

Sun™ Ultra™ 2 Series Service Manual



The Network Is the Computer™

Sun Microsystems Computer Company

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Revision History

Revision	Dash	Date	Comments
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Preface

The *Ultra™ 2 Series Service Manual* provides detailed procedures that describe the removal and replacement of field replaceable units (FRUs) in the Ultra 2 series computer (system unit) and the Ultra Enterprise™ 2 server (server). People that should use this book include technicians, advanced computer system end-users with experience in replacing hardware and troubleshooting, system administrators, and qualified service providers.

Document Organization

Refer to Table P-1. This book is comprised of seven parts. Each part is divided into chapters as follows:

Table P-1 Document Organization

Part Number/Title	Chapter Number/Title	Content Description
Part 1, "System Information"	Chapter 1, "Product Description"	Describes the major components of the Ultra 2 series desktop system and the Ultra Enterprise 2 server
Part 2, "Troubleshooting"	Chapter 2, "SunVTS Overview"	Describes the execution of individual tests for verifying hardware configuration and functionality
	Chapter 3, "Power-On Self-Test (POST)"	Describes the execution of POST and provides examples of POST output patterns
	Chapter 4, "Troubleshooting Procedures"	Provides actions to generalized hardware symptom casualty
Part 3, "Preparing for Service"	Chapter 5, "Safety and Tool Requirements"	Explains how to work safely when servicing the Ultra 2 series
	Chapter 6, "Power On and Off"	Provides step-by-step procedures to power on and power off the Ultra 2 series
Part 4, "Subassembly Removal and Replacement"	Chapter 7, "Internal Access"	Provides step-by-step procedures to remove the Ultra 2 series cover, attach the wrist strap, and replace the cover
	Chapter 8, "Major Subassemblies"	Provides step-by-step procedures to remove and replace major subassemblies
	Chapter 9, "Storage Devices"	Provides step-by-step procedures to remove and replace storage devices
Part 5, "System Board"	Chapter 10, "System Board and Component Replacement"	Provides step-by-step procedures to remove and replace the system board, and to remove and replace various components associated with system board operation

Table P-1 Document Organization (Continued)

Part Number/Title	Chapter Number/Title	Content Description
Part 6, “Illustrated Parts Breakdown”	Chapter 11, “Replacement Parts”	Lists replaceable parts for the Ultra 2 series system unit
Part 7, “Appendixes, Glossary, and Index”	Appendix A, B, and C	Provide product specifications, signal descriptions, and functional descriptions for the Ultra 2 series, respectively
	Glossary	Provides a listing of acronyms, terms, and definitions
	Index	Provides a quick reference to specific topics

Warnings and Cautions



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



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



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



Caution – The surface of the UltraSPARC CPU™ chip may be hot and cause personal injury if touched. Avoid contact.

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

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

Note – Prior to performing service or repair, carefully read the associated procedure. If a similar repair has not been performed on comparable equipment, *do not attempt* to perform the procedure.

Typographic Conventions

Table P-2 lists typographic conventions used within this service manual.

Table P-2 Typographic Conventions

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

Related Documentation

Table P-3 lists related manuals supporting the *Ultra 2 Series Service Manual* which are also available on-line (refer to the *Ultra 2 Series Hardware AnswerBook*™ or the *Solaris on Sun Hardware AnswerBook* set).

Table P-3 Related Documentation

Application	Title	Part Number
Installation	<i>Sun™ Ultra™ 2 Series Installation Guide</i>	802-2560
Installation	<i>Sun™ Ultra™ 2 Series Hardware AnswerBook™ Installation</i>	804-5318
Configuration	<i>Sun™ Ultra™ 2 Series Reference Manual</i>	802-2562
Setup	<i>Sun™ Ultra™ 2 Series Hardware Setup Instructions</i>	802-5933
Specification	<i>17-Inch Entry, 17-Inch Premium, and 20-Inch Premium Color Monitors Specifications</i>	802-6178
Specification	<i>SunCD™ 4 Drive Specifications</i>	802-4157
Specification	<i>Diskette Drive Specifications</i>	802-5283
Specification	<i>2.5-Gbyte QIC Tape Drive Specifications</i>	802-3615
Specification	<i>8-mm Tape Drive Specifications</i>	802-5775
Specification	<i>4-mm Tape Drive Specifications</i>	802-5324
Diagnostics	<i>SunVTS™ 2.0 User's Guide</i>	802-5331
Diagnostics	<i>SunVTS™ 2.0 Test Reference Manual</i>	802-5330
Diagnostics	<i>SunVTS™ 2.0 Quick Reference Card</i>	802-5329

Shell Prompts

Table P-4 lists the default system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

Table P-4 Shell Prompts

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

Ordering Sun Documents

The SunDocs™ Order Desk is a distribution center for Sun Microsystems technical documents. Technical documents may be purchased through major credit cards or company purchase orders. Table P-5 lists the locations where you can order documents.

Table P-5 Ordering Sun Documents

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United Kingdom	0-800-89-88-88	0-800-89-88-87
France	05-90-61-57	05-90-61-58
Belgium	02-720-09-09	02-725-88-5
Luxembourg	32-2-720-09-09	32-2-725-88-5
Germany	01-30-81-61-91	01-30-81-61-92
The Netherlands	06-022-34-45	06-022-34-46
Sweden	020-79-57-26	020-79-57-27
Switzerland	155-19-26	155-19-27
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Part 1 — System Information

<i>Product Description</i>	<i>page 1-1</i>
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1.1 Ultra 2 Series Overview

The Ultra 2 series desktop workstation and the Ultra Enterprise 2 server are multi-processor devices that use the family of UltraSPARC™ processors. Both the desktop workstation and the server offer super-scalar processor technology, multiprocessing, high-performance memory interconnection, and high bandwidth I/O. In addition, the desktop workstation provides accelerated graphics.

Figure 1-1 illustrates the Ultra 2 series desktop workstation. Major components include:

- Input/output (I/O) devices:
 - Monitor
 - Keyboard
 - Mouse
 - Microphone (not illustrated)
 - Color camera (optional, not illustrated)
- External cables (not illustrated)
- System unit

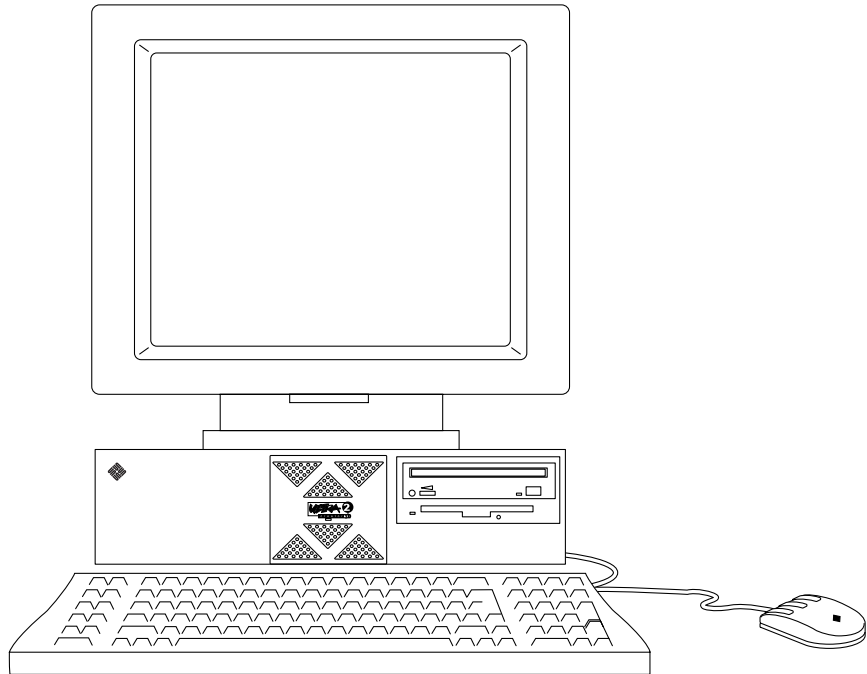


Figure 1-1 Ultra 2 Series Desktop System

Figure 1-2 illustrates the Ultra Enterprise 2 server. The major components include:

- External cables (not illustrated)
- System unit

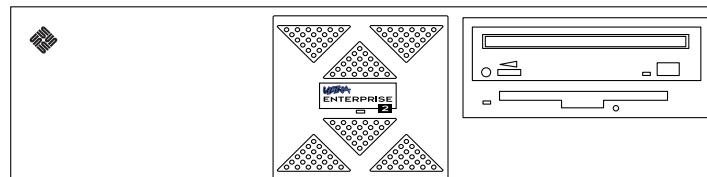


Figure 1-2 Ultra Enterprise 2 Server

The following sections provide a brief description of the Ultra 2 series desktop workstation I/O devices. Also included is a detailed overview of the Ultra 2 series and the Ultra Enterprise 2 system unit.

1.1.1 I/O Devices (Ultra 2 Series Desktop)

The Ultra 2 series desktop workstation uses the following I/O devices:

- Keyboard
- Optical mouse
- Multimedia speaker system
- Microphone
- Color camera
- One of several types of monitors

Table 1-1 lists the supported I/O devices and provides a brief description of each device.

Table 1-1 Supported I/O Devices (Ultra 2 Series Desktop)

I/O Device	Description
17-inch (43-cm) color monitor	1152 x 900 resolution, 76- or 66-Hz refresh rate, 100 dots per inch (DPI)
	1280 x 1024 resolution, 76- or 66-Hz refresh rate, 110 DPI
	960 x 680 resolution, 112-Hz refresh rate, 81 DPI
20-inch (51-cm) color monitor	1152 x 900 resolution, 76- or 66-Hz refresh rate, 84 DPI
	1280 x 1024 resolution, 76- or 66-Hz refresh rate, 93 DPI
	960 x 680 resolution, 112-Hz refresh rate, 79 DPI
Microphone	SunMicrophone™ II
Color camera	Optional SunVideo™ and SunCamera™
Keyboard	Sun Type 5; AT 101 or UNIX layout available
Optical mouse	Optomechanical, 3-button

1.1.2 System Unit Features

System unit components are located in a Sun Ultra 2 chassis. Overall chassis dimensions (width x depth x height) are 17.87 inches x 17.63 inches X 5.20 inches (450mm x 444mm x 130mm). The chassis contains (or may be upgraded to contain) electrical components with the following features:

- SPARC™ V9 64-bit UltraSPARC processor on the module
 - One to two 167-Megahertz (MHz) processor modules with 512-Kilobyte (Kbyte) external caches each
 - One to two 200-MHz processor modules with 1-Megabyte (Mbyte) external cache each
- Solaris™ 2.5.1 operating system
- High performance Ultra Port Architecture™ (UPA)
- High bandwidth memory system using 144-bit, 60-nanosecond (ns) dynamic random access memory (DRAM) single in-line memory module (SIMM)
- 16 DRAM SIMM (DSIMM) sockets providing from 64 Mbytes to 2 Gigabytes (Gbytes) of memory using 16-Mbyte, 32-Mbyte, 64-Mbyte, and 128-Mbyte DSIMMs
- Fast frame buffer (FFB) graphics (67-MHz graphics clock) with 24-bit color and 8-bit overlay: single buffer FFB, double buffer FFB (Ultra 2 series desktop only). Double buffer FFB with 75-MHz graphics clock (200-MHz Ultra 2 series desktop only)
- 16-bit CD quality audio with support for line in/out, headphone, and stereo microphone
- 20-Mbyte-per-second small computer system interface (SCSI)
- 10-Megabits-per-second (Mbps)/100-Mbps twisted-pair Ethernet (TPE) networking
- 100-Mbps Media-Independent Interface (MII) networking
- Four IEEE 1496-compliant 25-MHz SBus Input/Output (I/O) slots
- Two DB25-type standard connector serial ports

Note – Each serial port supports synchronous and asynchronous communication.

- DB25-type connector parallel port (Centronics compatible)
- Standard Sunness

Note – Standard Sunness includes the time of day (TOD)/nonvolatile random-access memory (NVRAM), and boot programmable read-only memory (PROM) or FlashPROM for Power-On Self-Test/OpenBoot PROM (POST/OBP)

- Built-in speaker
- Diagnostic LED
- Power conservation support

1.1.3 System Unit Components

System unit components are listed in Table 1-2. Figure 1-3 illustrates the system unit interior. Figure 1-4 illustrates the system unit rear panel.

Note – Part numbers listed in Table 1-2 are correct as of the service manual publication date but are subject to change without notice. Consult your authorized Sun sales representative or service provider to confirm a part number prior to ordering a replacement part.

Table 1-2 System Unit Components

Component	Part Number	Description	Model
System Board	501-3132-xx	167-MHz or 200-MHz system board	All
Assy, 1/2 Mbyte, 6ns, Mod	501-2942-xx	167-MHz CPU module, 512-Kbyte external cache	Models 1170 and 2170 only
Assy, 1 Mbyte, 5ns, Mod	501-3041-xx	200-MHz CPU module, 1-Mbyte external cache	Models 1200 and 2200 only
16-Mbyte DSIMM	501-2479-xx	16-Mbyte DSIMM, 60-nanosecond (ns)	All
32-Mbyte DSIMM	501-2622-xx	32-Mbyte DSIMM, 60-ns	All
64-Mbyte DSIMM	501-2480-xx	64-Mbyte DSIMM, 60-ns	All
128-Mbyte DSIMM	501-3136-xx	128-Mbyte DSIMM, 60-ns	All
DFB-FFB graphics card, 67-MHz	501-4126-xx	DFB,FFB graphics card, 67-MHz	All (Ultra 2 series desktop workstation only)
SFB-FFB graphics card, 67-MHz	501-4127-xx	SFB,FFB graphics card, 67-MHz	All (Ultra 2 series desktop workstation only)
DFB-FFB graphics card, 75-MHz	501-3129-xx	DFB,FFB graphics card, 75-MHz	All (Ultra 2 series desktop workstation only)
350-watt power supply	300-1315-xx	350-watt (W) power supply	All
3.5-inch floppy drive, 3D (optional)	370-2151-xx	Drive, floppy, 3.5inch, 3D, black bezel	All
4X CD drive (optional)	370-2102-xx	Quadspeed CD drive	All

Table 1-2 System Unit Components (Continued)

Component	Part Number	Description	Model
Speaker	370-1579-xx	Speaker (P/O shroud assembly)	All
4-mm tape drive (optional)	370-2176-xx	4-Gbyte/8-Gbyte, 4-mm tape drive, light gray	All
8-mm tape drive (optional)	370-1857-xx	8505XL 8-mm tape drive 7/14 Gbytes	All
2.5-Gbyte QIC tape drive (optional)	370-2018-xx	2.5-Gbyte QIC tape drive, light grey	All
TOD, 48T59Y, w/Carrier	525-1417-xx	TOD/NVRAM, 48T59Y, w/carrier	All
SCSI cable (optional)	530-2137-xx	SCSI cable	All
Diskette drive cable (optional)	530-2138-xx	Floppy cable	All
2.1-Gbyte SCA, 7200 RPM, wide	540-2730-xx	2.1-Gbyte SCA,7200 RPM, wide	All
Shroud assembly	540-2603-xx	Shroud assembly	All

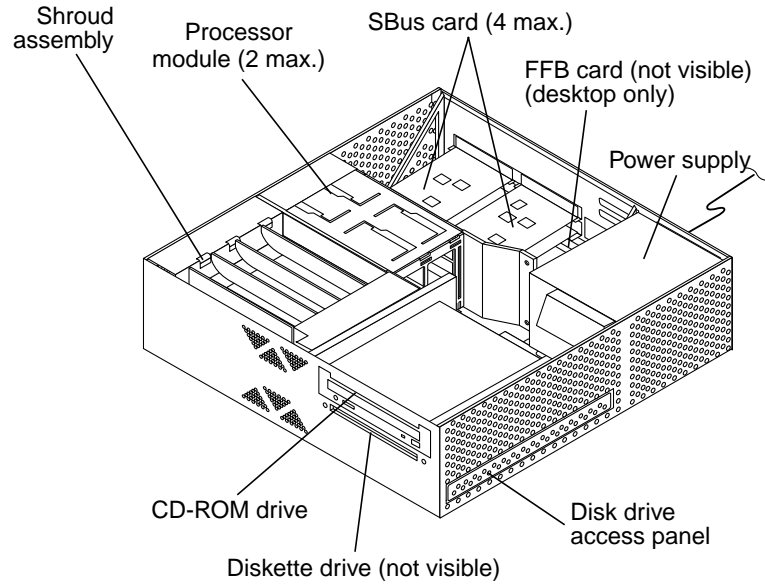


Figure 1-3 System Unit Interior

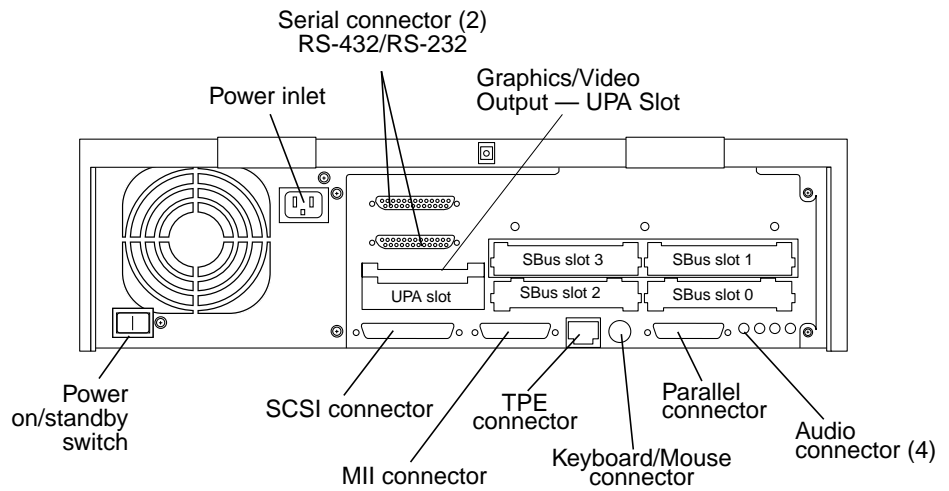


Figure 1-4 System Unit Rear Panel

Part 2 — Troubleshooting

<i>SunVTS</i>	<i>page 2-1</i>
<i>Power-On Self-Test</i>	<i>page 3-1</i>
<i>Troubleshooting Procedures</i>	<i>page 4-1</i>

This chapter contains an overview of the Sun Validation and Test Suite (SunVTS™) diagnostic tool/application. The following is the list of the SunVTS diagnostic topics presented in this chapter.

<i>SunVTS Overview</i>	<i>page 2-1</i>
<i>SunVTS Kernel</i>	<i>page 2-2</i>
<i>SunVTS User Interface</i>	<i>page 2-2</i>
<i>SunVTS TTY</i>	<i>page 2-3</i>

2.1 SunVTS Overview

The SunVTS software executes multiple diagnostic hardware tests from a single user interface and is used to verifying configuration and functionality of most hardware controllers and devices. SunVTS operates primarily from the OpenWindows™ user interface, allowing test parameters to be set quickly and easily while a diagnostic test operation is being performed.

The SunVTS operation is provided in the documents listed in Table 2-1. These documents furnish detailed information about SunVTS and are available on the *Solaris on Sun Hardware AnswerBook*. The *Solaris on Sun Hardware AnswerBook* is provided on the *SMCC Updates* CD for the Solaris release being operated.

Table 2-1 SunVTS Documentation

Title	Part Number	Description
<i>SunVTS User's Guide</i>	802-5331	Describes the SunVTS environment; starting and controlling various user interfaces; feature descriptions
<i>SunVTS Test Reference Manual</i>	802-5330	Describes each SunVTS test; provides various test options and command line arguments
<i>SunVTS Quick Reference Card</i>	802-5329	Provides overview of <code>vtsui</code> interface features

The main features of the SunVTS environment include:

- SunVTS kernel
- SunVTS user interface
- SunVTS teletype

2.1.1 SunVTS Kernel

The SunVTS kernel (`vtsk`) diagnostic tool controls all testing and operates in the OpenWindows background. When activated, `vtsk` probes the hardware configuration of the system tested and responds to `vtsui`. `vtsk` coordinates execution of individual tests and manages the messages sent by these tests.

2.1.2 SunVTS User Interface

The SunVTS user interface (`vtsui`) diagnostic tool operates in the OpenWindows background. Upon activation, `vtsui` provides `vtsk` control, various user options, tests, and read-log files.

2.1.3 SunVTS TTY

The `vtstty` diagnostic tool controls the `vtsk` from either a command shell or a terminal attached to a serial port. Most options available in `vtstty` have equivalent options in `vtsui`. `vtstty` is applicable to server configurations only.

Power-On Self-Test



This chapter contains procedures to initiate the Power-On Self-Test (POST) diagnostics. Procedures are also included to support pre-POST preparation, POST data interpretation, and bypassing POST diagnostics. The following is a list of the POST diagnostic topics presented in this chapter.

<i>POST Overview</i>	<i>page 2-2</i>
<i>Pre-POST Preparation</i>	<i>page 2-2</i>
<i>Intilizing POST</i>	<i>page 2-5</i>
<i>Max and Min Levels of POST</i>	<i>page 2-6</i>
<i>POST Progress and Error Reporting</i>	<i>page 2-14</i>
<i>Bypassing POST</i>	<i>page 2-15</i>
<i>Additional Keyboard Control Commands</i>	<i>page 2-15</i>
<i>System and Keyboard LEDs</i>	<i>page 2-15</i>
<i>System Board Test</i>	<i>page 2-18</i>

2.1 POST Overview

POST is useful in determining if a portion of the system has failed and should be replaced. POST detects approximately 85 percent of Ultra 2 series system faults and is located in the system board OpenBoot PROM (OBP). The setting of the diag-level switch determines the POST function. Table 2-1 lists the diag-level switch settings for disabling POST (off), enabling POST Maximum (max), or enabling POST Minimum (min).

Table 2-1 Diag-Level Switch Settings

Diag-Level Switch Setting	POST Initialization?	Serial Port A I/O	Serial Port A Error Output	Diag-Switch Setting
Off	No	N/A	N/A	False
Max	Yes (power-on)	Enabled	Enabled	True
Min	Yes (power-on)	Disabled	Enabled	True

2.2 Pre-POST Preparation

Pre-POST preparation includes:

- Setting up a tip connection to another workstation or terminal to view POST progress and error messages (see Section 2.2.1, “Setting Up a Tip Connection.”) Verifying baud rates between a workstation and a monitor or a workstation and a terminal (see Section 2.2.2, “Verifying the Baud Rate.”)

If a terminal or a monitor is not connected to serial port B (default port) of a workstation or server to be tested, the keyboard LEDs are used to determine error conditions (see Section 2.8, “System and Keyboard LEDs.”)

2.2.1 Setting Up a Tip Connection

A tip connection permits a remote shell window to be used as a terminal to display test data of a system being tested. Serial port A or serial port B of a workstation or server being tested is used to establish the tip connection between the workstation or server being tested and another Sun Workstation monitor or TTY-type terminal. The tip connection is used in a SunOS window and provides features to help with the OBP.

To set up a tip connection:

- 1. Connect serial port A of the system being tested to another Sun Workstation serial port B using a serial null modem cable (connect cable pins 2-3, 3-2, 7-20, and 20-7).**
- 2. At the other Sun Workstation, check the `/etc/remote` file:**

```
hardware:\  
:dv=/dev/term/b:br#9600:e1=^C^S^Q^U^D:ie=%$:oe=^D:
```

Note – The example shows connection to serial port B, `ttyb`, the default port.

- 3. To use serial port A:**
 - a. Copy and paste the following:**

```
hardware:\  
:dv=/dev/term/b:br#9600:e1=^C^S^Q^U^D:ie=%$:oe=^D:
```

- b. Then modify as follows:**

```
hardwarea:\  
:dv=/dev/term/a:br#9600:e1=^C^S^Q^U^D:ie=%$:oe=^D:
```

- 4. In a shell tool window on the Sun Workstation, enter `tip hardware`. The system replies:**

```
hostname% tip hardware
connected
```

Note – The shell window is now a tip window directed to the serial port of the Sun Workstation or server being tested. When power is applied to the system being tested, POST messages will be displayed in this window.

- 5. When POST is completed, disconnect the tip window as follows:**
 - a. Open a shell tool.**
 - b. Enter `ps -a` to view the active tip line and process ID (PID) number.**
 - c. Enter `kill -9 XXXX` (where XXXX is the PID number) of the tip hardware process.**

```
hostname% kill -9 PID# of tip hardware process
```

2.2.2 Verifying the Baud Rate

To verify the baud rate between the system being tested and a terminal or another Sun Workstation monitor:

- 1. Open a shell tool.**
- 2. Enter `eeeprom`.**
- 3. Verify the following serial port default settings as follows:**

```
ttyb-mode = 9600,8,n,1
ttya-mode = 9600,8,n,1
```

Note – Ensure that the above settings are consistent with TTY-type terminal or workstation monitor settings.

2.3 *Initilizing POST*

Initilize POST by setting the `diag-switch` NVRAM variable to true and then power cycling the system.

