunVTS	A diagnostic application for testing hardware.
superscalar	A processor that can execute more than one instruction per cycle.
superuser	A privileged account with unrestricted access to all files and commands.

T

Tip connection	A connection that enables a remote shell window to be used as a terminal to display test data from a system using the terminal interface protocol (Tip).
TPE	Twisted-pair Ethernet.
TOD	Time of day. A timekeeping integrated circuit.

U

UltraDMA	Ultra direct memory access. A DMA mode within an IDE controller.
UltraSPARC IIIi	The high-performance central processing unit used in the Sun workstations. The CPU uses SPARC V9, 64-bit reduced instruction set computer (RISC) architecture.
USB	Universal Serial Bus. USB 1.1 can transfer data up to 12 Mbps. USB 2.0 can transfer data up to 480 Mbps.
UTP	Unshielded twisted-pair.

V

VCC   Voltage at the common collector (positive [+] electrical connection).

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