To set the `diag-switch` NVRAM variable to true and power cycle the system:

1. **At the system prompt, enter: `setenv diag-switch? true`. Verify the prompt, `diag-switch? true`, is displayed**
2. **At the Sun type-5 keyboard, power cycle the system by simultaneously pressing the shift key and the power-on key (Figure 2-1). After a few seconds, press the power-on key.**
3. **Verify the following:**
 - a. **The display prompt disappears.**
 - b. **The monitor power-on indicator flashes on and off.**
 - c. **The keyboard Caps Lock key indicator flashes on and off.**
4. **When the POST is complete, set the `diag-switch?` variable to false (default setting).**

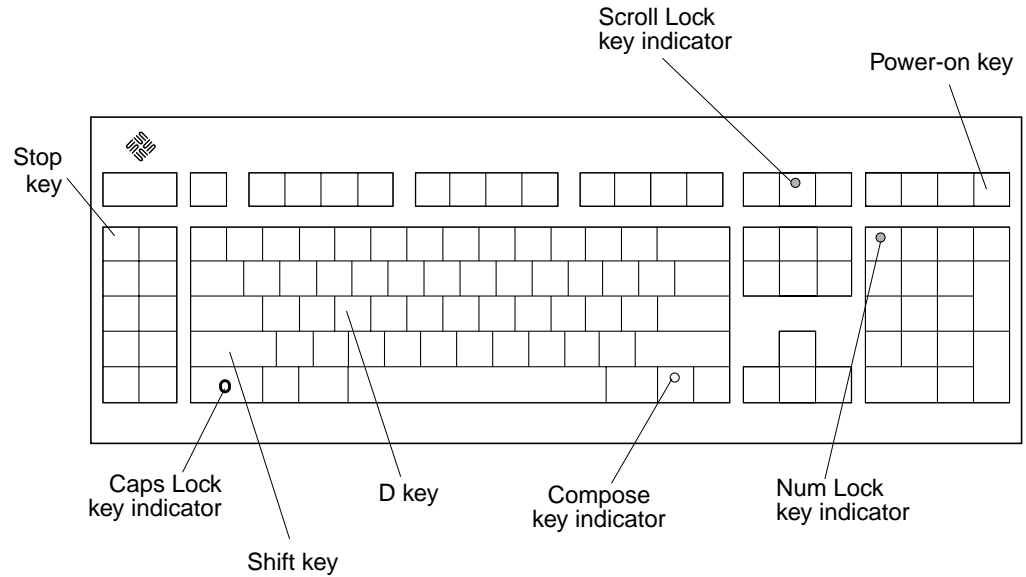


Figure 2-1 Sun Type-5 Keyboard

2.4 Max and Min Levels of POST

Two levels of POST are available: *max* (maximum level) and *min* (minimum level). The system initiates the selected level of POST based upon the setting of `diag-level`, a NVRAM variable.

The default setting for `diag-level` is *max*. An example of a *max* level POST output on serial port A is provided in Section 2.4.1, “Diag-Level NVRAM Variable Set to Max.” An example of a *min* level POST output on serial port A is provided in Section 2.4.2, “Diag-level NVRAM Variable Set to Min.”

1. To set the `diag-level` variable to *min*, enter:

```
ok setenv diag-level min
```

2. To return to the default setting:

```
ok setenv diag-level max
```

2.4.1 Diag-Level NVRAM Variable Set to Max

When the diag-level NVRAM parameter is set to *max*, POST enables an extended set of diagnostic-level tests. This mode requires approximately 2.5 minutes to complete with a dual CPU configuration or approximately 1.5 minutes to complete with a single CPU configuration. Code Example 2-1 identifies a typical serial port A POST output with the diag-level NVRAM variable set to *max*.

Note – XXXX placeholders used in table entries represent numeric values that may change without notice.

Code Example 2-1 Diag-Level NVRAM Variable Set to Max

```

ok Hardware Power ON
Button Power ON
Button Power ON

@(#)Sun Ultra 2 UPA/SBus X.X X.X FCS Test PROM Version X created
XXXX/XX/XX XX:XX
Clearing DTAGS 0000.0000.0008.0000 Done
Probing keyboard Done
%o0 = 0000.0000.0000.4001

Executing Power On SelfTest

0>@(#) Sun Ultra Enterprise 2 POST, FCS_Version XX.XX.XX X/XX/XX
XX:XX XX
0>@(#) Sun Ultra Enterprise 2 POST, FCS_Version XX.XX.XX X/XX/XX
XX:XX XX
0> UltraSparcX Version X.X
1> UltraSparcX Version X.X
0>Ecache Probe
1>Ecache Probe
0> Ecache size XXXX Kb
1> Ecache size XXX Kb
0> Ecache size XXXX Kb
1> Ecache size XXXX Kb
0>Ecache Tag Test
1>Ecache Tag Test
0>Ecache RAM Test
1>Ecache RAM Test
0>Ecache Address Line Test
1>Ecache Address Line Test
0>Initialize and Verify Ecache
1>Initialize and Verify Ecache
0>SC Initialization
0> SC_MP id=XXXX, UPA Number=X, Impl=X, Ver=X

```

Code Example 2-1 Diag-Level NVRAM Variable Set to Max (Continued)

```

0>BMX Test
0>   Checking BMX's 0>Probing Memory
0>   Found Memory Group (Variable based upon memory configuration)
0>   Found (Variable based upon memory configuration) of usable
Main Memory
0>SIMM Group      Base Addr      Size      Group Status
0>  0              00000000.00000000 08000000 00
0>  1              00000000.20000000 08000000 00
0>  2              00000000.40000000 08000000 00
0>  3              00000000.60000000 08000000 00
0>Quick Memory Test
0>Clear and Test Stack Memory
SelfTest Initializing
0>Basic CPU Test
0>   Instruction Cache Tag RAM Test
0>   Instruction Cache Instruction RAM Test
0>   Instruction Cache Next Field RAM Test
0>   Instruction Cache Pre-decode RAM Test
0>   Data Cache RAM Test
0>   Data Cache Tags Test
0>MMU Enable Test
0>   DMMU Registers Access Test
0>   DMMU TLB DATA RAM Access Test
0>   DMMU TLB TAGS Access Test
0>   IMMU Registers Access Test
0>   IMMU TLB DATA RAM Access Test
0>   IMMU TLB TAGS Access Test
0>   DMMU Init
0>   IMMU Init
0>   Mapping Selftest Enabling MMUs
0>FPU Register Test
0>   FPU Registers and Data Path Test
0>   FSR Read/Write Test
0>EPROMs Test
0>   PROM Datapath Test
0>Serial Ports Test
0>   Slavio Serial Ports Test
0>NVRAM TOD Test
0>   M48T59 (TOD) Init
0>   M48T59 (TOD) Functional Part 1 Test

```

Code Example 2-1 Diag-Level NVRAM Variable Set to Max (Continued)

```
SelfTest Initializing
1>Basic CPU Test
1>   Instruction Cache Tag RAM Test
1>   Instruction Cache Instruction RAM Test
1>   Instruction Cache Next Field RAM Test
1>   Instruction Cache Pre-decode RAM Test
1>   Data Cache RAM Test
1>   Data Cache Tags Test
1>MMU Enable Test
1>   DMMU Registers Access Test
1>   DMMU TLB DATA RAM Access Test
1>   DMMU TLB TAGS Access Test
1>   IMMU Registers Access Test
1>   IMMU TLB DATA RAM Access Test
1>   IMMU TLB TAGS Access Test
1>   DMMU Init
1>   IMMU Init
1>   Mapping Selftest Enabling MMUs
1>FPU Register Test
1>   FPU Registers and Data Path Test
1>   FSR Read/Write Test
1>Memory Test
0>Memory Test
1>   Memory Clear Test
0>   Memory Clear Test
1>   Test being relocated into Cache
0>   Test being relocated into Cache
1>   Memory RAM (blk) Test
0>   Memory RAM (blk) Test
1>   Test being relocated into Cache
0>   Test being relocated into Cache
1>   Memory Stress Test
1>   Test being relocated into Memory
0>   Memory Stress Test
0>   Test being relocated into Memory
0>   Memory Address Line Test
1>   Memory Address Line Test
0>   Test being relocated into Memory
```

Code Example 2-1 Diag-Level NVRAM Variable Set to Max (Continued)

```
0>Forcing ECC Faults Test
0>   ECC CE Pattern Test
1>CPU Speed
1>   CPU 1 Running at XXX MHZ.

1>CPU Functional Test
1>   Mapping Selftest Enabling MMUs
1>   SPARC Atomic Instructions Test
1>   CPU Dispatch Control Register Test
1>   CPU Softint Registers and Interrupts Test
1>   CPU Tick and Tick Compare Registers Test
1>   Uni-Processor Cache Coherence Test
1>   UltraSPARC-2 Prefetch Instructions Test
0>   ECC CE Check bit Test
1> *UltraSparc-1 module detected, tests skipped
1>   Processor 1 is in slave-wait phase...
0>   ECC UE Pattern Test
0>   ECC UE Check bit Test
0>SysIO Registers Test
0>   SysIO Regsiter Initialization
0>   IOMMU Registers and RAM Test
0>   Streaming Buffer Registers and RAM Test
0>   SBus Control and Config Registers Test
0>   SysIO RAM Initialization
0>SysIO Functional Test
0>   Mapping Selftest Enabling MMUs
0>   Clear Interrupt Map and State Registers
0>   SysIO Interrupts Test
0>   SysIO Timers/Counters Test
0>   IOMMU Virtual Address TLB Tag Compare Test
0>   Streaming Buffer Flush Test
0>   DMA Merge Buffer Test
0>CPU Speed
0>   CPU 0 Running at XXX MHZ.
0>Ecache Stress Test
0>   Ecache Stress Test
0>APC Test
0>   APC Registers Tests Test
0>   APC DVMA Test
```

Code Example 2-1 Diag-Level NVRAM Variable Set to Max (Continued)

```
0>Data Cache Test
0>   Dcache Init
0>   Dcache Enable Test
0>   Dcache Functionality Test

0>FEPS Test
0>   Parallel Port Registers Test
0>     Parallel Port ID is: XxX
0>   Parallel Port DVMA burst mode read/write Test
0>   FAS366 Registers Test
0>   ESP FAS366 DVMA burst mode read/write Test
0>   FEPS Internal Loopbacks Test
0>   Ethernet Transceiver Internal Loopbacks Test
0>CPU Functional Test
0>   Mapping Selftest Enabling MMUs
0>   SPARC Atomic Instructions Test
0>   CPU Dispatch Control Register Test
0>   CPU Softint Registers and Interrupts Test
0>   CPU Tick and Tick Compare Registers Test
0>   Uni-Processor Cache Coherence Test
0>   UltraSPARC-2 Prefetch Instructions Test
0>     *UltraSparc-1 module detected, tests skipped
0>Cross Calls Test (Dual CPU configuration only)
0>   Cross Calls Test
0>Cache Coherency Test
0>   Multi-Processor Cache Coherence Test
0>

    << POST COMPLETE(0) >>
```


2.4.2 Diag-level NVRAM Variable Set to Min

When the `diag-level` NVRAM parameter is set to `min`, POST enables an abbreviated set of diagnostic-level tests. This mode requires approximately 1.5 minutes to complete with a dual CPU configuration; or approximately 30 seconds to complete with a single CPU configuration. Code Example 2-2 identifies a serial port A POST output with the `diag-level` NVRAM variable set to `min`.

Note – XXXX placeholders used in table entries represent numeric values that may change without notice.

Code Example 2-2 Diag-Level NVRAM variable Set to Min

```
Hardware Power ON
Button Power ON
Button Power ON

@(#) Sun Ultra 2 UPA/SBus X.X X.X FCS Test PROM Version Xcreated
XXXX/XX/XX XX:XX
Clearing DTAGS 0000.0000.0008.0000 Done
Probing keyboard Done
%o0 = 0000.0000.0000.2001

Executing Power On SelfTest

0>@(#) Sun Ultra Enterprise 2 POST, FCS_Version XX.XX.XX
X/XX/XXXX XX:XX XX
1>@(#) Sun Ultra Enterprise 2 POST, FCS_Version XX.XX.XX
X/XX/XXXX XX:XX XX
0> UltraSparcX Version X.X
1> UltraSparcX Version X.X
0 << POST COMPLETE(0) >>

Power On Selftest Completed
      Status = 0000.0000.0000.0000 0000.XXXX.XXXX.XXXX
XXXX.XXXX.XXXX.XXXX

Software Power ON
```

2.5 *POST Progress and Error Reporting*

While POST is initialized, the Caps Lock key on the Sun type-5 keyboard flashes on and off to indicate that POST tests are being executed. Additional POST progress indications are also visible when a TTY-type terminal or a tip line is connected between serial port B (default port) of the system being tested and a POST monitoring system.

If an error occurs during the POST execution, the keyboard Caps Lock key indicator stops flashing and an error code is displayed using the Caps Lock, Compose, Scroll Lock, and Num Lock key indicators. The error code indicates a particular system hardware failure.

Note – An error code may only be visible for a few seconds. Observe the Caps Lock, Compose, Scroll Lock, and Num Lock key indicators closely while POST is active.

In most cases, POST also attempts to send a failure message to the POST monitoring system. Code Example 2-3 identifies the typical appearance of a failure message. If a keyboard error code is displayed, determine the meaning of the error code by comparing the keyboard error code pattern to the corresponding error code meaning listed in Table 2-2 on page 2-17.

Note – The system does not automatically boot if a POST error occurs; it halts at the `ok` prompt to alert the user of a failure.

Code Example 2-3 Typical Error Code Failure Message

```
Power On Self Test Failed.  
Cause: SIMM U0701 or System Board  
ok
```

2.6 Bypassing POST

POST may be disabled and thereby bypassed. To bypass POST:

1. Prior to powering on the system, press and hold the Stop and D keys on the Sun type-5 keyboard.
2. With the Stop and D keys pressed, turn on the system by pressing the power-on key (Figure 2-1 on page 2-6).

2.7 Additional Keyboard Control Commands

- Stop Key
If the `diag-switch?` variable is set to `true` and POST is not to be executed when the system is powered on, press and hold the keyboard Stop key and press the keyboard power-on key.
- Stop and N Keys
If the system NVRAM parameters are set to the original default settings, press and hold the Stop and N keys before powering on the system. Continue to hold the Stop and N keys until the system banner appears on the monitor.

2.8 System and Keyboard LEDs

The power LED, located at the chassis front, remains lighted when the system is operating normally. Figure 2-2 shows the location of the power LED.

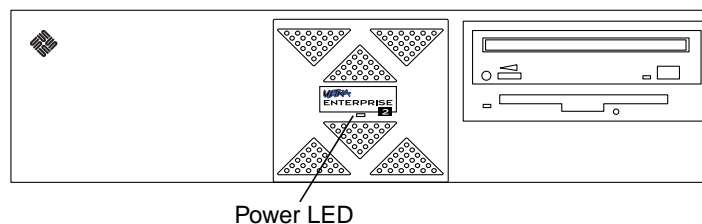


Figure 2-2 Power LED

Keyboard light emitting diode (LED) patterns are activated as a result of POST. While POST is being executed, the Caps Lock key LED blinks and the remaining LEDs are off. If POST detects an error, a pattern is encoded in the LEDs to indicate the failure. If the POST detects no errors, all LEDs turn off before returning to the OpenBoot PROM (OBP) banner.

Figure 2-3 shows the location of the LED keys on the Sun type-5 keyboard. Table 2-2 defines the keyboard LED patterns.

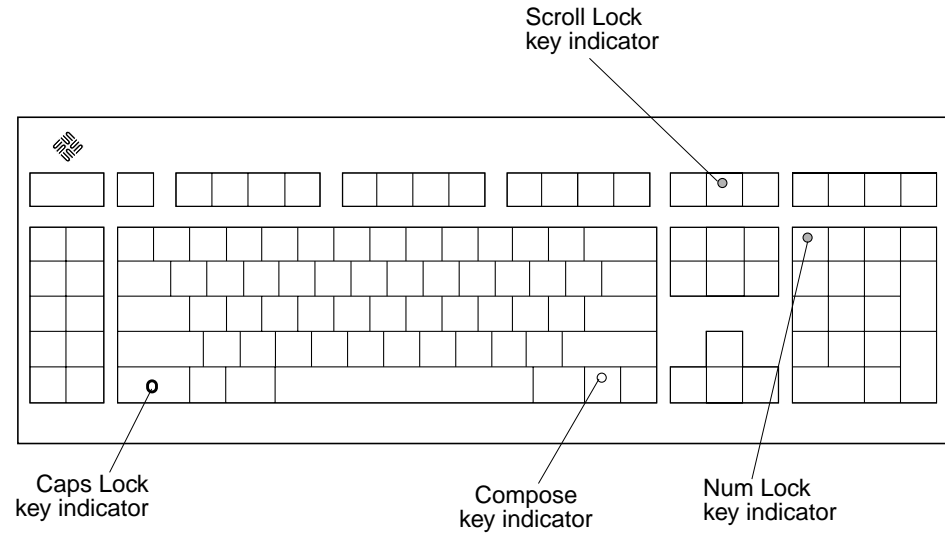


Figure 2-3 Sun Type-5 Keyboard LEDs

Table 2-2 Keyboard LED Patterns

Caps Lock	Compose	Scroll Lock	Num Lock	Bit Value	Meaning of Pattern
Blink	Off	Off	Off	x000 ₍₂₎	POST in progress
Off	Off	Off	Off	0000 ₍₂₎	POST successfully completed
Off	Off	Off	On	0001 ₍₂₎	DSIMM in slot U 0401/0501 failed
Off	Off	On	Off	0010 ₍₂₎	DSIMM in slot U 0601/0701 failed
Off	Off	On	On	0011 ₍₂₎	DSIMM in slot U 0402/0502 failed
Off	On	Off	Off	0100 ₍₂₎	DSIMM in slot U 0602/0702 failed
Off	On	Off	On	0101 ₍₂₎	DSIMM in slot U 0403/0503 failed
Off	On	On	Off	0110 ₍₂₎	DSIMM in slot U 0603/0703 failed
Off	On	On	On	0111 ₍₂₎	DSIMM in slot U 0404/0504 failed
On	Off	Off	Off	1000 ₍₂₎	DSIMM in slot U 0604/0704 failed
On	Off	Off	On	1001 ₍₂₎	System board failed
On	Off	On	Off	1010 ₍₂₎	No memory found
On	Off	On	On	1011 ₍₂₎	Reserved
On	On	Off	Off	1100 ₍₂₎	Reserved
On	On	Off	On	1101 ₍₂₎	Reserved
On	On	On	Off	1110 ₍₂₎	Bad CPU0
On	On	On	On	1111 ₍₂₎	Bad CPU1

2.9 System Board Test

To initialize the POST system board test:

1. **At the Sun type-5 keyboard:**
 - a. **Simultaneously press and hold the Stop and D keys.**
 - b. **While holding the Stop and D keys, press the power-on key.**
2. **Verify the keyboard LEDs light to confirm the system is in the POST mode and the keyboard Caps Lock key LED flashes on and off to indicate the system has enabled the POST.**
3. **If a failure occurs during POST, a keyboard key LED other than the Caps Lock key LED may light, indicating a failed system component (refer to Section 2.8, “System and Keyboard LEDs.”)**
4. **If the Caps Lock key LED fails to flash after the Stop and D keys are pressed, POST has failed (refer to Section 2.8, “System and Keyboard LEDs.”)**

Note – The most probable cause of this type of failure is the system board. However, optional system components could also cause POST to fail.

5. **Before replacing the system board, remove any optional components such as SBus cards and memory, and repeat the POST.**

Note – Non-optional components such as: four DSIMMs in slots U401, U501, U601, and U701; CPU module 0; the system board; the power supply; and the keyboard must be installed for POST to execute properly. Removing the optional system components and retesting the system isolates the possibility that those components are the cause of the failure.

6. **To receive additional POST failure information, establish a tip connection (Section 2.2.1, “Setting Up a Tip Connection.”)**

Troubleshooting Procedures



This chapter describes how to troubleshoot possible problems and includes suggested corrective actions.

<i>Power-On Failure</i>	<i>page 4-2</i>
<i>Video Output Failure</i>	<i>page 4-3</i>
<i>Disk or CD-ROM Drive Failure</i>	<i>page 4-3</i>
<i>Power Supply Test</i>	<i>page 4-5</i>
<i>DSIMM Failure</i>	<i>page 4-9</i>
<i>OpenBoot PROM On-Board Diagnostics</i>	<i>page 4-11</i>

4.1 Power-On Failure

The following provides examples of power-on failure symptoms and suggested actions.

Symptom

The system unit does not power up when the keyboard power switch is pressed.

Action

Check the AC power cord. Ensure that the AC power cord is properly connected to the system unit and to the wall receptacle. Verify that the wall receptacle is supplying AC power to the system.

Press the power switch at the rear of the system unit. If the system powers on, the keyboard may be defective or the system unit is unable to accept the keyboard power-on signal. Power off the system unit and press the keyboard power-on switch again. If the system unit powers on, no further action is required. If the system unit does not power on, the keyboard may be defective. Connect a spare Sun type-5 keyboard to the system unit and press the *power-on* key.

If the wall receptacle AC power has been verified and the system unit does not power up, the system unit power supply may be defective. See Section 4.4, “Power Supply Test.”

Symptom

The system unit attempts to power up but does not boot or initialize the monitor.

Action

Press the power-on switch and watch the keyboard. You should see the keyboard LEDs light briefly and hear a tone from the keyboard. If you do not hear a tone or if the keyboard LEDs do not light briefly, the system unit power supply may be defective. See Section 4.4, “Power Supply Test.” If you hear a keyboard tone and see the keyboard LEDs light briefly but the system unit still fails to initialize, refer to Section 3.9, “System Board Test.”

4.2 Video Output Failure

The following provides an example of a video output failure symptom and suggested action.

Symptom

No video at the system monitor.

Action

Check the AC power cord. Ensure that the AC power cord is connected to the monitor and to the wall receptacle. Verify that the wall receptacle is supplying AC power to the monitor. Check the video cable connection between the monitor and the system unit graphics card output port at the rear of the system unit. If the AC connection to the monitor is correct and the video cable is correctly connected, the system monitor or the system unit graphics card may be defective. Replace the monitor or the graphics card.

4.3 Disk or CD-ROM Drive Failure

The following provides examples of disk drive and CD-ROM drive failure symptoms and suggested actions.

Symptom

- A disk drive read, write, or parity error is reported by the operating system or customer application.
- A CD-ROM drive read error or parity error is reported by the operating system or customer applications.

Action

Replace the drive indicated by the failure message. The operating system identifies the internal drives as identified in Table 4-1.

Table 4-1 Identification of Internal Drives

Operating System Address	Drive Physical Location and Target
c0t0d0s#	SCSI Disk, target 0
c0t1d0s#	SCSI Disk, target 1
c0t6d0s#	CD-ROM drive, target 6

Note – The # symbol in the examples may be a number between 0 and 7 that describes the slice or partition on the drive.

Symptom

Disk drive or CD-ROM drive fails to boot or is not responding to commands.

Action

A defective system SCSI controller. Test the drive response to the `probe-scsi` command as follows:

1. **At the system `ok` prompt:**
 - a. Enter `reset-all`.
 - b. Enter `probe-scsi`.
2. **If the disk drive responds correctly to `probe-scsi`, the message identified in Code Example 4-4 on page 4-14 appears.**

If the drives respond and a message is displayed, the system SCSI controller has successfully probed the devices. This is an indication that the system board is operating correctly. If one drive does not respond to the SCSI controller probe but the others do, replace the unresponsive drive.

If one internal disk drive is configured with the system and the `probe-scsi` test fails to show the device in the message, replace the drive. If the problem is still evident after replacing the drive, replace the system board. If replacing both the disk drive and the system board does not correct the problem, replace the internal disk drive cable and SCSI backplane assembly.

4.4 Power Supply Test

The following provides instructions to test the power supply.

Note – Figure 4-1 and Table 4-2 identify power supply connector J3203. Figure 4-2 and Table 4-3 identify power supply connector J3204. Figure 4-3 and Table 4-4 identify power supply connector J3205. Figure 4-4 and Table 4-5 identify power supply connector J3206.

- 1. Using a volt-ohm-milliammeter (VOM), check the power supply output voltages as follows:**

Note – Power supply connectors J3203 through J3206 must remain connected to the system board.

- a. With the negative probe of the VOM meter placed on the ground (Gnd) pin, position the positive probe on each power pin.**
- b. Verify +12 VDC, -12 VDC, +5 VDC, +3.3 VDC and +3.0 VDC.**
- c. If any power pin signal is not present with the power supply active and properly connected to the system board, replace the power supply.**

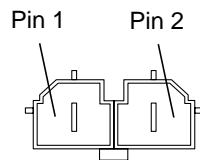


Figure 4-1 Power Supply Connector J3203

Table 4-2 Connector J3203 Pin Description

Pin	Description
1	+3.3 VDC (A) ¹
2	Return

1. +3.0 VDC (A) is a variable value dependent upon the CPU module type. Nominal value is 3.3 VDC. With CPU module absent, variable value is < 0.5 VDC.

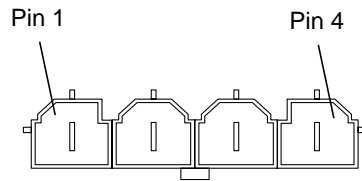


Figure 4-2 Power Supply Connector J3204

Table 4-3 Connector J3204 Pin Description

Pin	Description
1	+3.0 VDC (B) ¹
2	Return +3.0 VDC (B)
3	+5.0 VDC
4	Return +5.0 VDC

1. +3.0 VDC (B) is a variable value dependent upon the CPU module type. Nominal value is 3.3 VDC. With CPU module absent, variable value is < 0.5 VDC.

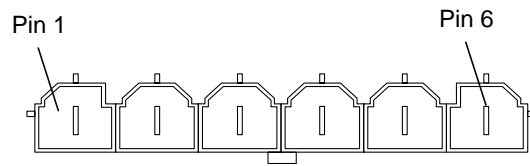


Figure 4-3 Power Supply Connector J3205

Table 4-4 Connector J3205 Pin Description

Pin	Description
1	+3.3 VDC
2	+3.3 VDC
3	+3.3 VDC
4	Return
5	Return
6	Return

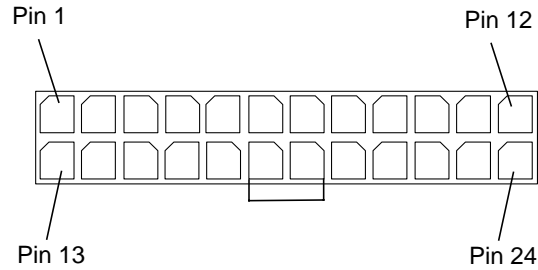


Figure 4-4 Power Supply Connector J3206

Table 4-5 Connector J3206 Pin Description

Pin	Description	Pin	Description
1	+3.0 VDC (A) Sense	13	+3.0 VDC (A) -Sense
2	+3.0 VDC (A) VPROG	14	+3.0 VDC (A) Ovp Prog
3	+3.0 VDC (B) Sense	15	+3.0 VDC (B) -Sense
4	+3.0 VDC (A) VPROG	16	+3.0 VDC (B) Ovp Prog
5	Fan Speed	17	Power On Reset
6	+3.3 VDC +Sense	18	+3.3 -Sense
7	+5.0 VDC +Sense	19	+5.0 -Sense
8	+12.0 VDC	20	Return
9	+12.0 VDC	21	Return
10	-12.0 VDC	22	Interlock
11	On	23	Off
12	Temp Sense	24	Temp Sense

4.5 DSIMM Failure

At times the operating system, diagnostic program, or POST may not display a DSIMM location (U number) as part of a memory error message. In this situation, the only available information is a physical memory address and failing byte (or bit). Table 4-6 lists the necessary information to locate a defective DSIMM.

Table 4-6 DSIMM Memory Address Map

DSIMM Number	DSIMM Type	Address Range (Physical Address [30:0])
0	16 Mbyte	0x0000_0000 to 0x03ff_ffff (first double word)
0	32 Mbyte	0x0000_0000 to 0x07ff_ffff (first double word)
0	64 Mbyte	0x0000_0000 to 0x0fff_ffff (first double word)
0	128 Mbyte	0x0000_0000 to 0x1fff_ffff (first double word)
1	16 Mbyte	0x0000_0000 to 0x03ff_ffff (second double word)
1	32 Mbyte	0x0000_0000 to 0x07ff_ffff (second double word)
1	64 Mbyte	0x0000_0000 to 0x0fff_ffff (second double word)
1	128 Mbyte	0x0000_0000 to 0x1fff_ffff (second double word)
2	16 Mbyte	0x2000_0000 to 0x23ff_ffff (first double word)
2	32 Mbyte	0x2000_0000 to 0x27ff_ffff (first double word)
2	64 Mbyte	0x2000_0000 to 0x2fff_ffff (first double word)
2	128 Mbyte	0x2000_0000 to 0x3fff_ffff (first double word)
3	16 Mbyte	0x2000_0000 to 0x23ff_ffff (second double word)
3	32 Mbyte	0x2000_0000 to 0x27ff_ffff (second double word)
3	64 Mbyte	0x2000_0000 to 0x2fff_ffff (second double word)
3	128 Mbyte	0x2000_0000 to 0x3fff_ffff (second double word)

Table 4-6 DSIMM Memory Address Map (Continued)

DSIMM Number	DSIMM Type	Address Range (Physical Address [30:0])
4	16 Mbyte	0x4000_0000 to 0x43ff_ffff (first double word)
4	32 Mbyte	0x4000_0000 to 0x47ff_ffff (first double word)
4	64 Mbyte	0x4000_0000 to 0x4fff_ffff (first double word)
4	128 Mbyte	0x4000_0000 to 0x5fff_ffff (first double word)
5	16 Mbyte	0x4000_0000 to 0x43ff_ffff (second double word)
5	32 Mbyte	0x4000_0000 to 0x47ff_ffff (second double word)
5	64 Mbyte	0x4000_0000 to 0x4fff_ffff (second double word)
5	128 Mbyte	0x4000_0000 to 0x5fff_ffff (second double word)
6	16 Mbyte	0x6000_0000 to 0x63ff_ffff (first double word)
6	32 Mbyte	0x6000_0000 to 0x67ff_ffff (first double word)
6	64 Mbyte	0x6000_0000 to 0x6fff_ffff (first double word)
6	128 Mbyte	0x6000_0000 to 0x7fff_ffff (first double word)
7	16 Mbyte	0x6000_0000 to 0x63ff_ffff (second double word)
7	32 Mbyte	0x6000_0000 to 0x67ff_ffff (second double word)
7	64 Mbyte	0x6000_0000 to 0x6fff_ffff (second double word)
7	128 Mbyte	0x6000_0000 to 0x7fff_ffff (second double word)

Each bank listed in Table 4-6 (Bank 0, Bank 1, Bank 2, and Bank 3) allows enough address space to accommodate four 16-Mbyte, four 32-Mbyte, four 64-Mbyte, or four 128-Mbyte DSIMMs. Unused addresses are mapped by the memory management hardware. Regardless of the installed DSIMM capacity, the memory starting address is as listed in Table 4-6.

4.6 OpenBoot PROM On-Board Diagnostics

The following sections describe the OpenBoot PROM (OBP) on-board diagnostics. To execute the OBP on-board diagnostics, the system must be at the `ok` prompt. The OBP on-board diagnostics are listed as follows:

<i>watch-clock</i>	<i>page 4-11</i>
<i>watch-net</i>	<i>page 4-12</i>
<i>watch-net-all</i>	<i>page 4-12</i>
<i>probe-scsi and probe-scsi-all</i>	<i>page 4-13</i>
<i>test <Alias Name>, <Device Path>, -All</i>	<i>page 4-16</i>
<i>FFB Card</i>	<i>page 4-17</i>

4.6.1 watch-clock

`watch-clock` reads a register in the NVRAM/TOD chip and displays the result as a seconds counter. During normal operation, the seconds counter repeatedly increments from 0 to 59 until interrupted by pressing any key on the Sun type-5 keyboard. Code Example 4-1 identifies the `watch-clock` output message.

Code Example 4-1 `watch-clock` Output Message

<code>ok watch-clock</code>	
Watching the 'seconds' register of the real time clock chip. Type any key to stop.	It should be 'ticking' once a second.
41	41 is an example. Counter increments from 0 to 59

4.6.2 watch-net

`watch-net` monitors Ethernet packets broadcast on the Ethernet cable(s) connected to the system. Good packets received by the system are indicated by a period (.) displayed on the screen. Errors such as Framing error and Cyclic Redundancy Check (CRC) error are indicated with an X and an associated error description. Code Example 4-2 identifies the `watch-net` output message.

Code Example 4-2 watch-net Output Message

```
ok watch-net
Internal loopback test --
succeeded.
Transceiver check -- Using
Onboard Transceiver - Link up.
passed
Using Onboard Transceiver -
Link up.
Looking for Ethernet packets.
'.' is a good packet.'X' is a
bad packet.
Type any key to stop.
```

4.6.3 watch-net-all

`watch-net-all` monitors Ethernet packets on any Ethernet interface installed in the system. For example, if there is an SBus card installed in one of the system SBus slots, `watch-net-all` monitors the Ethernet transmissions occurring through that card. When the test is interrupted by pressing any key, `watch-net-all` searches to test the next Ethernet interface card installed in the system. Code Example 4-3 identifies the `watch-net-all` output message.

Code Example 4-3 watch-net-all Output Message

```
ok watch-net-all

/sbus@1f,0/SUNW, hme@e,
8c00000
Transceiver check -- Using
Onboard Transceiver - Link up.
passed
Using Onboard Transceiver -
Link up.
External loopback test --
succeeded.
Looking for Ethernet packets.
'.' is a good packet. 'X' is
a bad packet.
Type any key to stop.
```

4.6.4 *probe-scsi and probe-scsi-all*

`probe-scsi` transmits an inquiry command to internal and external SCSI devices connected to the Ultra 2 series on-board SCSI interface. If the SCSI device is connected and active, the target address, unit number, device type, and manufacturer name is displayed. Code Example 4-4 identifies the `probe-scsi` output message

Code Example 4-4 probe-scsi Output Message

```
ok probe-scsi

This command may hang the system
if a Stop-A or halt command has
been executed. Please type reset-
all to reset the system before
executing this command.
Do you wish to continue? (y/n)      Enter n
                                     Enter reset-all
                                     Verify display blanks for
                                     approximately 5 seconds and
                                     returns to the ok prompt.

ok probe-scsi

This command may hang the system
if a Stop-A or halt command has
been executed. Please type reset-
all to reset the system before
executing this command.

Do you wish to continue? (y/n)      Enter y

Target 0                             SEAGATE ST32550W
  Unit 0   Disk                      Sun2.1G041200000000
                                     Copyright (c) 1995 Seagate
                                     All rights reserved ASA2

Target 1                             SEAGATE ST32550W
  Unit 0   Disk                      Sun2.1G041200000000
                                     Copyright (c) 1995 Seagate
                                     All rights reserved ASA2

Target 6                             TOSHIBA XM-
  Unit 0   Removable Read Only      5301TASUN4XCD173506/22/95
device
```

`probe-scsi-all` transmits an inquiry command to SCSI devices connected to the system SCSI host adapters. The first identifier listed in the display is the SCSI host adapter address in the system device tree followed by the SCSI device identification data. Code Example 4-5 identifies the `probe-scsi-all` output message.

Code Example 4-5 `probe-scsi-all` Output Message

```

ok probe-scsi-all

This command may hang the system if
a Stop-A or halt command has been
executed. Please type reset-all to
reset the system before executing
this command.
Do you wish to continue? (y/n)      Enter n
                                     Enter reset-all
                                     Verify display blanks for
                                     approximately 5 seconds
                                     and returns to the ok
                                     prompt.

ok probe-scsi-all

This command may hang the system if
a Stop-A or halt command has been
executed. Please type reset-all to
reset the system before executing
this command.
Do you wish to continue? (y/n)      Enter y
/sbus@1f,0/SUNW, fas@e, 8800000

Target 0                            SEAGATE ST32550W
  Unit 0   Disk                     Sun2.1G041200000000
                                     Copyright (c) 1995 Seagate
                                     All rights reserved ASA2

Target 1                            SEAGATE ST32550W
  Unit 0   Disk                     Sun2.1G041200000000
                                     Copyright (c) 1995 Seagate
                                     All rights reserved ASA2

Target 6                            TOSHIBA XM-
  Unit 0   Removable Read Only device 5301TASUN4XCD173506/22/95

```

4.6.5 test <Alias Name>, <Device Path>, -All

The `test` command, combined with a device alias or device path, enables a device self-test program. If a device has no self-test program, the message: *No selftest method for <device name>* is displayed. To enable the self-test program for a device, enter the `test` command followed by the device alias or device path name. Code Example 4-6 identifies the `test` output message. Table 4-7 lists `test <alias name>` selections, a description of the selection, and preparation.

Note – The floppy drive is selected as the `test <alias name>` example.

Code Example 4-6 test Output Message

```
ok test floppy

Testing floppy disk system. A
formatted disk should be in the
drive.
Test succeeded.
```

Table 4-7 Selected OBP On-Board Diagnostic Tests

Type of Test	Description	Preparation
Test screen	Tests system video graphics hardware and monitor	Diag-switch? NVRAM parameter must be true for the test to execute.
Test floppy	Tests floppy drive response to commands	A formatted diskette must be inserted into the drive.
Test net	Performs internal/external loopback test of the system auto-selected Ethernet interface	An Ethernet cable must be attached to the system and to an Ethernet tap or hub or the external loopback test fails.
Test ttya Test ttyb	Outputs an alphanumeric test pattern on the system serial ports:ttya, serial port A; ttyb, serial port B	A terminal must be connected to the port being tested to observe the output.
Test keyboard	Executes the keyboard selftest.	Four keyboard LEDs should flash once and a message is displayed: <i>Keyboard Present</i> .
Test-all	Sequentially test system-configured devices containing selftest.	Tests are sequentially executed in device-tree order (viewed with the <i>show-devs</i> command).

4.6.6 FFB Card

The FFB card contains a built-in diagnostic test that is enabled through the OBP. The FFB card built-in diagnostic test verifies basic graphics functionality without booting the operating system software.

To execute the built-in diagnostic test, the system must be at the OBP monitor ok prompt.

To activate the FFB card diagnostic:

1. Enter `setenv diag-switch? true` at the ok prompt. The `diag-switch? = true` prompt and the ok prompt are displayed.

Note – If the FFB card is being used as the system display device, perform Steps 2 and 4. If the FFB card is not being used as the system display device, perform Steps 3 and 4.

2. Enter test screen at the ok prompt.

```
Verifying Console Mode for Frame Buffer Board  
This will take a few minutes.
```

```
Verifying Frame Buffer Memory used for console mode  
This will take about two minutes.
```

- a. A series of patterns are displayed.**
- b. FFB Frame Buffer functional test passed appears.**

3. Enter test /SUNW,ffb at the ok prompt.

```
Verifying Console Mode for Frame Buffer Board  
This will take a few minutes.
```

```
Verifying Frame Buffer Memory used for console mode  
This will take about two minutes.
```

- a. A series of patterns are displayed.**
- b. FFB Frame Buffer functional test passed appears.**

4. When the FFB on-board diagnostics are completed, enter setenv diag-switch? false. The diag-switch? = false is displayed.

Part 3 — Preparing for Service

<i>Safety and Tool Requirements</i>	<i>page 5-1</i>
<i>Powering On and Off</i>	<i>page 6-1</i>

Safety and Tool Requirements

This chapter provides a description of safety requirements, symbols, safety precautions, and tools required.

<i>Safety Requirements</i>	<i>page 5-2</i>
<i>Symbols</i>	<i>page 5-2</i>
<i>Safety Precautions</i>	<i>page 5-3</i>
<i>Tools Required</i>	<i>page 5-5</i>

5.1 Safety Requirements

Before servicing any part of the Ultra 2 series system or server units, read the instructions and cautions in this section. This information explains how to work safely when servicing a Sun Microsystems product. For protection, observe the following safety precautions when setting up the equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Ensure that the voltages and frequency rating of the power receptacle match the electrical rating label on the equipment.
- Never push objects of any kind through openings in the equipment. They may touch dangerous voltage points or short components, resulting in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

5.2 Symbols

The following symbols mean:



Caution – Risk of personal injury and equipment damage. Follow the instructions.



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



Caution – Hot surfaces. Avoid contact. Surfaces are hot and may cause personal injury if touched.

5.3 Safety Precautions

The following safety precautions mean:

5.3.1 Modification to Equipment



Caution – Do not make mechanical or electrical modifications to the equipment. Sun Microsystems Incorporated is not responsible for regulatory compliance of a modified Sun product.

5.3.2 Placement of a Sun Product



Caution – To ensure reliable operation of the Sun product and to protect it from overheating, openings in the equipment must not be blocked or covered. A Sun product should never be placed near a radiator or hot air register.

5.3.3 Power Cord Connection



Warning – Not all power cords have the same current ratings. Household extension cords do not have overload protection. Do not use household extension cords with the Sun product.



Warning – The power switch of this product functions as a standby type device only. The power cord serves as the primary disconnect device for the system. Be sure to connect the power cord into a grounded electrical receptacle that is nearby the system and is readily accessible. Do not connect the power cord when the power supply has been removed from the system chassis.

5.3.4 *Electrostatic Discharge*



Caution – The system board and disk drives contain electrical components that are extremely sensitive to static electricity. Use proper ESD grounding techniques when handling components. Wear an antistatic wriststrap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing it on any surface.



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

5.3.5 *Lithium Battery*



Caution – On Sun system boards, a lithium battery is molded into the real-time clock, SDS No. M48T59Y, MK48TXXB-XX, M48T18-XXXPCZ or M48T59W-XXXPCZ. Batteries are not customer replaceable parts. They may explode if mistreated. Do not dispose of the battery in fire. Do not disassemble it or attempt to recharge it.

5.4 *Tools Required*

The following tools are required to service the Ultra 2 series desktop workstation and the Ultra Enterprise 2 server.

- Phillips screwdriver
- Long-nose plier
- Grounding wrist strap
- Volt-ohm-milliammeter (VOM)
- Antistatic surface

Place ESD-sensitive components such as system board, circuit cards, disk drives, and TOD/NVRAM on an antistatic surface. The following items can be used as an antistatic surface:

- Bag used to wrap a Sun replacement part
- Shipping container used to package a Sun replacement part
- Inner side (metal part) of the system unit cover
- Sun ESD mat, part no. 250-1088 (may be purchased through your Sun sales representative)
- Disposable ESD mat; shipped with replacement parts or optional system features

<i>Powering On the System</i>	<i>page 6-1</i>
<i>Powering Off the System</i>	<i>page 6-2</i>

6.1 Powering On the System

To power-on the system, proceed as follows.

1. Turn on power to all connected peripherals.

Note – Peripheral power is activated prior to system power so the system can recognize the peripherals when it is activated.

2. Set the power on/standby switch to the on (I) position (Figure 6-1) or press the Sun Type-5 keyboard power-on key (Figure 6-2).

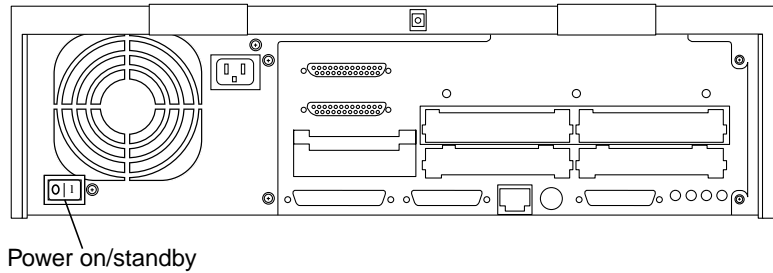


Figure 6-1 Rear View of the System

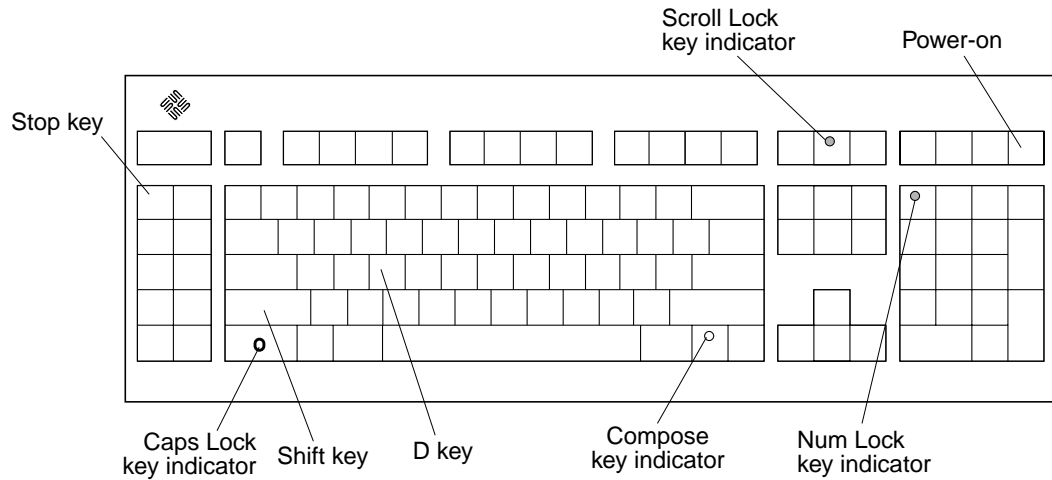


Figure 6-2 Sun Type-5 Keyboard

6.2 Powering Off the System

To power-off the system, proceed as follows.

Caution – Prior to turning off the system power, exit from the operating system. Failure to do so may result in loss of data.

1. **Notify users that the system is going down.**
2. **Back up system files and data.**

3. **Halt the system.**
4. **Set the power on/standby switch to the stand-by (O) position (Figure 6-1) or press the Sun Type-5 keyboard power-on key (Figure 6-2).**
5. **Verify the following:**
 - a. **Front panel LED is extinguished.**
 - b. **System fans are disabled.**



Warning – When the power on/standby switch is in stand-by (0) and the AC power cord remains connected to a power receptacle, AC voltage is present in the power supply primary.



Caution – Disconnect the AC power cord from the AC receptacle prior to handling the power supply. When servicing system components other than the power supply, the AC power cord should remain connected to the AC receptacle.

6. **Turn off the power to the monitor.**
7. **Disconnect cables to any external units.**

Part 4 — Subassembly Removal and Replacement

<i>Internal Access</i>	<i>page 7-1</i>
<i>Major Subassemblies</i>	<i>page 8-1</i>
<i>Storage Devices</i>	<i>page 9-1</i>

Internal Access



This chapter explains how to remove the cover, attach the wrist strap, and replace the cover.

<i>Removing the Cover</i>	<i>page 7-2</i>
<i>Attaching the Wrist Strap</i>	<i>page 7-3</i>
<i>Replacing the Cover</i>	<i>page 7-4</i>

7.1 Removing the Cover

To remove the cover:

1. **Power-off the system.**
2. **Loosen the screw securing the lock block (if installed) to the cover and back panel. Remove the lock block (Figure 7-1).**
3. **Pull the two top cover tabs to free the cover from the back panel.**
4. **Grasp the sides of the cover and proceed as follows:**
 - a. **Lift the cover from the back panel (Figure 7-2).**
 - b. **When the cover clears the back panel, move the cover away from the front panel to free it from the chassis and set aside.**

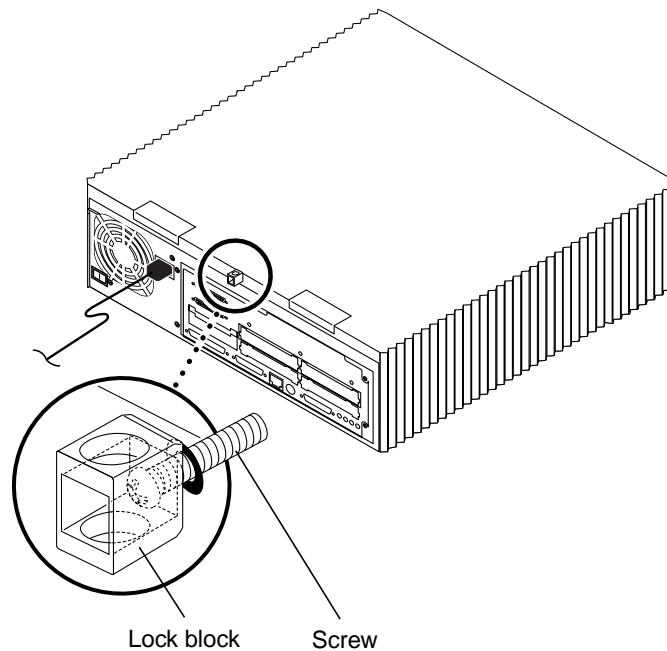


Figure 7-1 Location of Lock Block

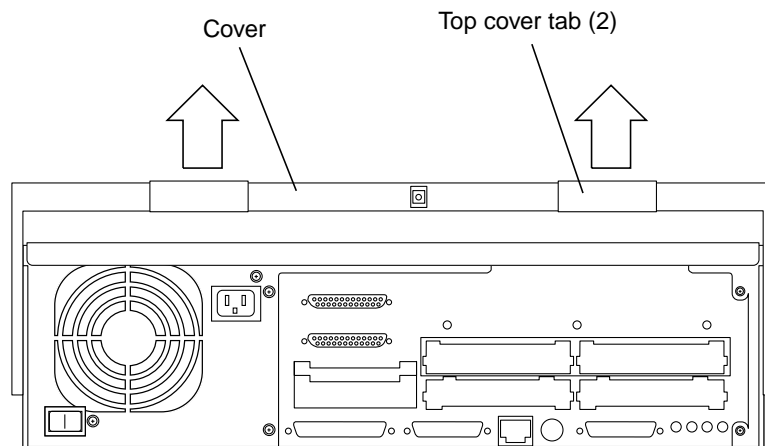


Figure 7-2 Removing the Cover

7.2 Attaching the Wrist Strap



Caution – Wear an antistatic wrist strap and use an ESD-protected mat when handling components. When removing components other than the power supply, leave the power cord connected to both the system/server unit and the wall receptacle. When removing the power supply, attach the copper end of the wrist strap to the system/server unit chassis, vice power supply. Store ESD-sensitive components in antistatic bags before placing it on any surface.

To attach the wrist strap:

1. Unwrap the first two folds of the wrist strap and wrap the adhesive side firmly against the wrist (Figure 7-3).
2. Peel the liner from the copper foil at the opposite end of the wrist strap. Attach the copper end of the wrist strap to the power supply top.

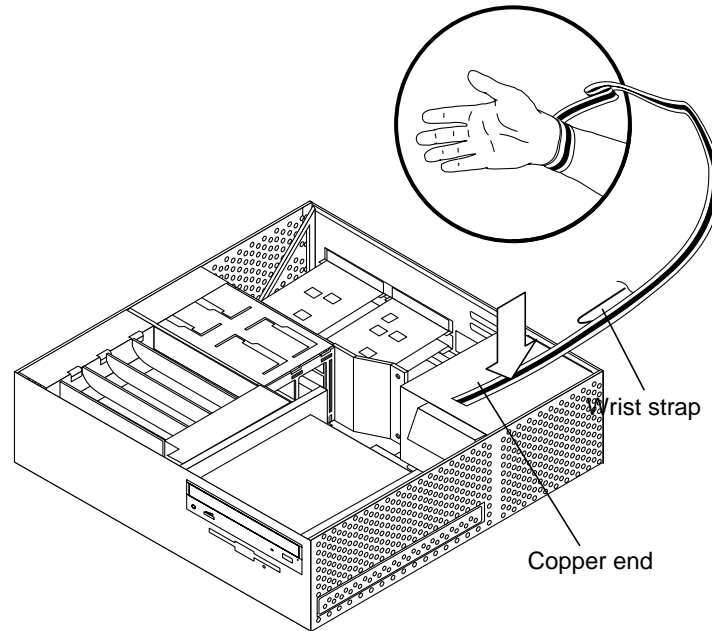


Figure 7-3 Attaching the Wrist Strap

7.3 Replacing the Cover

To replace the cover:

1. Hold the cover at a 30-degree angle to the system unit.
2. Position the cover lip to the chassis lip.
3. Lower the cover onto the system unit so that the rear of the cover is supported by the chassis back panel (Figure 7-4).
4. Press down on both sides of the cover near the front edges until it firmly seats with the chassis back panel.
5. Press the tabs near the back panel.

6. Position the lock block. Tighten the screw securing the lock block to the cover and back panel.
7. Power-on the system.

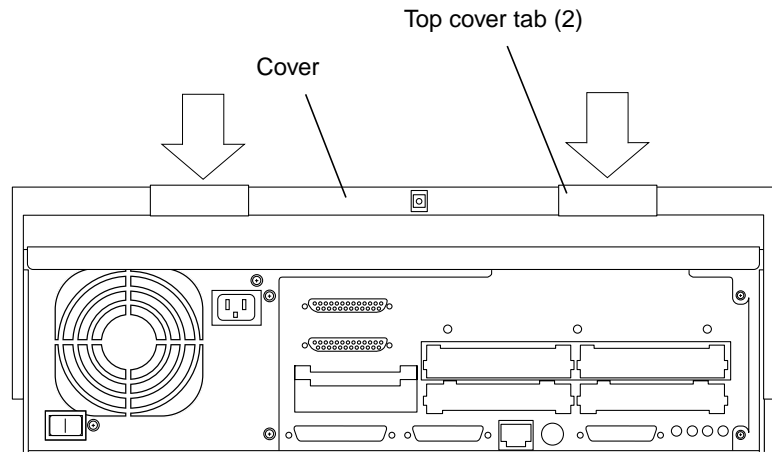


Figure 7-4 Replacing the Cover

Major Subassemblies



This chapter contains procedures to remove and replace the major subassemblies of the system and server units. The following is the list of the major subassemblies:

<i>Power Supply</i>	<i>page 7-2</i>
<i>SCSI Cable</i>	<i>page 7-5</i>
<i>Diskette Drive Cable</i>	<i>page 7-7</i>

7.1 Power Supply

To remove and replace the power supply, proceed as follows.

7.1.1 Removing the Power Supply

To remove the power supply:

1. **Power-off the system.**
2. **Remove the system unit cover.**



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

3. **Attach the wrist strap.**
4. **Disconnect the AC power cord from the system.**
5. **Disconnect the power supply connector J5 from the CD-ROM drive (or 4-mm/8-mm tape drive).**

Note – When disconnecting the power supply connectors, use thumb to press the retention latch on the connector shell.

6. **Disconnect the power supply connector J6 from the diskette drive.**
7. **Disconnect the following power supply connectors from the system board (Figure 7-1).**
 - J1 from J3206
 - J2 from J3205
 - J3 from J3203
 - J4 from J3204
8. **Loosen the two captive screws securing the power supply to the back panel.**

9. Push the power supply toward the chassis front to disengage the mounting hooks.
10. Tilt the power supply slightly toward the system board; lift the power supply from the chassis.

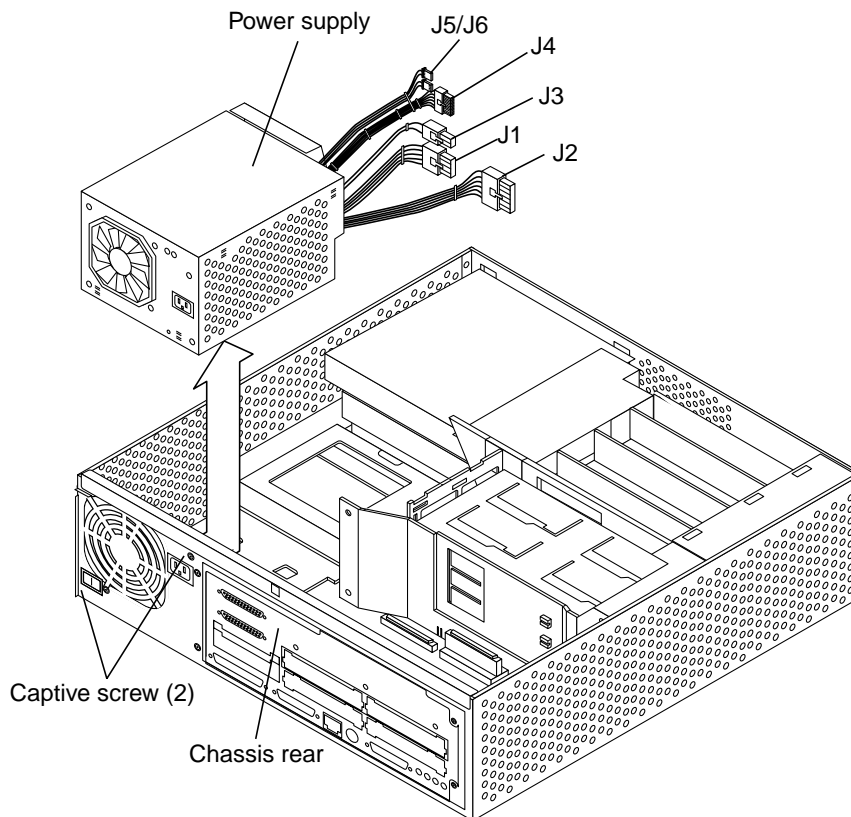


Figure 7-1 Removing the Power Supply

7.1.2 Replacing the Power Supply

To replace the power supply:



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

1. **Position the power supply into the chassis.**
2. **Push the power supply toward the chassis rear, engaging the mounting hooks.**

Note – Ensure that the hooks located on the chassis base engage with the cutouts located on the bottom of the power supply.

3. **Tighten the captive screws securing the power supply to the back panel.**
4. **Connect the following power supply connectors to the system board (Figure 8-2):**
 - J4 to J3204
 - J3 to J3203
 - J2 to J3205
 - J1 to J3206
5. **Connect the power supply connector J6 to the diskette drive.**
6. **Connect the power supply connector J5 to the CD-ROM drive (or 4-mm/8-mm tape drive).**
7. **Detach the wrist strap.**
8. **Replace the system unit cover.**
9. **Power-on the system.**

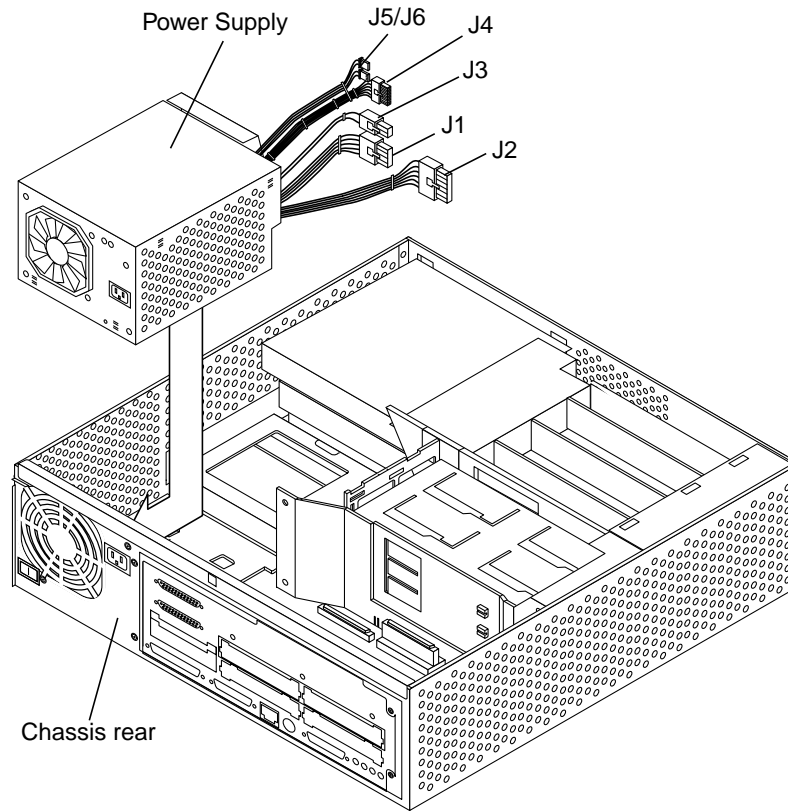


Figure 7-2 Replacing the Power Supply

7.2 SCSI Cable

To remove and replace the SCSI cable, proceed as follows.

7.2.1 Removing the SCSI Cable

To remove the SCSI cable:

1. **Power-off the system.**
2. **Remove the system unit cover.**



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

3. **Attach the wrist strap.**
4. **Disconnect the P2 connector from the CD-ROM drive.**

Note – Connector P2 may be connected to a 4-mm or 8-mm tape drive.

5. **Disconnect the P1 connector from J1202 on the system board.**
6. **Disconnect the P3 connector from J1203 on the system board.**
7. **Remove the SCSI cable.**

7.2.2 Replacing the SCSI Cable

To replace the SCSI cable:



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

1. **Position the SCSI cable.**
2. **Connect the P3 connector to J1203 on the system board.**
3. **Connect the P1 connector to J1202 on the system board.**
4. **Connect the P2 connector to the CD-ROM drive (4-mm or 8-mm tape drive).**
5. **Detach the wrist strap.**
6. **Replace the system unit cover.**
7. **Power-on the system.**

7.3 *Diskette Drive Cable*

To remove and replace the diskette drive cable, proceed as follows.

7.3.1 *Removing the Diskette Drive Cable*

To remove the diskette drive cable:

1. **Power-off the system.**
2. **Remove the system unit cover.**



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

3. **Attach the wrist strap.**
4. **Disconnect the following:**
 - a. **P2 connector from the rear of the diskette drive.**
 - b. **P1 connector from J1201 on the system board.**
5. **Remove the diskette drive cable.**

7.3.2 *Replacing the Diskette Drive Cable*

To replace the diskette drive cable:



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

1. **Position the diskette drive cable.**
2. **Connect the following:**
 - a. **P1 connector to J1201 on the system board.**
 - b. **P2 connector to the rear of the diskette drive.**

3. **Detach the wrist strap.**
4. **Replace the system unit cover.**
5. **Power-on the system.**

Storage Devices

This chapter contains procedures to remove and replace the storage devices of the system and server units. The following is the list of the storage devices and support hardware.

<i>Disk Drive</i>	<i>page 9-2</i>
<i>Media Bay Chassis Bracket</i>	<i>page 9-4</i>
<i>CD-ROM Drive or 4-mm/8-mm/2.5-Gbyte Tape Drive</i>	<i>page 9-6</i>
<i>Diskette Drive</i>	<i>page 9-7</i>

9.1 Disk Drive

To remove and replace disk drive, proceed as follows.

9.1.1 Removing a Disk Drive

To remove a disk drive:

1. **Power-off the system.**
2. **Remove the system unit cover.**



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

3. **Attach the wrist strap.**
4. **Remove the EMI door from the right side of the chassis.**
5. **Open the disk drive handle.**
6. **Fully extend the disk drive handle to disconnect the disk drive from the system.**
7. **Remove the disk drive from the chassis drive slot.**
8. **Place the disk drive on an antistatic surface.**

Note – Ensure that the disk drive is placed on the antistatic mat with the printed circuit card side up.

9.1.2 Replacing a Disk Drive

To replace a disk drive:

Note – Use only disk drives that are specifically designed for a Sun Ultra 2 series system. Sun Ultra 2 systems do not support disk drives taller than 1 inch (2.54 cm).



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

1. Remove the disk drive from the antistatic bag.

Note – Read the disk drive product guide for information about jumpers, switch settings, or other installation tasks.

Caution – Each disk drive slot has a unique SCSI target address (rear drive slot is target address 0, front drive slot is target address 1). Make note of the drive slot in which each disk drive is installed. Installing a disk drive into the incorrect drive slot could cause a file system or system boot problem.

2. Open the drive handle and proceed as follows:

- a. Slide the drive into the chassis drive slot.
- b. Firmly press the disk drive to connect it to the system.

3. Close the disk drive handle.

Note – The drive handle will not latch if the disk drive is not properly installed.

4. Replace the EMI door.

5. **Detach the wrist strap.**
6. **Replace the system unit cover.**
7. **Power-on the system.**

9.2 *Media Bay Chassis Bracket*

To remove and replace the media bay chassis bracket (chassis bracket), proceed as follows.

9.2.1 *Removing the Chassis Bracket*

To remove the chassis bracket:

1. **Power-off the system.**
2. **Remove the system unit cover.**



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

3. **Attach the wrist strap.**
4. **Remove the screws securing the drive bracket to the chassis.**
5. **Remove the DC harness from the clip located on the drive bracket.**
6. **Disconnect the DC harness from the peripheral power cable at P1.**
7. **Push the drive bracket toward the disk drive bay and gently flip it over. Place the drive bracket on top of the disk drive bay.**
8. **Disconnect the SCSI cable from the CD-ROM drive or 4-mm/8-mm tape drive.**
9. **Disconnect the peripheral power cable:**
 - a. **From the CD-ROM drive or 4-mm/8-mm tape drive (P3).**
 - b. **From the diskette drive (P2) if any.**

10. **Disconnect the diskette cable from the diskette drive (if any).**
11. **Place the bracket on an antistatic surface.**

9.2.2 *Replacing the Chassis Bracket*

To replace the chassis bracket:



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

1. **Position the drive bracket on top of the disk drive bay.**
2. **Connect the following if present:**
 - a. **SCSI cable to the CD-ROM drive or 4-mm/8-mm tape drive.**
 - b. **Diskette cable to the diskette drive.**
 - c. **Peripheral power cable to the CD-ROM drive or 4-mm/8-mm tape drive (P3) and the diskette drive (P2).**
3. **Position the bracket into the chassis.**
4. **Slide the bracket toward the chassis side opening.**

Note – Chassis base hooks must lock into the drive bracket bottom holes.

5. **Connect the DC harness to the peripheral power cable at P1.**
6. **Replace the DC harness to the clip located on the drive bracket.**
7. **Replace the screws securing the drive bracket to the chassis.**
8. **Detach the wrist strap.**
9. **Replace the system unit cover.**
10. **Power-on the system.**

9.3 *CD-ROM Drive or 4-mm/8-mm/2.5-Gbyte Tape Drive*

To remove and replace the CD-ROM drive or 4-mm/8-mm tape drive, proceed as follows.

9.3.1 *Removing a CD-ROM Drive or 4-mm/8-mm/2.5-Gbyte Tape Drive*

To remove the CD-ROM drive or 4-mm/8-mm/2.5-Gbyte tape drive:

1. **Power-off the system.**
2. **Remove the system unit cover.**



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

3. **Attach the wrist strap.**
4. **Position the bracket on a flat surface so that the CD-ROM drive or 4-mm/8-mm/2.5-Gbyte tape drive is flat.**
5. **Remove the screws securing the CD-ROM drive or 4-mm/8-mm/2.5-Gbyte tape drive to the drive bracket.**
6. **Remove the CD-ROM drive or 4-mm/8-mm/2.5-Gbyte tape drive and place aside.**

9.3.2 *Replacing a CD-ROM Drive or 4-mm/8-mm/2.5-Gbyte Tape Drive*

To replace the CD-ROM drive or 4-mm/8-mm/2.5-Gbyte tape drive:

1. **Position the CD-ROM drive or 4-mm/8-mm/2.5-Gbyte tape drive on an antistatic surface. Align the drive on the edge of the antistatic surface.**
2. **Position the bracket on top of the CD-ROM drive or 4-mm/8mm/2.5-Gbyte tape drive.**

Note – If the system has a diskette drive, it is assembled on the bracket.

3. Replace the four screws securing the CD-ROM drive or 4-mm/8-mm/2.5-Gbyte tape drive to the bracket.
4. Detach the wrist strap.
5. Replace the system unit cover.
6. Power-on the system.

9.4 Diskette Drive

To remove and replace the diskette drive, proceed as follows.

9.4.1 Removing a Diskette Drive

To remove the diskette drive:

1. Power-off the system.
2. Remove the system unit cover.



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

3. Attach the wrist strap.
4. If installed, remove the CD filler panel and the appropriate diskette filler panel.
5. Remove the screws from the system front.
6. Slide the drive bracket in; lift the drive bracket from the system.
7. Disconnect the following:
 - a. Diskette data cable end labeled P2 from the diskette drive.
 - b. Diskette data cable end labeled P1 from the system board connector J1201.
 - c. DC power cable from the diskette drive.

8. Position the drive bracket on top of a flat surface.
9. Remove the screws securing the diskette drive to the drive bracket.
10. Remove the diskette drive.

9.4.2 Replacing a Diskette Drive

To replace the diskette drive:



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

1. Remove the diskette drive from the antistatic bag.

Note – Read the disk drive product guide for information about jumpers, switch settings, or other installation tasks.

2. Replace the screws securing the diskette drive to the drive bracket.
3. Connect the DC power cable to the diskette drive.
4. Remove the diskette data cable from the kit and proceed as follows:
 - a. Connect the cable end labeled P1 to the system board connector J1201.
 - b. Connect the cable end labeled P2 to the diskette drive.
5. Lower the drive bracket into the chassis. Slide the drive bracket toward the opening.
6. Route the diskette data cable under the clip on the side of the drive bracket.
7. Replace the screws on the system front.
8. If necessary, replace the CD filler panel.

-
- 9. Detach the wrist strap.**
 - 10. Replace the system unit cover.**
 - 11. Power-on the system.**

Part 5 — System Board

System Board and Component Replacement

This chapter contains removal and replacement procedures for the system board and components of the system board. The following is a list of topics presented. In addition, procedures to remove and replace the shroud assembly speaker are also included.

<i>System Board</i>	<i>page 10-2</i>
<i>NVRAM/TOD</i>	<i>page 10-7</i>
<i>SBus Card</i>	<i>page 10-9</i>
<i>FFB Card (Workstation Only)</i>	<i>page 10-15</i>
<i>DSIMM</i>	<i>page 10-19</i>
<i>CPU Module</i>	<i>page 10-23</i>
<i>Shroud Assembly</i>	<i>page 10-26</i>
<i>Shroud Assembly Speaker</i>	<i>page 10-28</i>

10.1 System Board

To remove and replace a system board, proceed as follows.

Note – If the system board is being replaced, remove all DSIMMs and SBus card(s) prior to removing the system board. Note the chassis slot location for each DSIMM and SBus card prior to removal.

The disk drives must be disconnected from the system board prior to system board removal.

If a system board component (such as the shroud assembly) is being replaced, you do not need to remove all DSIMMs and SBus card(s) prior to removing the system board.

Note – The NVRAM/TOD clock contains the system host identification (ID) and Ethernet address. If the same ID and Ethernet address are to be used on the replacement system board, remove the NVRAM/TOD from the defective system board and install it on the replacement system board after the replacement system board is installed.

10.1.1 Removing a System Board

To remove a system board:



Caution – Use an antistatic mat when working with the system board. An antistatic mat contains the cushioning needed to protect the underside components to prevent board flexing, and to provide antistatic protection.

- 1. Power-off the system.**
- 2. Disconnect all cables, excluding the power cable, from the back of the system or server unit.**
- 3. Remove the unit cover.**
- 4. Attach a wrist strap.**



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

5. Depopulate the system board as follows:

a. Remove the following from the system board:

- NVRAM/TOD with carrier (Section 10.2.1, “Removing a NVRAM/TOD.”)
- All SBus card(s) (Section 10.3.1, “Removing an SBus Card.”)
- All DSIMMs (Section 10.5.1, “Removing a DSIMM.”)
- All CPU modules (Section 10.6.1, “Removing a CPU Module.”)
- FFB card (workstation only) (Section 10.4.1, “Removing an FFB Card.”)

b. Disconnect the following from the system board:

- SCSI cable (Section 8.2.1, “Removing the SCSI Cable.”)
- DC power cable connectors J1 from J3206, J2 from J3205, J3 from J3203, and J4 from J3204.
- Diskette drive cable (Section 8.3.1, “Removing the Diskette Drive Cable.”)
- Disk drive (Section 9.1.1, “Removing a Disk Drive.”)

6. Loosen the four captive screws securing the system board back panel to the chassis.

Note – Ensure that the hooks located on the chassis base disengage with the slots located on the bottom of the system board.

7. Disconnect the system board from the chassis by grasping the system board shroud assembly and pushing the system board forward to disengage the chassis base hooks from the system board slots.

8. Grasp the system board and lift it from the chassis (Figure 10-1).

9. Place the system board on an antistatic surface.



Caution – Handle the system board by the back panel or by the edges only.

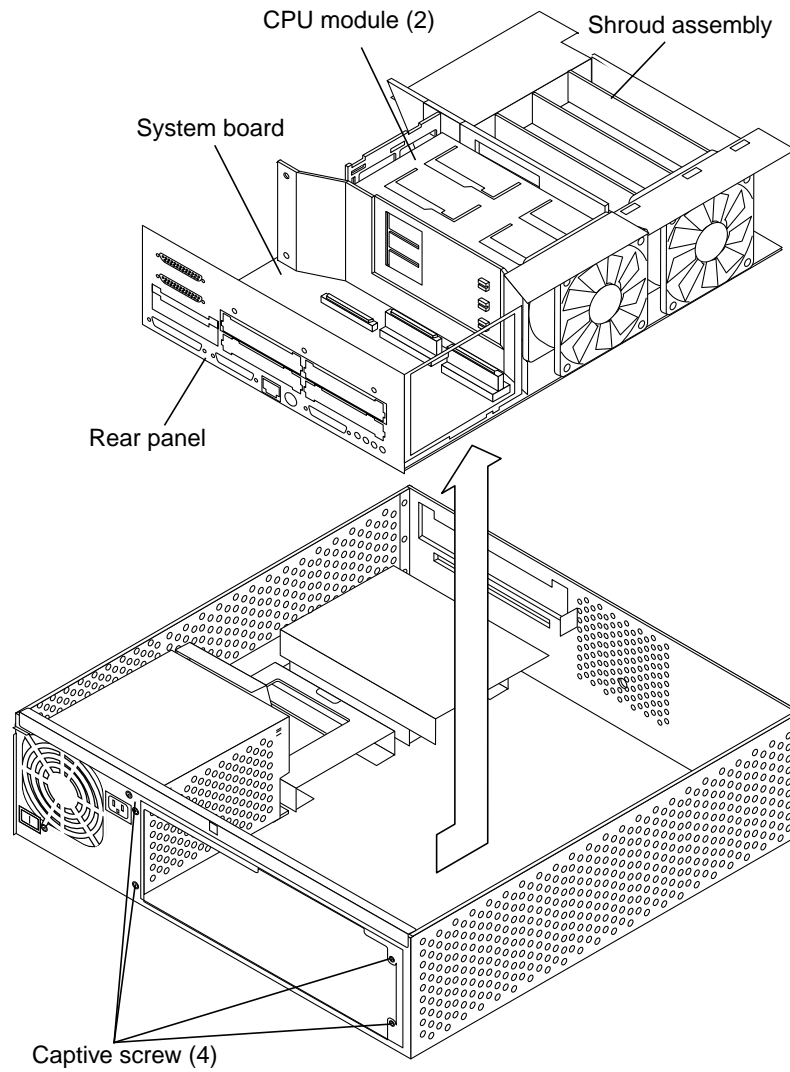


Figure 10-1 Removing a System Board

10.1.2 Replacing a System Board

To replace a system board:



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

- 1. Remove the SBus filler panel(s) from the replacement system board as follows:**
 - a. Squeeze the filler panel bottom locking tabs to unhook them from the back panel.**
 - b. Pull the filler panel away from the back panel.**
- 2. Remove the NVRAM/TOD with carrier from the replacement system board.**
- 3. Lower the system board into the chassis.**

Note – When lowering the system board, lower the system board at an angle to allow the bottom row of system board rear panel connectors to align with their respective chassis connector cutouts prior to lowering the system board front.

Note – Ensure that the hooks located on the chassis base engage with the slots located on the bottom of the system board.

- 4. Align the chassis base hooks with the system board slots.**
- 5. Tighten the four captive screws securing the system board back panel to the chassis.**
- 6. Populate the system board as follows:**
 - a. Connect the following to the system board:**
 - Disk drive (Section 9.1.2, “Replacing a Disk Drive.”)
 - SCSI cable (Section 8.2.2, “Replacing the SCSI Cable.”)
 - DC power cable connectors J1 from J3206, J2 from J3205, J3 from J3203, and J4 from J3204.

- Diskette drive cable (Section 8.3.2, “Replacing the Diskette Drive Cable.”)
- b. Using long-nose pliers, set the serial port jumpers (Section C.5, “Jumper Description.”)**
- c. Replace the following on the system board:**
 - FFB card (workstation only) (Section 10.4.2, “Replacing an FFB Card.”)
 - All CPU modules (Section 10.6.2, “Replacing a CPU Module.”)
 - NVRAM/TOD with carrier (Section 10.2.2, “Replacing a NVRAM/TOD.”)
 - All SBus card(s) (Section 10.3.2, “Replacing an SBus Card.”)
 - All DSIMMs (Section 10.5.2, “Replacing a DSIMM.”)

Note – The NVRAM/TOD that was removed from the replacement system board may be stored as a spare.

- 7. Detach the wrist strap.**
- 8. Replace the unit cover.**
- 9. Connect all cables to the back of the system or server unit.**
- 10. Power-on the system.**
- 11. Reset the #power-cycles NVRAM variable to zero as follows:**
 - a. Set the system power to on.**
 - b. Press Stop-A after the system banner appears on the monitor.**
 - c. At the systems ok prompt, type:**

```
ok setenv #power-cycles 0
```

- d. Verify that the #power-cycles variable increments each time the system is power cycled.**

Note – The Solaris operating environment power management software uses this variable to control the frequency of automatic system shutdown if automatic shutdown is enabled.

10.2 NVRAM/TOD

To remove and replace a NVRAM/TOD, proceed as follows.

10.2.1 Removing a NVRAM/TOD

To remove a NVRAM/TOD:

1. **Power-off the system.**
2. **Remove the unit cover.**



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

3. **Attach the wrist strap.**
4. **Locate the NVRAM/TOD and carrier on the system board (Figure 10-2).**
5. **Grasp the NVRAM/TOD carrier at each end. Lift the NVRAM/TOD carrier straight up.**

Note – Gently wiggle the NVRAM/TOD as necessary.

6. **Place the NVRAM/TOD and carrier on an antistatic surface.**

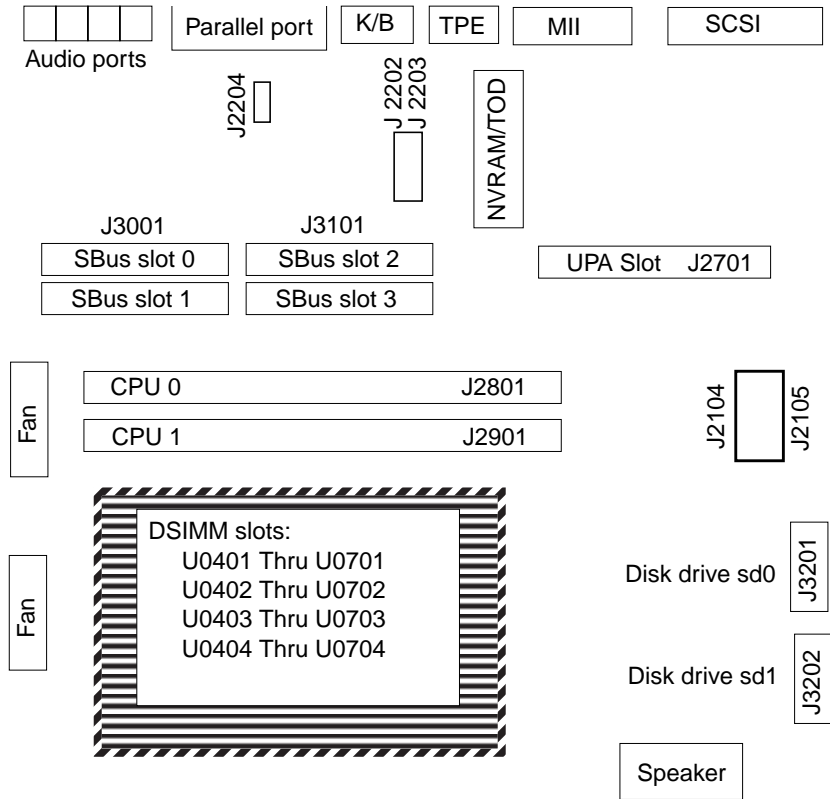


Figure 10-2 NVRAM/TOD Location

10.2.2 Replacing a NVRAM/TOD

To replace a NVRAM/TOD:



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

1. Position the replacement NVRAM/TOD and carrier on the system board (Figure 10-2).
2. Carefully insert the NVRAM/TOD and carrier into the socket.

Note – The carrier is keyed so the NVRAM/TOD can be installed only one way.

3. **Push the NVRAM/TOD into the carrier until properly seated.**
4. **Detach the wrist strap.**
5. **Replace the unit cover.**
6. **Power-on the system.**

10.3 SBus Card

To remove and replace the SBus card, proceed as follows.

Note – Illustrations supporting the SBus card removal and replacement are not representative of a system unit or sever chassis.

10.3.1 Removing an SBus Card

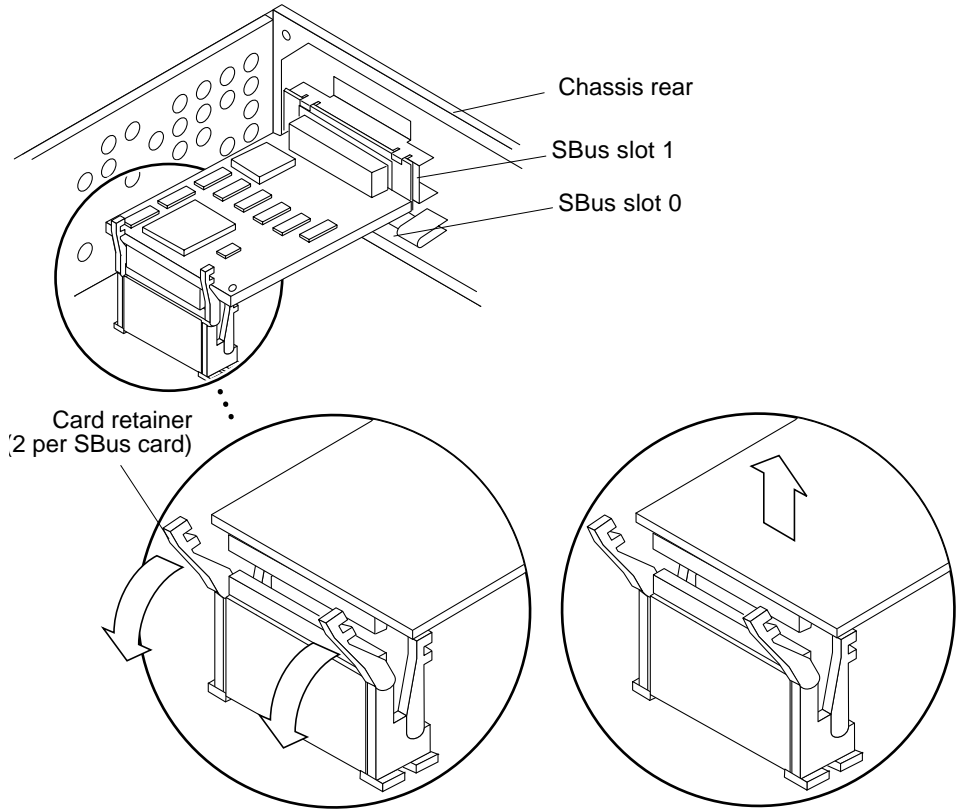
To remove the SBus card:

1. **Power-off the system.**
2. **Disconnect all cables from the SBus slots.**
3. **Remove the unit cover.**



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

4. **Attach the wrist strap.**
5. **Unlock the card retainers at the back edge of the SBus card by pushing the card retainers back from the edge of the SBus card (Figure 10-3).**



Note: SBus slot 2 and 3 not shown

Figure 10-3 Removing an SBus Card

6. Insert the extractor into the SBus card (Figure 10-4).

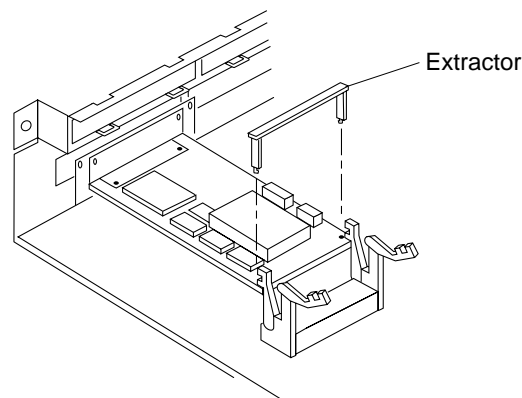


Figure 10-4 Installing the Card Extractor

7. **Holding both ends of the card extractor, pull upwards slowly until the connector is out of the slot.**
8. **Remove the card extractor from the SBus card.**
9. **Place the SBus card on an antistatic surface.**

10.3.2 Replacing an SBus Card

To replace the SBus card:



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

Note – Read the SBus card product guide for information about jumper or switch settings, slot requirements, and required tools.

1. **Identify the SBus slot and open the SBus card retainers.**
2. **As applicable, remove SBus filler panels as follows:**
 - a. **Using both hands, grasp the tabs at the base of the SBus filler panel.**

- b. Squeeze both tabs until the filler panel base disengages from the chassis.
 - c. Swing the filler panel base toward you and remove.
 3. Holding the SBus card by the edges, proceed as follows:
 - a. Unpack the SBus card.
 - b. Place the SBus card on an antistatic surface.
 - c. If required, set the SBus card jumpers or switches (refer to the SBus product guide).
 4. If the SBus card being installed has backplate tabs, proceed as follows (Figure 10-5):
 - a. Remove two screws securing the backplate adapter to the backplate.
 - b. Remove the backplate adapter.
 - c. Discard the screws and backplate adapter.

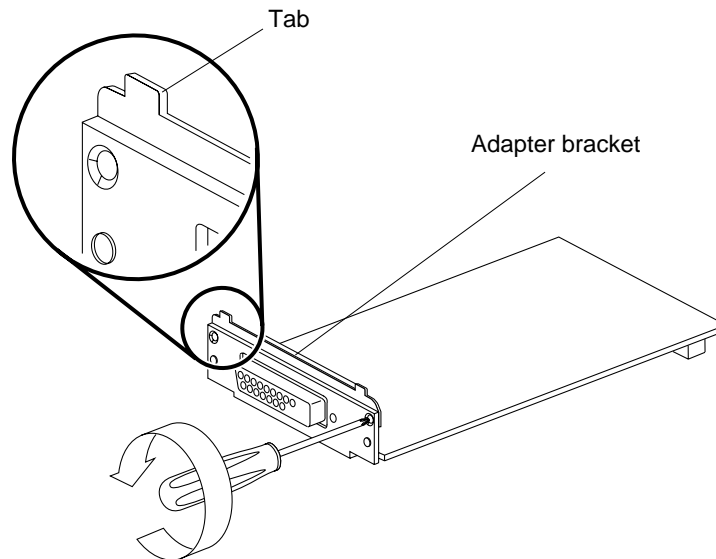


Figure 10-5 Removing the SBus Card Adapter Bracket

5. Remove the SBus card extractor handle as follows (Figure 10-6):
 - a. Bend one SBus card extractor handle leg slightly to the outside until the hook clears the hole in the SBus card.
 - b. Remove the other side.

Note – The extractor can be removed easily without bending.

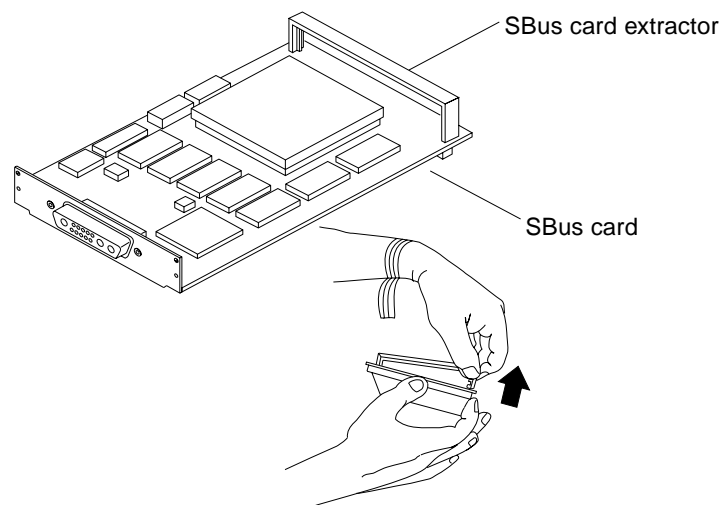


Figure 10-6 Removing an SBus Card Extractor

6. Holding the SBus card at an angle, insert the SBus card backplate behind the tabs at the top of the card opening (Figure 10-7).
7. Lower the SBus card into position.
8. Push the SBus card into the SBus slot by carefully pressing the SBus card corners.

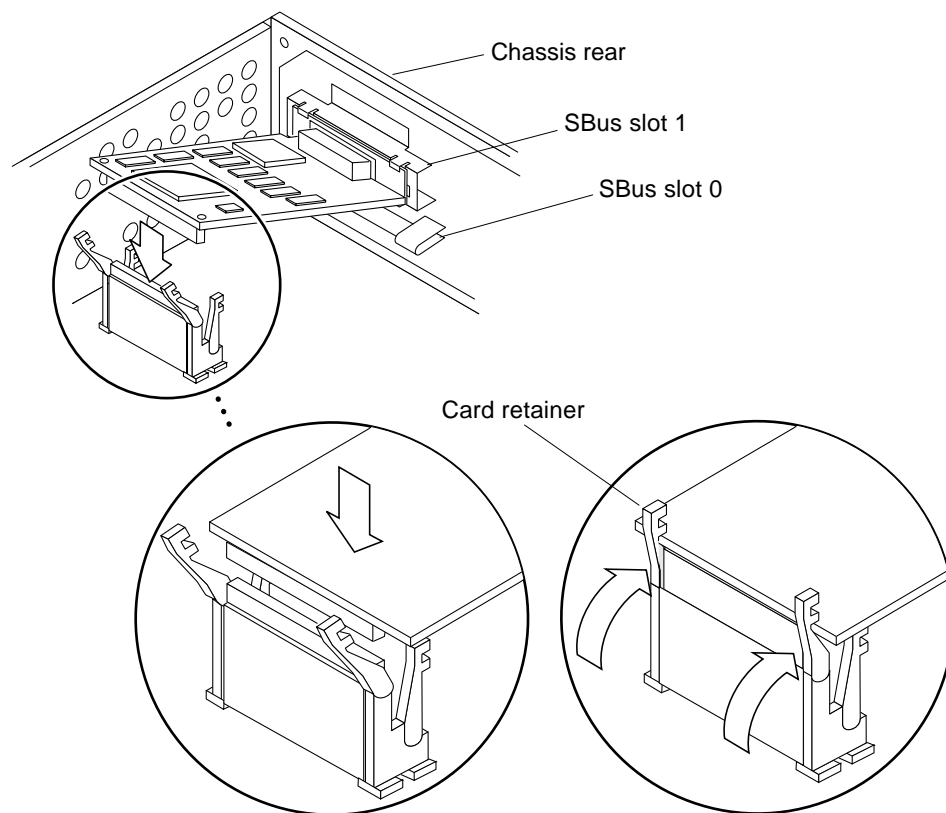


Caution – Do not force the SBus card or SBus slot pin damage may occur.

9. Push the card retainers forward over the edge of the SBus card.

Note – Refer to the SBus product guide to complete any required software installation, configuration, or setup procedures.

10. Detach the wrist strap.
11. Replace the unit cover.
12. Connect all cables to the SBus slots.
13. Power-on the system.



Note: SBus slot 2 and 3 not shown

Figure 10-7 Replacing an SBus Card

10.4 FFB Card (Workstation Only)

To remove and replace the FFB card, proceed as follows.

Note – Illustrations supporting the FFB card removal and replacement are not representative of a system unit or server chassis.

10.4.1 Removing an FFB Card

To remove the FFB card:

1. **Power-off the system.**
2. **Disconnect the video cable from the graphics card 13W3 video connector.**
3. **Remove the unit cover.**



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

4. **Attach the wrist strap.**
5. **Unlock the card retainers (Figure 10-8).**
6. **Holding the FFB card at each corner, gently pull the FFB card up to disconnect it from the UPA socket (Figure 10-9).**



Caution – Avoid applying unequal force to one end or one side of the FFB card or connector pin damage may occur.

7. **Slowly lift the FFB card at an upward angle.**
8. **Lower the FFB card backplate.**
9. **Disengage the FFB card backplate from the back panel.**
10. **Place the FFB card on antistatic surface.**

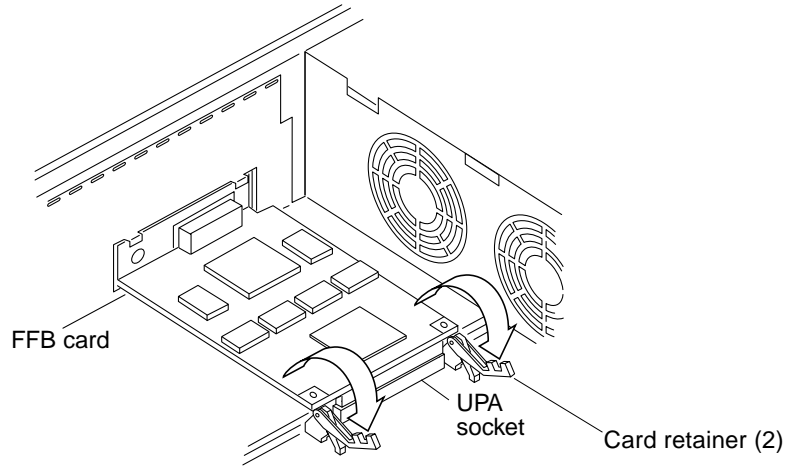


Figure 10-8 Preparing to Remove an FFB Card

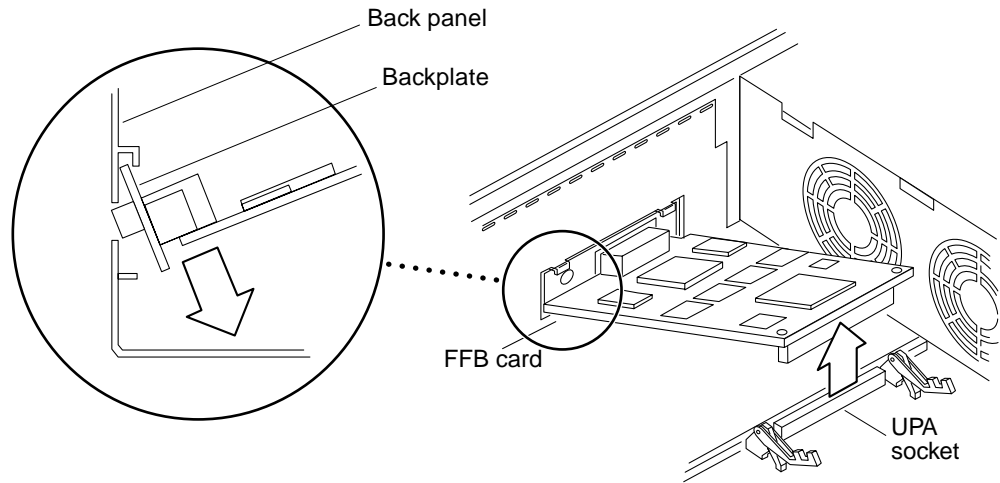


Figure 10-9 Removing an FFB Card

10.4.2 Replacing an FFB Card

To replace the FFB card:



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

1. Verify that both card retainers are pushed back (Figure 10-10).
2. Remove the replacement FFB card from its container.
3. At an angle, lower the FFB card into the chassis over the UPA socket.
4. Hook the FFB card backplate under the chassis back panel tabs.

Note – Ensure that the backplate is visible through the slot on the back panel.

5. Carefully press both corners of the FFB card evenly to seat the FFB card connector into the UPA socket (Figure 10-11).



Caution – Avoid applying unequal force to one end or one side of the FFB card or connector pin damage may occur.

6. Push the card retainer onto the FFB card (Figure 10-12).
7. Replace two screws and washers securing the FFB card to the back panel.
8. Detach the wrist strap.
9. Replace the unit cover.
10. Connect the video cable to the graphics card 13W3 video connector.
11. Power-on the system.

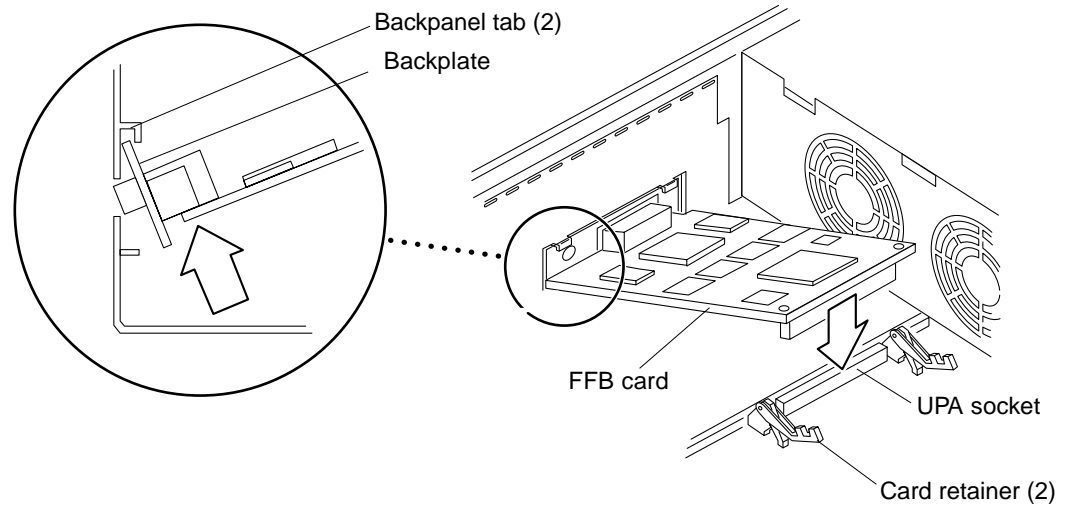


Figure 10-10 Replacing an FFB Card

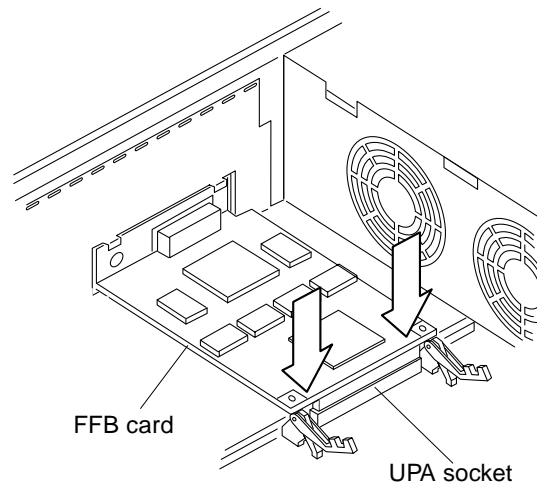


Figure 10-11 Seating an FFB Card into the Socket

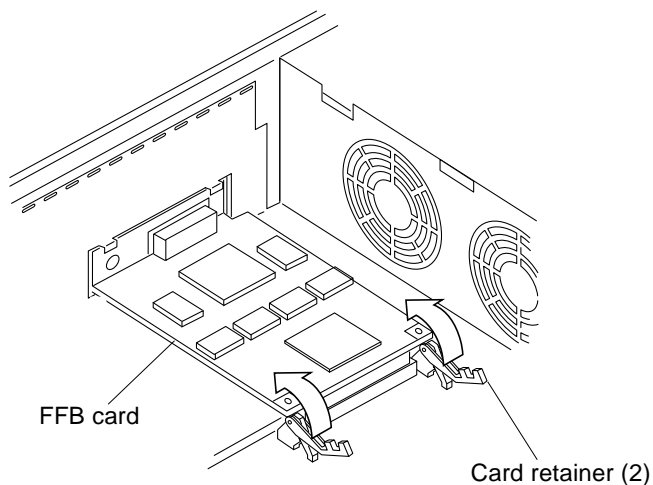


Figure 10-12 Securing an FFB Card in the Chassis

10.5 DSIMM

To remove and replace a DSIMM, proceed as follows.



Caution – DSIMMs consist of electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or work environment can destroy the DSIMM.

Note – The Ultra 2 system and server units support 16-, 32-, 64-, and 128-Mbyte DSIMMs.

Note – The Ultra 2 system and server units must have four DSIMMs in bank 0 for the unit to boot. Up to 16 DSIMMs can be installed in the unit. DSIMM installation location is listed in Table 10-1.

Table 10-1 DSIMM Bank and Socket Locations

Memory Group	Slots
0	U0501, U0701, U0401, U0601 (Required)
1	U0502, U0702, U0402, U0602
2	U0503, U0703, U0403, U0603
3	U0504, U0704, U0404, U0604

10.5.1 Removing a DSIMM

To remove a DSIMM:



Caution – Handle DSIMMs only by the edges. Do not touch the DSIMM components or metal parts. Always wear a grounding strap when handling a DSIMM.

1. **Power-off the system.**
2. **Remove the unit cover.**



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

3. **Attach the wrist strap.**
4. **Locate the DSIMM to be removed.**
5. **Push the ejection lever away from the DSIMM (Figure 10-13).**
6. **Remove the DSIMM from the socket.**

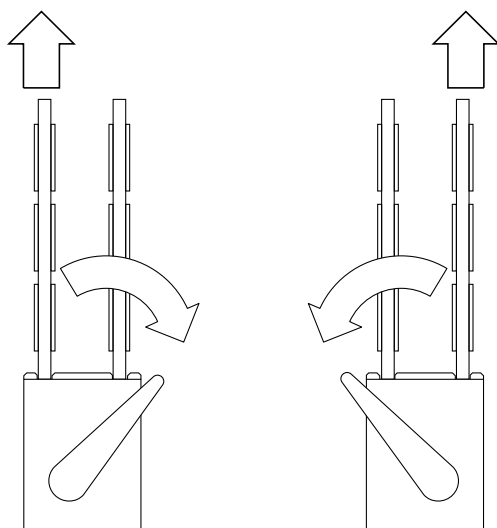


Figure 10-13 DSIMM Ejection Lever

10.5.2 Replacing a DSIMM

To replace a DSIMM:



Caution – DSIMMs are made of electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or work environment can destroy the DSIMM.



Caution – Do not remove any DSIMM from the anti-static container until ready to install it on the system board. Handle DSIMMs only by their edges. Do not touch DSIMM components or metal parts. Always wear a grounding strap when handling DSIMMs.



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



Caution – Each DSIMM bank must contain four DSIMMs of equal density (for example: four 16-Mbyte DSIMMs) to function properly. Do not mix DSIMM density in any bank.

To replace a DSIMM:

1. **Unlock and lift the DSIMM cover.**
2. **Locate and select an available quartet of DSIMM slots on the system board.**

Note – Use only DSIMMs that are specifically designed for system and server units.



Caution – Hold DSIMMs by edges only.

3. **Remove the DSIMM from the antistatic container.**

Note – DSIMMs must be added in groups of four. If all four DSIMMs are not of the same capacity, the four DSIMMs are treated as four times the lowest capacity DSIMM in the group.

4. For each DSIMM, align the notch on the side of the DSIMM with the ejector on the DSIMM slot. Insert the DSIMM into the slot.
5. Using thumbs, press firmly on the DSIMM top until the DSIMM is properly seated.

Note – Proper DSIMM seating is verified by a clicking sound.

6. Detach the wrist strap.
7. Replace the unit cover.
8. Connect all cables to the back of the system or server unit.
9. Power-on the system.

10.6 CPU Module

To remove and replace a CPU module, proceed as follows.

10.6.1 Removing a CPU Module

To remove a CPU module:

1. Power-off the system.
2. Remove the unit cover.



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

3. Attach the wrist strap.
4. Grip the sides of the shroud-assembly processor area (Figure 10-14).

5. With the thumb of each hand, simultaneously lift the CPU module levers upward and to the side at an approximate 135-degree angle (Figure 10-15).
6. Lift the CPU module upward until it clears the shroud assembly.
7. Place the CPU module on an antistatic surface.

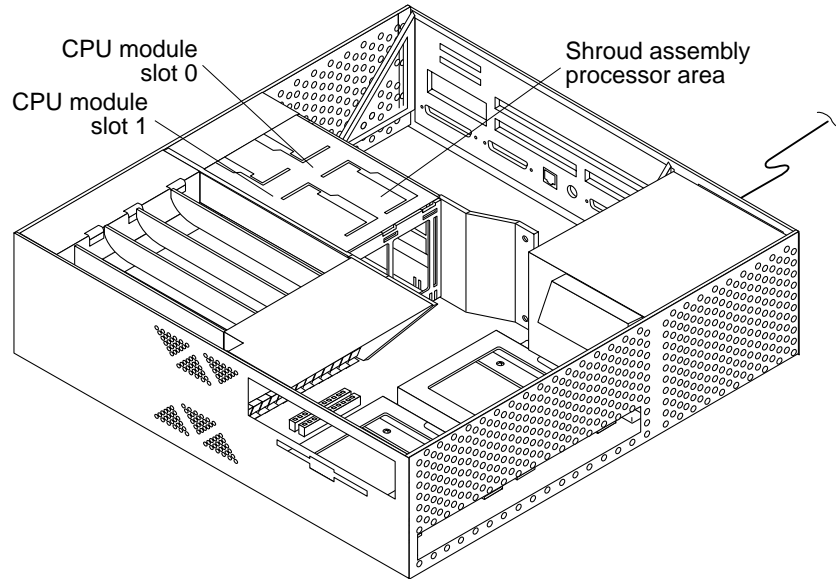


Figure 10-14 CPU Module Locations and Shroud Assembly Processor Area

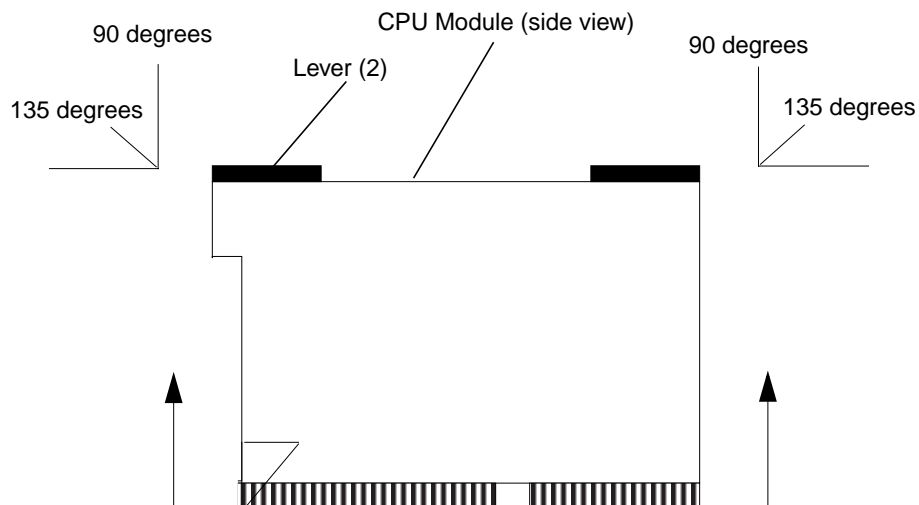


Figure 10-15 Removing a CPU Module

10.6.2 Replacing a CPU Module

To replace a CPU module:



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

1. **Unpack the CPU module.**
2. **Place the CPU module on an antistatic surface.**
3. **Identify the appropriate or available CPU module slot (Figure 10-14).**

Note – If the system unit or server is equipped with one CPU module, the module must be installed in slot 0. If the system unit or server is equipped with two CPU modules, each slot will have a module installed.

4. **On the antistatic surface, hold the CPU module in an upright position.**
5. **Open the CPU module levers to an approximate 135-degree angle.**

6. Lower the CPU module along the shroud assembly vertical plastic guides until the module touches the system board slot socket.
7. With both hands, simultaneously turn and press the CPU module levers downward to the fully horizontal position. Firmly press the CPU module downward into the socket until it is fully seated and the levers are fully locked.
8. Detach the wrist strap.
9. Replace the unit cover.
10. Connect all cables to the back of the system or server unit.
11. Power-on the system.

10.7 Shroud Assembly

To remove and replace the shroud assembly, proceed as follows.

10.7.1 Removing the Shroud Assembly

To remove the shroud assembly:

1. Power-off the system.
2. Remove the unit cover.



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

3. Attach the wrist strap.
4. Disconnect the fan connections.
5. Disconnect the speaker connections.
6. Remove the system board (Section 10.1.1, “Removing a System Board.”)
7. Flip the system board over. Dislodge the five retaining clips securing the shroud assembly to the system board (Figure 10-16).

8. Lift the system board from the shroud assembly.

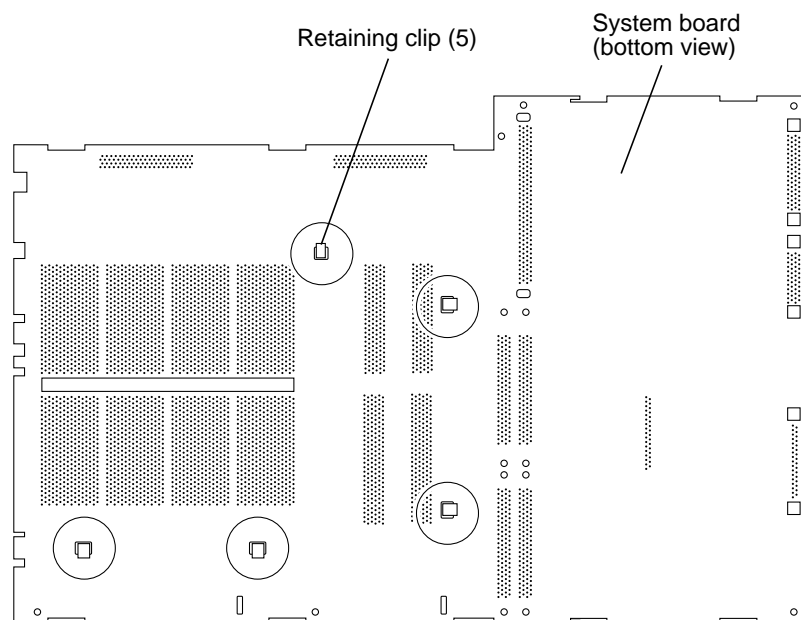


Figure 10-16 Shroud Assembly Removal

10.7.2 Replacing the Shroud Assembly

To replace the shroud assembly:



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

1. **Position the shroud assembly face down.**
2. **Position the system board on the shroud assembly, ensuring that the shroud assembly retaining clips are aligned with the system board retaining clip holes.**
3. **Secure each retaining clip by pressing down on the system board around the area of each retaining clip.**

4. Slowly flip the system board over, ensuring that the shroud assembly and the system board connection is secure.
5. Replace the system board (Section 10.1.2, “Replacing a System Board.”)
6. Connect the speaker connections.
7. Connect the fan connections.
8. Detach the wrist strap.
9. Replace the unit cover.
10. Connect all cables to the back of the system or server unit.
11. Power-on the system.

10.8 Shroud Assembly Speaker

To remove and replace the shroud assembly speaker, proceed as follows.

10.8.1 Removing the Shroud Assembly Speaker

To remove the shroud assembly speaker:

1. **Power-off the system.**
2. **Remove the unit cover.**



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

3. **Attach the wrist strap.**
4. **Remove the screw securing the speaker to the shroud assembly (Figure 10-17).**
5. **Disconnect the speaker connections.**
6. **Remove the speaker.**

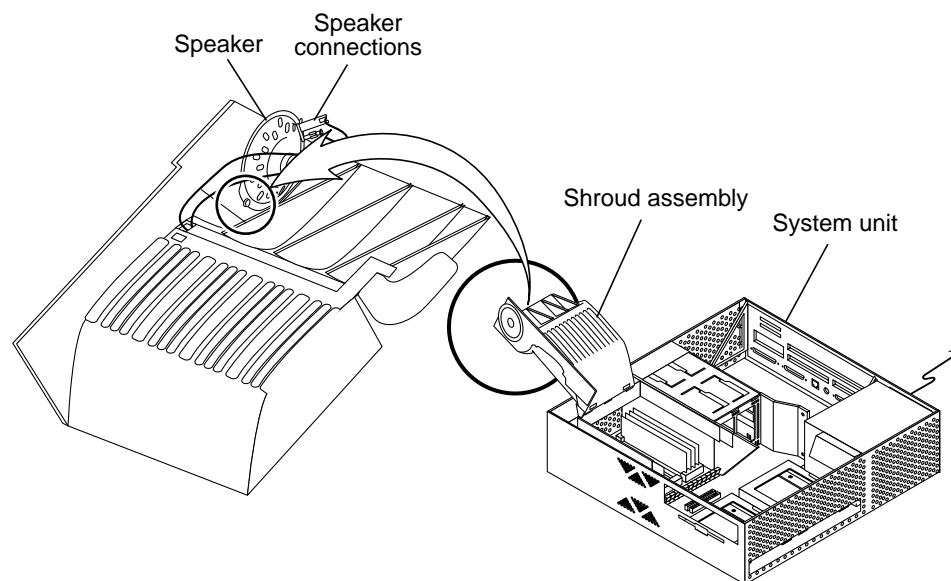


Figure 10-17 Shroud Assembly Speaker Removal

10.8.2 Replacing the Shroud Assembly Speaker

To replace the shroud assembly speaker:



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

1. **Position the speaker into the shroud assembly.**
2. **Connect the speaker connections.**
3. **Replace the screw securing the speaker to the shroud assembly.**
4. **Detach the wrist strap.**
5. **Replace the unit cover.**
6. **Connect all cables to the back of the system or server unit.**
7. **Power-on the system.**

Part 6 — Illustrated Parts Breakdown

<i>Replacement Parts</i>	<i>page 11-1</i>
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Replacement Parts

11

This chapter lists the authorized replaceable parts for the Ultra 2 series system unit and the Ultra Enterprise 2 server. Table 11-1 lists replaceable parts by nomenclature and part number. A brief description is also provided.

Note – Part numbers listed in Table 11-1 are correct as of the service manual publication date but are subject to change without notice. Consult your authorized Sun sales representative or service provider to confirm a part number prior to ordering a replacement part.

Table 11-1 List of Replacement Parts

Replacement Part Nomenclature	Part Number	Description
System board	501-3132-xx	167-/200-MHz system board, 10 ns
CPU	501-2942-xx	167-MHz CPU module, 512KByte cache, 6 ns
CPU	501-3041-xx	200-MHz, CPU module, 1MByte cache, 5 ns
TOD, w/carrier	525-1417-xx	Time of day, 48T59Y, W/Carrier
DSIMM	501-2479-xx	Assembly, DSIMM, 16-MByte
DSIMM	501-2622-xx	Assembly, DSIMM, 32-MByte
DSIMM	501-2480-xx	Assembly, DSIMM, 64-MByte
DSIMM	501-3136-xx	Assembly, DSIMM, 128-MByte
Graphics card	501-2633-xx	DFB, FFB graphics card, 67 MHz (Ultra 2 series desktop workstation only)
Graphics card	501-2634-xx	SFB, FFB graphics card, 67 MHz (Ultra 2 series desktop workstation only)
Graphics card	501-3129-xx	DFB, FFB graphics card, 75 MHz (Ultra 2 series desktop workstation only)
Power supply	300-1315-xx	350-watt power supply
3.5-inch floppy drive	370-1419-xx	Drive, Floppy, 3.5-inch, 3D, Black Bezel
CD-ROM drive	370-2082-xx	4X CD drive
Speaker	370-1579-xx	Speaker (P/O shroud assy)
Tape drive	370-2018-xx	2.5-Gbyte QIC tape drive
Tape drive	370-2176-xx	4-mm tape drive, 4-/8-Gbyte,
Tape drive	370-1857-xx	8-mm tape drive, 7-/14-Gbyte
SCSI cable	530-2137-xx	Cable Assy, SCSI

Table 11-1 List of Replacement Parts (Continued)

Replacement Part Nomenclature	Part Number	Description
Diskette drive cable	530-2138-xx	Diskette drive cable
Disk drive	540-2706-xx	Diskette drive, 2.1-Gbyte SCA, 7200 RPM, Wide
Shroud assembly	540-2603-xx	Assy, shroud/fan/speaker

Part 7 — Appendixes, Glossary, and Index

<i>Product Specifications</i>	<i>page A-1</i>
<i>Signal Description</i>	<i>page B-1</i>
<i>Functional Description</i>	<i>page C-1</i>

Product Specifications



This appendix provides product specifications for the Ultra 2 series system (system unit) and the Ultra Enterprise 2 server (server) and is divided into three parts:

- Physical specifications
- Electrical specifications
- Environmental specifications

Table A-1 lists physical specifications for the system unit and server. Table A-2 lists physical specifications for the 17-inch color monitor. Table A-3 lists physical specifications for the 20-inch color monitor.

Table A-1 System Unit and Server Physical Specifications

Specification	Value
Height	5.12 in. (13.00 cm)
Width	17.63 in. (45.00 cm)
Depth	17.87 in. (44.40 cm)
Weight (approx)	27.00 to 35.00 lb. (12.27 to 15.91 kg)

Table A-2 17-Inch Monitor Physical Specifications

Specification	Value
Height	16.40 in. (41.40 cm)
Width	16.00 in. (40.60 cm))
Depth	17.70 in. (45.00 cm)
Weight (approx)	57.00 lb. (25.90 kg)

Table A-3 20-Inch Monitor Physical Specifications

Specification	Value
Height	18.50 in. (47.10 cm)
Width	18.70 in. (47.50 cm))
Depth	19.50 in. (49.50 cm)
Weight (approx)	80.30 lb. (36.50 kg)

A.1 Electrical Specifications

Table A-4 lists the electrical specifications for the system unit and server.

Table A-4 Electrical Specifications

Parameter	Description	Value
Input	Voltage range	100 to 240 VAC
	Current range	1.5 to 3.1 A
	Frequency range	47 to 63 Hz
Output	1	+5 VDC, 18 A
Output	2	+3.3 VDC, 12 A
Output	3	+2.5 to 3.6 VDC, 12 to 8.3 A
Output	4	+12 VDC, 5.1 A
Output	5	-12 VDC, 0.3 A
Input power rating	Input power rating	260 W
Output power rating	Output power rating	350 W
Volt-ampere rating	Volt-ampere rating	260 VA
Power factor	Power factor	>.98

A.2 Environmental Specifications

Table A-5 lists operating and non-operating environmental specifications for the system unit and server.

Table A-5 Environmental Specifications

Environmental	Operating	Non-Operating
Temperature:		
System without removable tape media	50 to 104°F (10 to 40°C), 16-hour dwells at extremes	-4 to 131°F (-20 to 55°C), 16-hour dwells at extremes
System with removable tape media	50 to 95°F (10 to 35°C), 16-hour dwells at extremes	-4 to 131°F (-20 to 55°C), 16-hour dwells at extremes
Humidity	20 to 80% noncondensing at 104 °F (40°C), 16-hour dwells at extremes	95% noncondensing at 104°F (40°C) 16-hour dwells at extremes
Altitude:		
System without removable tape media	9,842.5 feet (3,000 meters) at 50 to 98.6°F (10 to 37°C), 2-hour dwells at extremes, to 104°F (40°C) at sea level	40,000 feet (12,192 meters) at 32°F (0°C), 2-hour dwells at extremes
System with removable tape media	9,842.5 feet (3,000 meters) at 50 to 89.6°F (10 to 32°C), 2-hour dwells at extremes, to 95°F (35°C) at sea level	40,000 feet (12,192 meters) at 32°F (0°C), 2-hour dwells at extremes
Maximum dwells at extremes	16 hours	16 hours
Shock	2.0 G peak for 11 ms, 3 shocks per face	15 G peak for 11 ms, 3 shocks per face
Vibration	0.1 G peak, 3 mutually perpendicular axes, 5-500-5 Hz sweep	0.5 G peak, 3 mutually perpendicular axes, 5-500-5 Hz sweep
Acoustic noise	5.4 bels	5.2 bels (idle)

Signal Description



This appendix provides signal descriptions for the Ultra 2 series system unit back panel connectors.

B.1 Keyboard/Mouse Connector and Serial Ports A and B Connector

The following sections provide brief descriptions of the keyboard/mouse and serial ports A and B connectors, respectively.

B.1.1 Keyboard/Mouse Connector

The keyboard/mouse connector is a DIN-8 type connector located on the system back panel. Figure B-1 illustrates the keyboard/mouse connector configuration. Table B-1 lists the keyboard/mouse connector pin assignments.



Figure B-1 Keyboard/Mouse Connector Pin Configuration

Table B-1 Keyboard/Mouse Connector Pin Assignments

Pin	Signal Name	Description	Pin	Signal Name	Description
1	Gnd	Ground	5	Kbd-txd	Keyboard out
2	Gnd	Ground	6	Kbd-rxd	Keyboard in
3	+5 Vdc	+5 VDC	7	Kbd-pwk	Keyboard power on
4	Mse-rxd	Mouse receive data	8	+5 Vdc	+5 volts dc

B.1.2 Serial Port Connector A and B (RS-423/RS-232)

Serial port connectors A and B are DB-25 type connectors located on the system board back panel. Figure B-2 illustrates the serial port A and serial port B connector configuration. Table B-2 lists the serial A and B port connector pin assignments.

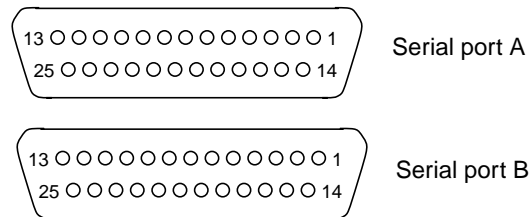


Figure B-2 Serial Port A and B Connector Pin Configuration

Table B-2 Serial Port A and B Connector Pin Assignments

Pin	Signal Name	Description	Pin	Signal Name	Description
1	Not connected (NC)	Not connected	14	NC	None
2	Transmit Data	TxD	15	Transmit Clock	TRxC
3	Receive Data	RxD	16	NC	Not connected
4	Ready To Send	RTS	17	Receive Clock	RTxC
5	Clear To Send	CTS	18	NC	Not connected
6	Data Set Ready	DSR	19	NC	Not connected
7	Signal Ground	Gnd	20	DTR	Data Terminal Ready
8	DCD	Data Carrier Detect	21	NC	Not connected
9	NC	Not connected	22	NC	Not connected
10	NC	Not connected	23	NC	Not connected
11	NC	Not connected	24	TxC	Transmit Clock
12	NC	Not connected	25	NC	Not connected
13	NC	Not connected			

B.2 TPE (Twisted-Pair Ethernet) Connector

The TPE connector is an RJ-45 type connector located on the system board back panel. Figure B-3 illustrates the TPE connector configuration. Table B-3 lists the TPE connector pin assignments.



Figure B-3 TPE Connector Pin Configuration

Table B-3 TPE Connector Pin Assignments

Pin	Signal Name	Description	Pin	Signal Name	Description
1	tpe0	Transmit data +	5	Common mode termination	Termination
2	tpe1	Transmit data -	6	tpe3	Receive data -
3	tpe2	Receive data +	7	Common mode termination	Termination
4	Common mode termination	Termination	8	Common mode termination	Termination

B.3 Fast Wide SCSI (Small Computer System Interface) Connector

The fast wide SCSI connector is located on the system board back panel. Figure B-4 illustrates the fast wide SCSI connector configuration. Table B-4 lists the fast wide SCSI connector pin assignments.

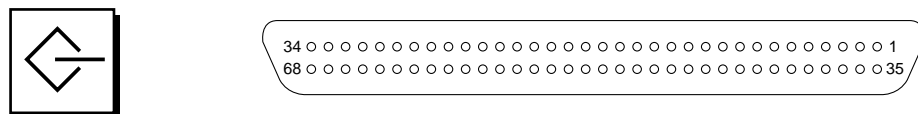


Figure B-4 Fast Wide SCSI Connector Pin Configuration

Table B-4 Fast Wide SCSI Connector Pin Assignments

Pin	Signal Name	Description	Pin	Signal Name	Description
1	Gnd	Ground	15	Gnd	Ground
2	Gnd	Ground	16	Gnd	Ground
3	Gnd	Ground	17	Termpower	Termpower
4	Gnd	Ground	18	Termpower	Termpower
5	Gnd	Ground	19	Not used	Undefined
6	Gnd	Ground	20	Gnd	Ground
7	Gnd	Ground	21	Gnd	Ground
8	Gnd	Ground	22	Gnd	Ground
9	Gnd	Ground	23	Gnd	Ground
10	Gnd	Ground	24	Gnd	Ground
11	Gnd	Ground	25	Gnd	Ground
12	Gnd	Ground	26	Gnd	Ground
13	Gnd	Ground	27	Gnd	Ground
14	Gnd	Ground	28	Gnd	Ground

Table B-4 Fast Wide SCSI Connector Pin Assignments (Continued)

Pin	Signal Name	Description	Pin	Signal Name	Description
29	Gnd	Ground	49	Gnd	Ground
30	Gnd	Ground	50	Term_dis_	Term disable
31	Gnd	Ground	51	Termpower	Termpower
32	Gnd	Ground	52	Termpower	Termpower
33	Gnd	Ground	53	Not used	Undefined
34	Gnd	Ground	54	Gnd	Ground
35	Dat<12>_	Data 12	55	Atn_	Attention
36	Dat<13>_	Data 13	56	Gnd	Ground
37	Dat<14>_	Data 14	57	Bsy_	Busy
38	Dat<15>_	Data 15	58	Ack_	Acknowledge
39	Par1 l_	Parity 1	59	Rst_	Reset
40	Dat<0>_	Data 0	60	Msg_	Message
41	Dat<1>_	Data 1	61	Sel_	Select
42	Dat<2>_	Data 2	62	Cd_	Command
43	Dat<3>_	Data 3	63	Req_	Request
44	Dat<4>_	Data 4	64	IO_	In/Out
45	Dat<5>_	Data 5	65	Dat<8>_	Data 8
46	Dat<6>_	Data 6	66	Dat<9>_	Data 9
47	Dat<7>_	Data 7	67	Dat<10>_	Data 10
48	Par0 l_	Parity 0	68	Dat<11>_	Data 11

Note - (l) signifies active low

B.4 Audio Port Connectors

The audio port connectors are located on the system board back panel. These ports use EIA standard 3.5-mm/0.125-inch jacks. Figure B-5 illustrates each audio port configuration. Table B-5 lists each audio port line assignment.

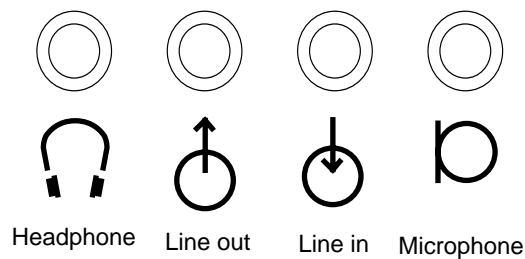


Figure B-5 Audio Port Connectors Jack Configuration

Table B-5 Audio Port Connectors Line Assignment

Component	Headphone	Line Out	Line In	Microphone
Tip	Left channel	Left channel	Left channel	Left channel
Ring (center)	Right channel	Right channel	Right channel	Right channel
Shield	Ground	Ground	Ground	Ground

B.5 Parallel Port Connector

The parallel port connector is a DB-25 type connector located on the system board back panel. Figure B-6 illustrates the parallel port connector configuration. Table B-6 lists the parallel port connector pin assignments.

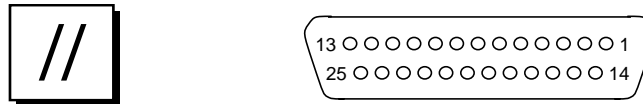


Figure B-6 Parallel Port Connector Pin Configuration

Table B-6 Parallel Port Connector Pin Assignments

Pin	Signal Name	Description	Pin	Signal Name	Description
1	nStrobe	Strobe	14	nAuto Fd	Auto feed
2	Data[0]	Date bit 0	15	nFault	Fault
3	Data[1]	Data bit 1	16	nInit	Initiate
4	Data[2]	Data bit 2	17	nSelectIn	Input select
5	Data[3]	Data bit 3	18	Signal ground	Signal ground
6	Data[4]	Data bit 4	19	Signal ground	Signal ground
7	Data[5]	Data bit 5	20	Signal ground	Signal ground
8	Data[6]	Data bit 6	21	Signal ground	Signal ground
9	Data[7]	Data bit 7	22	Signal ground	Signal ground
10	nAck	Acknowledge	23	Signal ground	Signal ground
11	Busy	Busy	24	Signal ground	Signal ground
12	PError	Parity error	25	Signal ground	Signal ground
13	Select	Select			

B.6 MII (Media Independent Interface) Connector

The MII connector (designated J2501) is located on the system board. Figure B-7 illustrates the MII connector configuration. Table B-7 lists the MII connector pin assignment.

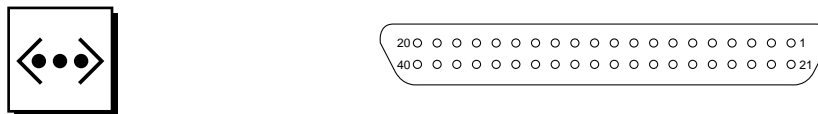


Figure B-7 MII Connector Pin Configuration

Table B-7 MII Connector Pin Assignments

Pin	Signal Name	Description	Pin	Signal Name	Description
1	Pwr	Power	21	Pwr	Power
2	Mdio	Management data I/O	22	Gnd	Ground
3	Mdc	Management data clock	23	Gnd	Ground
4	Rxd3	Receive data 3	24	Gnd	Ground
5	Rxd2	Receive data 2	25	Gnd	Ground
6	Rxd1	Receive data 1	26	Gnd	Ground
7	Rxd0	Receive data 0	27	Gnd	Ground
8	Rx dv	Receive data valid	28	Gnd	Ground
9	Rx clk	Receive clock	29	Gnd	Ground
10	Rx er	Receive error	30	Gnd	Ground
11	Tx er	Transmit error	31	Gnd	Ground
12	Tx clk	Transmit clock	32	Gnd	Ground
13	Tx en	Transmit data enable	33	Gnd	Ground
14	Txd0	Transmit data 0	34	Gnd	Ground
15	Txd1	Transmit data 1	35	Gnd	Ground
16	Txd2	Transmit data 2	36	Gnd	Ground
17	Txd3	Transmit data 3	37	Gnd	Ground
18	Col	Collision detected	38	Gnd	Ground
19	Crs	Carrier sense	39	Gnd	Ground
20	Pwr	Power	40	Pwr	Power

B.7 Graphics Card 13W3 Video Connector

The graphics card 13W3 video connector is located on the system board. Figure B-8 illustrates the graphics card 13W3 video connector configuration. Table B-8 lists the graphics card 13W3 video connector pin assignment.

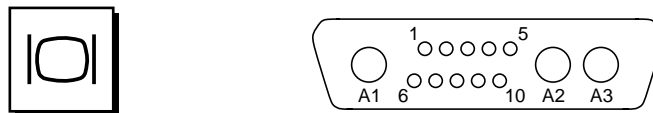


Figure B-8 Graphics Card 13W3 Video Connector Pin Configuration

Table B-8 Graphics Card 13W3 Video Connector Pin Assignments

Pin	Signal Name	Description	Pin	Signal Name	Description
A1	R	Red	5	Comp Sync	Composite Sync
A2	G	Green	6	Horiz Sync	Horizontal Sync
A3	B	Blue	7	Serial Write	Serial Write
1	Serial Read	Serial Read	8	Sense <1>	Sense <1>
2	Vert Sync	Vertical Sync	9	Sense <2>	Sense <2>
3	Sense <0>	Sense <0>	10	Gnd	Ground
4	Gnd	Ground			

Functional Description



This section provides a functional description of the system unit or server electronics.

<i>System Unit/Server Overview</i>	<i>page B-1</i>
<i>ASICS</i>	<i>page B-13</i>
<i>Power Supply</i>	<i>page B-19</i>
<i>System Board</i>	<i>page B-21</i>
<i>Enclosure</i>	<i>page B-25</i>
<i>Environmental Compliance</i>	<i>page B-26</i>
<i>Agency Compliance</i>	<i>page B-26</i>

B.1 System Unit/Server Overview

The processor-to-memory interconnection is provided by the UPA mechanism (Figure B-1). The output of the UltraSPARC processor(s) and the output of the system I/O (SYSIO) ASIC reside on the UPA. A slave UPA port is provided for graphic device communications between the FFB, the BMX and CBT ASICs, and the SYSIO ASIC. All UPA interactions are orchestrated by the multi-processing system controller (SC-MP) ASIC.

The I/O sub-system connects to the processor-to-memory sub-system through the SYSIO ASIC. The SYSIO ASIC provides connectivity to four SBus slots, the fast Ethernet parallel port SCSI (FEPS) ASIC, the audio (APC) ASIC, and the Slavio ASIC.

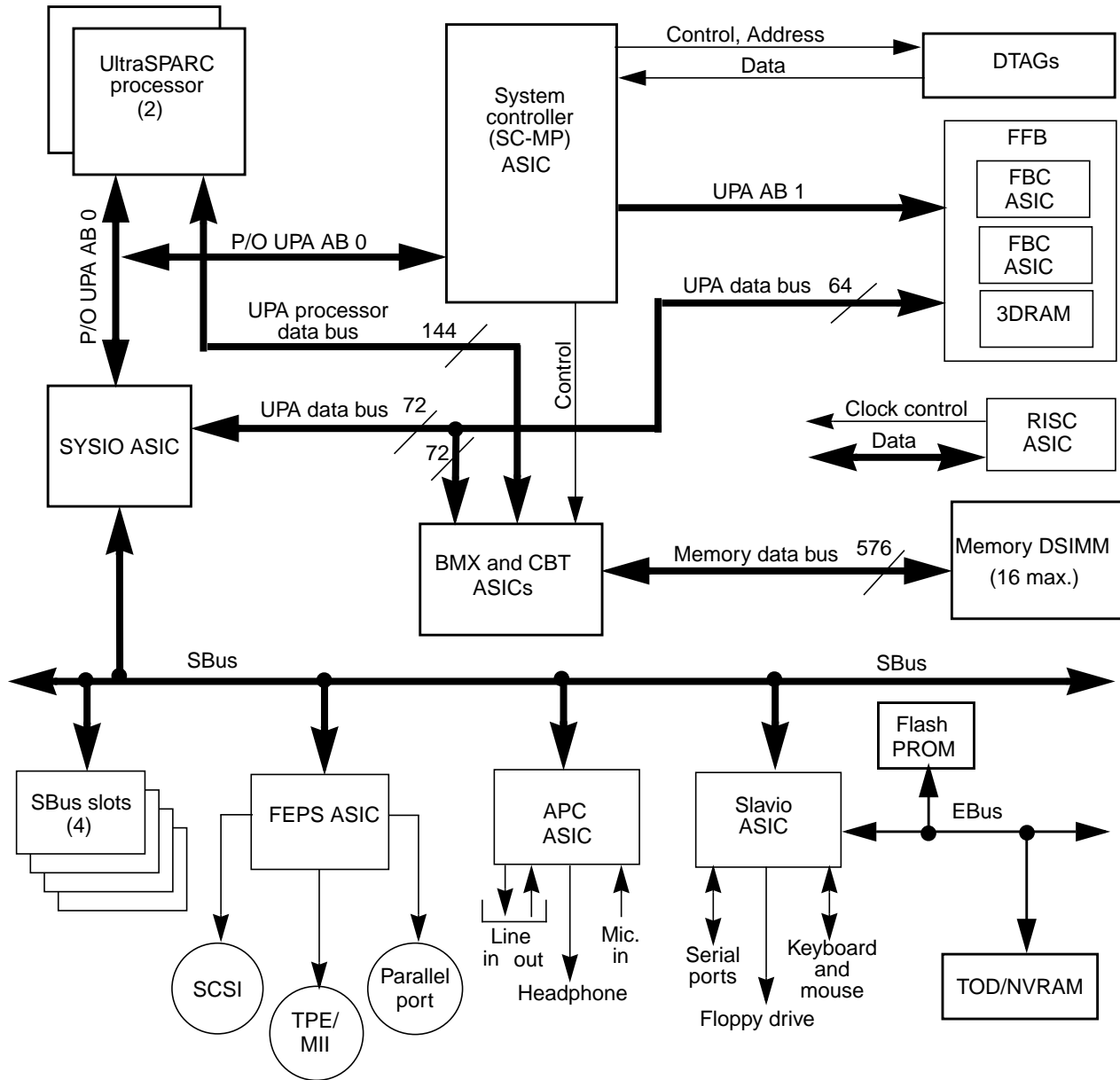


Figure B-1 System Unit or Server Functional Block Diagram

B.1.1 UPA

The UPA is a cache-coherent processor-to-memory interconnect. A key advantage of the UPA processor-to-memory interconnect is a scalable bandwidth through support of multiple bussed interconnects for both data and address. Other advantages include more bandwidth, high-performance graphics support with two-cycle, single-word writes on the 64-bit UPA data bus, and centralized coherence and memory controller functions (see Figure B-1). The UPA consists of the following, as implemented on the system board:

- Eighteen buffered memory crossbar (BMX) ASICs and eighteen memory data multiplexer-demultiplexer (CBT) ASICs
 - The BMX ASICs connect the 144-bit UPA processor data bus to a 576-bit memory data bus through CBT ASICs, a 72-bit UPA data bus for graphics and I/O devices
 - The memory path is 576 bits using eighteen CBT ASICs
- The processor(s) share(s) a UPA address bus (UPA address bus 1) with the SYSIO ASIC; a second address bus (UPA address bus 0) supports slave UPA connection to the expansion slot for graphics capability
- Low voltage transistor-transistor logic (TTL) voltage levels for signal input
- Low voltage complementary metal-oxide semiconductor (CMOS) voltage levels for signal output

UPA performance characteristics include:

- Peak bandwidth: 1.3-Gbytes per second with one 144-bit processor data bus on an 83-MHz UPA

B.1.2 SBus

The system unit or server uses the IEEE 1496 SBus specification. This includes (see Figure B-1):

- 16.6-MHz to 25-MHz operation. Default frequency is 25 MHz

Note – SBus frequency is independent of processor frequency and UPA operating frequency.

- Extended transfer mode (64-bit data path)

- Transfer sizes to 64 bytes (maximum)
- Parity
- Dedicated interrupts per SBus slot.

The system unit or server supports four SBus slots. The four slots are configured in a side-by-side stacked configuration.

B.1.3 UltraSPARC Processor

The UltraSPARC processor is mounted on a module that is plugged into the system unit or server. Up to two modules are supported, one CPU per module.

The UltraSPARC processor has the following features (see Figure B-1):

- SPARC V9 compatibility
 - V9 specifies a 64-bit instruction set architecture that is downwards-compatible with the 32-bit SPARC V8 architecture.
 - V9 provides for 64-bit data and addressing as well as other features to enhance operating system and application performance.
- Implements 44-bit virtual address bits and 41-bit physical address bits.
- Implements the visual instruction set (VIS) used by the FFB graphics device to provide optimal graphics performance (this also includes instructions to help with imaging performance)
- Execution of up to four instructions in parallel (1 memory access, 2 integer ALU instructions, 1 floating point add class, 1 floating point multiply class, and 1 control transfer instruction)
- Each module receives a separate programmable core voltage to permit mixing of modules with different power-rail requirements
- Each module is thermo-coupled for temperature sensing; Ultra 2 series provides two levels; warning and shut-down

UltraSPARC processor performance characteristics include:

- 249 SpecInt92, 349 SpecFP92 for 168-MHz uni-processor
- 332 SpecInt92, 505 SpecFP92 for 200-MHz multi-processor

B.1.4 Memory

Memory uses conventional 5-VDC DRAM SIMMs (DSIMMs) with a 60-ns access time (see Figure B-1).

The system unit or server memory configuration allows 4, 8, 12, or 16 DSIMMs with DSIMM memory capacity options of 16 Mbytes, 32 Mbytes, 64 Mbytes, or 128 Mbytes. Memory upgrades are in 4-DSIMM increments. Each DSIMM in a 4-DSIMM quad must contain the same memory capacity if not, the lower of the DSIMM memory capacities determines the other DSIMM capacities.

Characteristic memory performance includes a peak memory read bandwidth of 667 Mbytes per second and a peak memory write bandwidth of 485 Mbytes per second with random accesses to the DRAM using eight or more DSIMMs.

B.1.5 Graphics and Imaging (Workstation Only)

The system unit takes advantage of UPA features to provide high performance graphics. An FBC ASIC provides acceleration for 2D and 3D imaging primitives (see Figure B-1).

The fast frame buffer (FFB) consists of the FBC, the FBRAM, RAMDAC, and associated circuitry. The FFB connects to the system unit through the UPA64S expansion connector.

FBRAM is a standard DRAM that includes a multi-level cache. The FBC definition permits a write-mostly interface. This, combined with the 3DRAM cache and support for graphics operations, allows a high performance frame buffer.

FFB supports the VESA standard for monitor control. FFB also supports stereo video.

Configuration restrictions include:

- FFB configurations are configured to operate the FBRAM interface at 66-MHz; FFB single-buffer (SB), FFB double-buffer plus Z (DBZ); or 75-MHz for the DBZ speed-sort.
- ZX is supported as an optional upgrade only.

Graphics performance characteristics include:

- SB (168-MHz processor)
 - 2D vectors: 1.9 Mvectors per second
 - 3D vectors: 2.4 Mvectors per second
 - 3D AA vectors: 1.4 Mvectors per second
- DBZ (168-MHz processor)
 - 2D vectors: 1.9 Mvectors per second
 - 3D vectors: 2.4 Mvectors per second
 - 3D AA vectors: 1.4 Mvectors per second
 - 3D triangles: 753 Ktriangles per second
- SB (200-MHz processor)
 - 2D vectors: 1.9 Mvectors per second
 - 3D vectors: 2.4 Mvectors per second
 - 3D AA vectors: 1.4 Mvectors per second
- DBZ Speed Sort (200-MHz processor)
 - 2D vectors: 2.2 Mvectors per second
 - 3D vectors: 2.8 Mvectors per second
 - 3D AA vectors: 1.8 Mvectors per second
 - 3D triangles: 930 Ktriangles per second

Imaging performance characteristics include:

- Display
 - Clear: 30,000 Mpixels per second
 - Font: 2.5 Mcharacters per second
 - BLIT: 80 Mpixels per second
 - Scroll (vertical): 300 Mpixels per second
 - Pan: 50Mpixels per second with FFB
 - Zoom: 30Mpixels per second (6-ns CPU)

B.1.6 Peripherals

The following peripherals are supported by the system unit or server: CD-ROM drive, floppy drive, and disk drive. A small computer system interface (SCSI) and optional tape drive components; 2.5-Gbyte, 4-mm, and 8-mm are also supported. Refer to Figure B-1.

B.1.6.1 CD-ROM Drive

The CD-ROM drive is a standard device with multimedia features. This includes multi-session capability and fast access (quadra-speed) for image and video data. The CD-ROM drive dimensions are 5.94 inch x 7.78 inch x 1.71 inch (149.5 mm x 196 mm x 43 mm) and the drive slot is a standard 1.6-in. (40.64 mm) bay that uses industry standard bezels. Both vertical and horizontal operation is permitted. Headphone access, eject, pin eject, and volume control is available on the front panel. Audio from the CD is available through either the front panel headphone connection, the line-out connector at the system unit or server rear (accessible by cabling from front to rear), or the internal speaker. The CD-ROM drive supports an approximate 600-KByte-per-second data transfer rate and an access time of 200 ms (maximum). The *SunCD 4 Drive Specifications*, document part number 802-4157, provides cleaning, jumper setting, and operation instructions for the CD-ROM drive (see Figure B-1).

Note – Both multifunction and quadra-speed CD-ROM drives are supported as long as they conform to the 5.94-inch x 7.78-inch x 1.71-inch dimensions.

B.1.6.2 Floppy Drive

The system unit or server uses a standard 1.44-Mbyte floppy drive that is 1 inch (25.40 mm) high. The system unit- or server-to-floppy drive interface is a 82077 style interface (see Figure B-1).

B.1.6.3 Disk Drives

The system unit or server supports two 535 Mbyte SCSI disk drives. Each drive is of the 3.5-inch form factor with a single connector configuration. A drive bracket is used to mount the drive to the system unit or server (see Figure B-1). Table B-1 lists the supported disk drives.

Table B-1 Supported Disk Drives

Form Factor Dimension	Disk Drive Capacity	Fast Wide	RPM	Access Time
1 inch	535 Mbytes	No	4500	12 ms
1 inch	1 Gbyte	Yes	5400	11 ms
1 inch	2 Gbytes	Yes	7200	11 ms

B.1.6.4 SCSI Interface

The system unit or server provides a 20-Mbyte per second SCSI interface that is supported by the FEPS ASIC. 20 Mbytes per second is provided by 16-bit single-ended operation at 10 MHz. Both internal and external peripherals are connected to the same daisy chain. External connection is provided through a 68-pin SCSI connector (see Figure B-1).

System configuration requires external devices to be connected in a daisy chain configuration. A maximum of 12 external devices may be daisy-chained through a maximum cable length of 19.69 feet (6 meters). The end of the daisy chain must be terminated with an active terminator. If both 50-pin and 68-pin external devices are connected externally, the 68-pin device must be connected earlier in the daisy chain. A special terminator is available for the last 68-pin device that terminates the extra signals and converts the extra signals into a 50-pin configuration. The last 50-pin device must be terminated.

B.1.6.5 Optional 2.5-Gbyte, 4-mm, and 8-mm Tape Drives

The system unit or server supports the optional 2.5-Gbyte, 4-mm, and 8-mm tape drives. Either the 2.5-Gbyte tape drive, 4-mm tape drive, or 8-mm tape drive may be installed in the system/server unit in lieu of the CD_ROM drive.

2.5-Gbyte Tape Drive

The 2.5-Gbyte tape drive is a 1/4-inch tape drive that is equipped with an intelligent controller and an embedded SCSI-type interface. The *2.5-Gbyte QIC Tape Drive Specifications*, document part number 802-3615, provides cleaning, jumper setting, and tape cartridge instructions for the 2.5-Gbyte tape drive.

4-mm Tape Drive

The 4-mm tape drive is equipped with a single-ended SCSI controller and a 1-MByte on-drive buffer. The *4-mm Tape Drive Specifications*, document part number 802-5324, provides cleaning, jumper setting, and tape cartridge instructions for the 4-mm tape drive.

8-mm Tape Drive

The 8-mm tape drive is an enhanced 8-mm digital helical-scan cartridge tape subsystem. It is packaged in the industry standard 5.25-inch half-height form factor. The *8-mm Tape Drive Specifications*, document part number 802-5775, provides cleaning, jumper setting, and tape cartridge instructions for the 8-mm tape drive.

B.1.7 Networking

The system unit or server supports 10-Mbit and 100-Mbit local area Ethernet IEEE standard 802.3u (also known as 100BASE-T) through the FEPS ASIC. The FastEthernet standard is backwards-compatible with the standard 10-Mbits per second Ethernet standard. The speed is auto-sensed (see Figure B-1).

Twisted-pair Ethernet support is provided through a RJ45 connector. In addition, a media independent interface (MII) connection provides support to any other form of Ethernet (AUI/TP/ThinNet). The MII connection is provided through a 40-pin MII connector. MII converters include MII-to-AUI and MII-to-fiber optic.

B.1.8 Terminal, Modem, Keyboard, and Mouse Connectivity

Terminal, modem, keyboard, and mouse connectivity is traditional Sunness connectivity (see Figure B-1). Two serial ports provide synchronous and asynchronous communication. The synchronous port supports data throughput rates up to 64 Kbaud. The asynchronous port supports data throughput rates up to 76.8 Kbaud.

Both RS-232 and RS-423 interface standards are supported. RS-232 or RS-423 interface selection is provided through a jumper setting. Default configuration is RS-423. Two DB25 connectors are provided for the two serial ports.

Keyboard and mouse functionality is provided through a DIN8 connector. Sun type-5 keyboards and a new mechanical mouse are supported.

B.1.9 Printer connectivity

Parallel printer port connectivity is provided with a DB25 connector. This interface supports up to two Mbytes-per-second data throughput and is Centronics-compatible. All SPARC printers are supported (see Figure B-1).

B.1.10 Audio

Audio includes interface, built-in speaker, and microphone (see Figure B-1).

B.1.10.1 Interface

The system unit or server includes the Codec for audio functionality. Four external connectors are supplied: line input, line output, a headphone, and stereo microphone. All connectors are 0.125-inch (3.18-mm) mini-stereo connectors. Line-in and line-out support 16-bit CD quality stereo. Table B-2 lists each audio port function. Table B-3 identifies the audio specifications.

Table B-2 Audio Port Functions

Port	Function
Headphones	Connects stereophonic headphones for private listening of audio output
Line Out	Connects the system audio output to an external stereophonic amplifier and loudspeakers
Line In	Connects external stereophonic audio sources such as a compact disc player or cassette tape player to the system
Microphone	Connects the SunMicrophone II (or other suitable microphone ¹) to the system

1. The Ultra 2 Series microphone port accepts stereophonic input; however, the Sun Microphone II is a monophonic device. Note also that the older SunMicrophone is not compatible with the Ultra 2 Series system.

Note – Specifications listed in Table B-2 assume that the Audio Tool format setting, “CD-ROM or DAT” is selected.

Table B-3 Audio Inputs and Output

Stereo I/Os	Specifications
Line In	2V typical, 4V max.; 5-50 Ω impedance
Frequency Response	20 Hz-17 kHz +/- 0.5 dB
Internal CD Input	
Input Level	0.1 Vrms typical at 10 k Ω ; 2Vpp max.
Distortion	0.01%, typical at 1 kHz
S/N Ratio	84 dB, typical IEC 179 A-weighted
Frequency Response	20 Hz-17 kHz +/- 0.5 dB
Microphone Input	15 mV typical, 0.6-1.0 k Ω impedance; +5 VDC input bias via a 2.2k Ω resistor
Headphone Output	1V typical, 2.4V max.; 16 Ω -1k Ω impedance
Line Out	1V typical, 2.4V max.; 5-50 k Ω impedance

B.1.10.2 Built-In Speaker

The system unit or server contains a cost-effective speaker. The speaker provides audio functionality in the absence of external speakers. Audio from all sources is available. Table B-4 lists the built-in speaker specifications.

Table B-4 Built-In Speaker Specifications

Speaker	Specifications
Power Output	1.5W average, 3W peak
Distortion	0.02%, typical at 1 kHz
Impedance	16 Ω +/- 20%
Frequency Response	150 Hz-17 kHz +/- 0.5 dB

B.1.10.3 Microphone

A SunMicrophone II mono microphone is included with each system unit.

B.2 ASICS

The system unit or server achieves a high level of integration through application-specific intergrated circuits (ASICs). The system unit or server uses particular ASICs that are also common with the Ultra 1 Creator Series: system I/O controller (SYSIO), buffered memory crossbar (BMX), RISC, and FEPS ASICs. In addition, the system unit or server also uses specific ASICs that include multi-processing system controller (SC_MP), memory data multiplexer and de-multiplexer (CBT). All ASICs are 1149.1 (JTAG) compliant. Table B-5 lists each ASIC by name and provides characteristics of each device.

Table B-5 ASIC Characteristics

ASIC Name	Gates	RAM (bits)	Package	Die Size (mm x mm)	Power (W)	Reqd Per Unit
SC_MP	140K	0	372BGA		3.9	1
SYSIO	116K	14K	372BGA	10 x 10	2.7	1
BMX	7K	0	44TSSOP	NA	0.2	18
RISC	7k	0	160MQFP	6.25 x 6.25	0.4	1
FBC	202K	16K RAM, 32K ROM	313BGA	10.54 x 10.54	5.9	1
CBT	0.4K	0	56TSSOP	NA	0.2	18
RAMDAC			208PQFP	NA	2.0	1
FEPS	115K	4K	240PQFP		2.0	1

B.2.1 Multi-Processing System Controller (SC_MP)

The SC_MP ASIC is the key element for controlling the UPA and main memory. The SC_MP ASIC controls accesses from UPA master device to UPA slave device, and UPA accesses to memory. SC_MP includes a complete coherency controller which controls system dual tags (DTAGs).

A highlight of the SC_MP ASIC features follow:

- Integrates memory controller functionality. Memory controller is programmable to accommodate multiple DRAM and UPA speeds
- Supports four banks of memory, each with four SIMMs
- Supports 16-Mbyte, 32-Mbyte, 64-Mbyte, and 128-Mbyte, 60-ns DSIMMs
- Maximum memory configurations of 2 Gbytes with sixteen 128-Mbyte DSIMMs
- Supports 3 UPA masters and 1 UPA slave with independent address busses (independent busses are required for graphics streaming)
- Controls the BMX ASIC which connects the UPA data bus and memory

- Controls the CBT ASICs
- 372-pin BGA package
- 3.3-VDC and 5-VDC power supply voltage

B.2.2 System I/O Controller (SYSIO)

The SYSIO ASIC bridges between the UPA and the SBUS.

A highlight of the SYSIO ASIC features follow:

- Contains the IOMMU
- Integrates streaming buffer to enhance sequential I/O performance
- Provides logic for dispatching interrupt vectors to processors
- Provides ECC generation and checking logic
- Provides 372-pin BGA packaging
- Provides 3.3-VDC and 5-VDC (for SBus) supply voltages

B.2.3 Buffered Memory Cross Bar (BMX)

The BMX ASIC is a three-port crossbar connecting a 144-bit UPA data bus, a 288-bit-wide DRAM memory bus, and a 72-bit UPA data bus. To maintain a manageable pin count, the devices are sliced so that 18 BMX ASICs are needed to form the complete switch function.

A highlight of the BMX ASIC features follow:

- 8 bits of UPA 128, 4 bits of UPA 72, and 16 bits of DRAM bus per ASIC
- 3.3-VDC and 5-VDC power supply voltage
- Switch connections controlled by SC
- 48-pin TSSOP package

B.2.4 Clock Chip (RISC)

This RISC ASIC implements four functions: reset, interrupt, scan, and clock. Generation and stretching of the reset pulse is performed in this ASIC. Interrupt logic concentrates 42 different interrupt sources into a 6-bit code which communicates with the SYSIO ASIC. RISC also integrates a JTAG controller. In cases where there are multiple processors, they are required to run at the same frequency. A 3-bit code is output by each processor module to indicate the speed for that module. Logic inside RISC determines what the minimum value of the processor codes presented to it is, and outputs the selected value for the remaining clock logic to set the main system frequency.

A highlight of the RISC ASIC features follow:

- Determines system clock frequency
- Controls reset generation
- Provides JTAG
- Performs SBus and miscellaneous interrupt concentration for SYSIO
- Controls flash PROM programming, frequency margining, and lab console operation
- 25-MHz operation
- 160-pin MQFP package
- 3.3-VDC and 5-VDC supply voltage

B.2.5 Fast Ethernet Parallel Port (FEPS)

The FEPS ASIC provides throughput for I/O devices connected to the Ethernet, SCSI, and parallel port interfaces. FEPS consists of a frame buffer controller and RAMDAC ASICs.

A highlight of the FEPS ASIC features follow:

- Integrates 20-Mbyte per second SCSI interface core with low system overhead
- Integrates 10-Mbit per second and 100-Mbit per second Ethernet

- Complies with IEEE 1496 SBus specification. Also provides for 64-bit SBUS transfers
- Supports SBus extended transfer and 64-byte burst transfer
- 25-MHz SBus operation
- 5-VDC supply voltage

B.2.5.1 Frame Buffer Controller (FBC)

The FBC ASIC is the graphics draw ASIC that interfaces to the UPA and to the frame buffer FBRAM. The FBC provides graphics draw acceleration.

A highlight of the FBC ASIC features follow:

- UPA slave device with write-mostly philosophy
- Supports single buffered and double buffered with Z buffer configurations
- Interfaces with 3DRAM to achieve accelerated graphics performance
- Supports frame buffer to frame buffer copy
- Supports viewport clipping, picking, and pixel processing
- Supports byte, plane masks, raster operations, blend operations, and conditional writes in 3DRAM
- 313-pin BGA package
- 3.3-VDC and 5-VDC (for RAMDAC) supply voltage

B.2.5.2 RAM Digital-to-Analog Converter (RAMDAC)

The RAMDAC ASIC is listed for reference. It is being designed in conjunction with an outside vendor.

A highlight of the RAMDAC ASIC features follow:

- Built in VTG
- Direct interface to FBRAMs
- On board phase-lock loop (PLL) and clock generator circuitry for the pixel clock
- 64 X 64 cursor LUT

- Direct support for X visual types
- 208-pin PQFP package
- 5-VDC supply voltage

B.2.6 Slave I/O (SLAVIO)

The SLAVIO ASIC provides most of the Sunness I/O requirements. It contains serial ports, floppy control, and extended bus (EBus) control.

A highlight of the SLAVIO ASIC features follow:

- Highly integrated for supplying Sunness I/O requirements
- Integrated keyboard/mouse interface
- Complies with IEEE 1496 SBus specification
- 25-MHz SBus operation
- 5-VDC supply voltage

B.2.7 CBT

The CBT ASIC is a two-port switch between a 576-bit memory bus (DSIMM side) and 288-bit memory bus (BMX side). To maintain a manageable pin count, the CBT ASICs are sliced into 18 parts to form the complete switch function.

A highlight of the CBT ASIC features follow:

- 16 bits of MEMORY 288 bus and 32 bits of DRAM bus per ASIC
- 5-VDC power supply voltage

- Switch connections controlled by SC_MP ASIC
- 56-pin TSSOP package

B.3 Power Supply

Table B-6 lists power budgets for the Ultra 2 series desktop workstation and the Ultra Enterprise 2 server power supply.

A highlight of the power supply features follow:

- Remote sensing on +3.0 VDC, +3.3 VDC, and +5.0 VDC
- Six cables required for power distribution: one to the CD-ROM drive, one to the diskette drive, and four to the system board

Note – System board cables consist of two for the programmable voltages, one for other voltages, and one for sense.

- The programmable supply ranges from 2.5 VDC to 3.5 VDC. The programmable voltages are controlled by the CPU module(s) to permit CPU modules having different core voltages to operate conjointly within the same system unit or server.

Note – Power values listed in Table B-6 translate to worse-case current requirements. Peak current requirements are greater. Note that the amount of power dissipated as heat is not listed. Also, the maximum delivered power is not the same as the sum of the output powers because of configuration restrictions and peripheral power-dissipation limits that are smaller than peak current requirements. All component power supply budget values are measured as a function of wattage.

Table B-6 Ultra 2 series Desktop Workstation and Ultra Enterprise 2 Server Power Supply Budget

Component	3.3V	Programmable (2X)	5V	+12V	-12V	Power Delivered (max)
UltraSPARC module (2X) ¹	30.0	70.0	0.0	0.0	0.0	100.0
Memory	0.0	0.0	45.0	0.0	0.0	45.0
Graphics (double-buffer, desktop workstation only)	16.0	0.0	2.5	0.5	0.0	19.0
System board	12.3	0.0	6.6	17.7	0.5	37.1
SBus (4 slots)	0.0	0.0	40.0	4.8	4.8	40.0
Disks (2X)	0.0	0.0	<15.0	<28.8	0.0	30.0
CDROM	0.0	0.0	<6.0	<12.0	0.0	12.0
4-mm tape drive	0.0	10.0	5.5	6.0	0.0	10.0
8-mm tape drive	0.0	0.0	12.0	8.4	0.0	15.0
Floppy	0.0	0.0	1.5	0.0	0.0	1.5
Keyboard/mouse (desktop workstation only)	0.0	0.0	1.6	0.0	0.0	1.6
Output sized to	182.0	80.0	125.0	76.5	4.1	
Total						311.2

1. Power supply budget measurements for two 168-MHz UltraSPARC modules. Power supply budget values for two 200-MHz UltraSPARC modules are somewhat less.

B.4 System Board

Figure B-2 illustrates a block diagram of the Ultra 2 series desktop workstation and Ultra Enterprise 2 server system board.

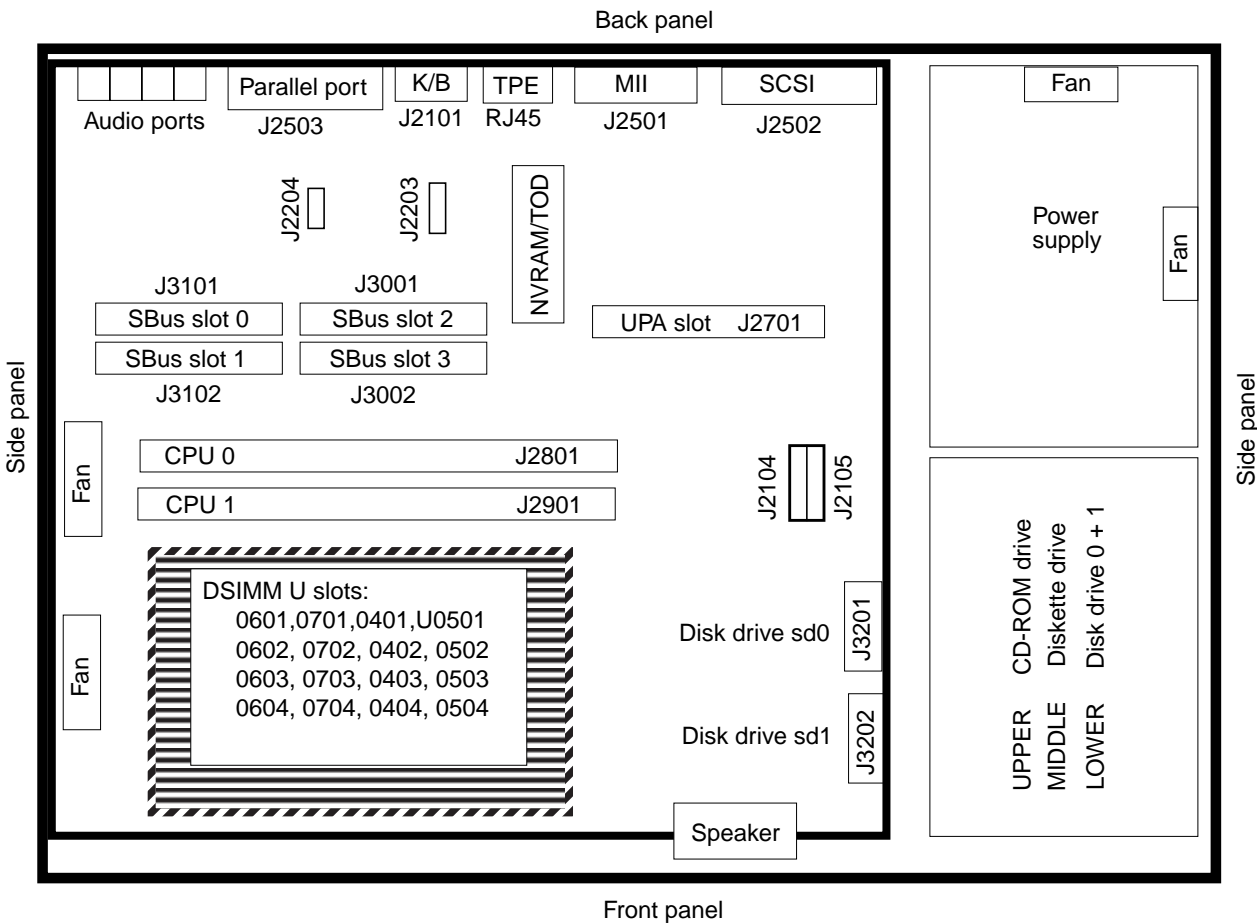


Figure B-2 Ultra 2 Series Desktop Workstation and Ultra Enterprise 2 Server System Board Block Diagram

B.5 Jumper Description

The jumper description includes a brief overview of serial port jumpers, flash PROM jumpers, and additional system board jumpers and connector blocks.

Jumpers are identified on the system board by J designations. Figure B-3 distinguishes jumpers with identifying asterisks. Jumper pins are located immediately adjacent to the J designator. Pin 1 is marked with an asterisk in any of the positions shown (Figure B-3). Ensure that the serial port jumpers are set correctly.

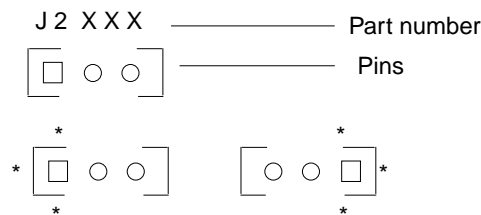


Figure B-3 Identifying Jumper Pins

B.5.1 Serial Port Jumpers

Serial port jumpers J2104 and J2105 can be set to either RS-423 or RS-232 serial interface. The jumpers are preset for RS-423. RS-232 is required for digital telecommunication within the European Community. Table B-7 identifies serial port jumper settings. If the system is being connected to a public X.25 network, the serial port mode jumper setting may need to change from RS-423 to RS-232 mode.

To change the serial port mode jumper setting:

1. **Power-off the system**
2. **Remove the unit cover**



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

3. **Attach the wrist strap.**
4. **Locate the jumpers on the system board and change the selection of jumpers J2104 and J2105 to position B.**
5. **Detach the wrist strap.**
6. **Replace the unit cover.**
7. **Power-on the system.**

Table B-7 Serial Port Jumper Settings

Jumper	Pins 1 + 2 Select	Pins 2 + 3 Select	Default Jumper on Pins	Signal Controlled
J2104	RS-232	RS-423	2 + 3	RS-232/RS-423 SEL
J2105	RS-232	RS-423	2 + 3	RS-232/RS-423 SEL

B.5.2 Flash PROM Jumpers

Flash PROM jumpers J2202, J2203, and J2204 permit the reprogramming of specific code blocks. Table B-8 identifies the flash PROM jumper settings. The default setting of J2202 through J2204 is on pins 1 and 2. Table B-8 identifies the signals controlled by the non-default settings of jumpers J2203 and J2204.

Table B-8 Flash PROM Jumper Settings

Jumper	Pins 1 + 2 Select	Pins 2 +3 Select	Default Jumper on Pins	Signal Controlled
J2202	Flash PROM	Not to be used	1 + 2	FLASH PROM SEL
J2203	Write Protect	Write Enable	1 + 2	FLASH PROM PROG ENABLE
J2204	High half booting	Normal Booting	2 + 3	XOR LOGIC SET

Note – After reprogramming the system flash PROMs, verify that the flash PROM Write Protect/Enable jumper (J2003) is set to the Write Protect position to ensure system security.

B.5.3 Additional System Board Jumper Blocks

Additional system board jumper blocks are identified in Table B-9 and are listed for information purposes only.

Note – Do not attempt to add jumpers to jumper blocks identified in Table B-9.

Table B-9 Additional System Board Jumper Blocks

Jumper Block ID	Description
J2103	Enable Test Edge Serial Ports Enable (manufacturing only)
J2201	External Reset: jumper pin 1 to pin 2 to force XIR reset; jumper pin 2 to pin 3 to force POR reset
J2202	Manufacturing ROMBO connector
J2203	Manufacturing JTAG/Scan test connector
J3402	Enable Test Edge Ethernet Port (manufacturing only)
J3403	Enable Test Edge Ethernet Port (manufacturing only)

B.6 Enclosure

The Sun Ultra 2 series uses an enclosure that reflects style, ergonomics, serviceability, functionality, versatility, and quality. Physical orientation allows for a rack-mount or desktop installation. The enclosure design complies with all necessary environmental and regulatory specifications.

B.6.1 Enclosure Basics

Overall dimensions of the enclosure are 17.86 inches x 17.63 inches x 0.40 inches (450 mm x 444 mm x 130 mm). The enclosure houses:

- One 3.5-inch floppy drive
- One 1.6-inch CD-ROM drive in a industry standard 1.6-inch bay

Note – The CD-ROM drive slot is used for either the CD-ROM drive or optional 4-mm and 8-mm tape drives.

- Two 1-inch single-connector 3.5-inch disk drives
- Two plug-in UltraSPARC modules
- Sixteen DSIMMs
- Four SBus modules
- One UPA64S module

B.6.2 Enclosure Features

Enclosure features include:

- Good service access for internal upgrades and field replaceable units (FRUs)
- Optimized system board layout
- Graphics expansion module (UPA64S connector)
- Processors placed on plug in modules. Allows for upgrades and conversion from UP to MP system

- Four SBus cards in a 2 x 2 configuration
- All standard connectors and no splitter cables on rear panel

B.7 Environmental Compliance

The Ultra 2 series meets or exceeds the specifications defined by the “Controlled Office” classification of the 990-1146-03, Rev A document.

B.8 Agency Compliance

The Ultra 2 series complies with international and domestic regulatory requirements for safety, ergonomics, EMI, immunity, electrical, and telecommunication.

Glossary

address

A unique location within a computer memory or peripheral. Reference is usually made to an address for retrieving or storing data.

ALU

Arithmetic logic unit. The part of a computer's central processor unit which performs mathematical and logical operations.

ASIC

Application specific intergrated circuit

AUI

Attachment unit interface.

BMX

Buffered memory crossbar. Provides a three-port cross bar connecting a 144-bit UPA data bus, a 288-bit-wide DRAM memory bus, and a 72-bit UPA data bus.

boot

Sometimes referred to as bootstrap. A term used to identify the process of reading in initial software to the computer.

boot PROM

In Sun workstations, contains the PROM monitor program, a command interpreter used for booting, resetting, low-level configuration, and simple test procedures.

boot PROM diagnostics

The diagnostic firmware contained in the boot PROM. These diagnostics include the Power-On Self Test (POST) and on-board diagnostics.

CBT

Memory data multiplexer and de-multiplexer. A 2-port switch electrically connected between a 576-bit memory bus (DSIMM side) and a 288-bit memory bus (BMX side).

CRC

Cyclic redundancy check

DBZ

Double-buffer plus Z.

default

A preset value that is assumed to be correct unless changed by the user.

DPI

Dots per inch

DPS

Data path scheduler. Controls all data flow coordinating the activity of the BMX chips.

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.

DSIMM

DRAM single in-line memory module. A printed circuit card containing DRAM chips.

DTAG

Dual tag or data tag.

EMI

Electromagnetic interference. An electromagnetic phenomena which, either directly or indirectly, can contribute to a degradation in performance of an electronic system.

ESD

Electrostatic discharge.

Ethernet

A type of network hardware that permits communications between systems connected directly together by transceiver taps, transceiver cables, and coaxial or twisted-pair cables.

FBC

Frame buffer controller. Provides the interface between the UPA and the frame buffer RAM (FBRAM). Also controls graphic draw acceleration.

FEPS

Fast ethernet parallel interface. Provides data throughput for I/O devices connected to Ethernet, SCSI, and parallel port interfaces.

FFB

Fast frame buffer. Circuit card consisting of the FBC, FBRAM, RAMDAC, and associated circuitry.

Gbyte

Gigabyte.

Kbyte

Kilobyte.

LED

Light-emitting diode. A semiconductor diode that radiates light when the junction is forward biased and there is sufficient current through the diode.

Mbps

Mega-Bits-Per-Second.

Mbyte

Megabyte.

MHz

Megahertz.

NVRAM

Non-volatile random access memory. Provides storage of system variables used by the boot PROM. Contains the system `hostID` number and Ethernet address.

OBP

Open boot PROM. A program or routine used to locate and diagnose trouble in computer hardware or software.

POST

Power-on self test. Automatically initialized at system turn-on or when the system is rebooted. A series of tests that verify major system board components (including the processor chip set) are working properly.

RISC

Provides four functions: reset, interrupt, scan, and clock.

RS-232

The Electronics Industry Association standard defining interface voltage and current levels and other signal characteristics for connecting digital equipment to a transmission line.

RS-423

The Electronics Industry Association standard defining interface voltage and current levels and other signal characteristics for connecting digital equipment to a transmission line.

SCSI

Small computer system interface.

Slavio

Slave I/O. Provides most of the Sunness I/O requirements. Contains serial ports, floppy control, and extended bus (EBus) control.

SC_MP

Multi-processing system controller.

S/N

Signal-to-noise.

SunVTS

Sun validation and test suite applications. A diagnostic tool designed to test Sun hardware.

SYSIO

System I/O controller. Provides an electrical bridge between the UPA and the SBUS.

TOD

Time of day clock chip.

TPE

Twisted pair Ethernet. Provides 10-Mbps or 100-Mbps networking.

TTL	Transistor-transistor logic. A digital system semiconductor logic gate circuit design comprised of multiple emitter input transistors, a unique dual-mode coupling transistor, and a transistor totem pole output.
UPA	Ultra port architecture.
VIS	Visual Instruction Set.
VOM	Volt-ohm-milliammeter. A multifunction, multirange instrument for troubleshooting and maintaining electrical and electronic equipment. It measures voltage, current, and resistance. Also called a multimeter.
VTSK	VTS Kernel. Part of SunVTS. Controls all testing. Used to probe the hardware configuration of the system and wait for instructions from the user interface.
VTSUI	VTS Open Look User Interface. Part of SunVTS. Allows various user options, tests, read-log files, and start or stop testing sessions to be selected through the numerous buttons and windows of OpenWindows.
VTSTALK	VTS Script Interface. Part of SunVTS. Allows individual commands to be transmitted and status messages to be received from <i>vtstk</i> without initiating a user interface.
VTS_CMD	VTS Command. Part of SunVTS. Identical to VTSTALK.
10BASE-T	An IEEE standard 802.3u Ethernet interface. Provides a 10-Mbits-per-second data transfer.
100BASE-T	An IEEE standard FastEthernet interface. Provides a 100-Mbits-per-second data transfer rate.

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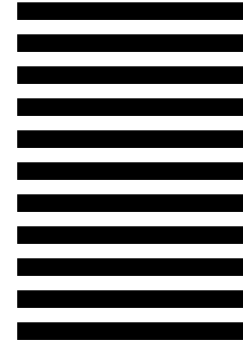
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