SPARCstation IPC Service Manual

Warning – Qualified Technicians Only —See Preface for details.

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

Removal of the shrink wrapping from this manual signifies that you will read and agree to comply with the notes, cautions, and warnings found in the Preface of this manual.

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Refer to the notes, cautions, and warnings found in the Preface of this manual.

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About This Book

The *SPARCstation IPC Service Manual* describes how to diagnose system problems by running diagnostics and how to remove and replace field replaceable units (FRUs).

Notes, Cautions, and Warnings

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.

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

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

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

Who Should Read This Book

This book is written for Sun Field Service representatives, original equipment manufacturers (OEMs), valued-added resellers (VARs), and other customers with self-maintenance contracts.

What This Book Contains

This book contains four chapters, four appendixes, and a glossary:

- System Overview—Chapter 1
  This chapter presents a high-level description of the SPARCstation IPC system, followed by brief descriptions of each subsystem. Read this chapter to gain a general familiarity with the hardware.
- Diagnostics Overview—Chapter 2
  This chapter describes the different types of diagnostics and how they are related. This chapter also briefly discusses the Forth Toolkit. Read this chapter to gain general knowledge about the diagnostic and Forth Toolkit tools available to you.
- Preparing to Work on the System—Chapter 3
  This chapter explains tools you will need, how to halt the system, how to disconnect the Desktop Storage Packs and the External Storage Module from the system unit, how to remove the system unit's top section, and how to attach a wrist strap to your wrist and to the system chassis. **Read this chapter before replacing any hardware**.
- FRU Replacement—Chapter 4
  This chapter explains how to locate, remove, and replace defective field-replaceable units (FRUs) or install new ones. Drawings and callouts are provided to illustrate the process. **Read this chapter before attempting to replace any hardware**.

- System Specifications—Appendix A
  This appendix contains system specifications, including dimensions, electrical and power requirements, and environmental constraints.
- Illustrated Parts Breakdown—Appendix B
  This appendix contains illustrations of global views of the system, part numbers for FRUs, other hardware, and related books.
- NVRAM Parameters—Appendix C
  This appendix contains the Non-Volatile system configuration parameters used during reset.
- Manufacturing Diagnostics—Appendix D
  This appendix contains instructions for using Manufacturing Diagnostics.
- Glossary
  The glossary contains definitions of technical terms, abbreviations, and acronyms.

Before Reading This Book

Before reading this book, you should have performed hardware installation. If you are connecting to a network, you should also be proficient with system administration and networking procedures. If you are not proficient in these areas, please read the following books before attempting to repair your system:

- *SPARCstation IPC Installation Guide*
- *Sun System & Network Manager's Guide*

Typographical Conventions

This book uses a number of typographical conventions:

- *This font* is used for emphasis and for the title of a book. For example:

  The heart of the *SPARCstation IPC* is contained in a main chassis or system unit.

  SPARCstation IPC Installation Guide

- `This font` indicates text the system displays on the screen.

  ```
  Syncing file systems... done
  ```

- **`This font`** indicates characters and words you enter.

  Enter **`passwd`**.

The term “enter” means to type the command indicated and press the Return key. For example, “enter `sync`” means to type the command indicated and press the Return key.

Related Books

The following books provide additional information that you may need, and are occasionally referenced in this book:

- *Open Boot PROM Toolkit User’s Guide* provides a summary of the Forth Toolkit commands.
- *Introduction to Open Boot 2.0* provides a summary of Forth Toolkit commands for revision 2.0 of the Open Boot PROM.
- *Open Boot 2.0 Command Reference* provides detailed information about revision 2.0 of the Open Boot PROM.
- *Sundiag User’s Guide* provides information about Sundiag, a system exerciser that runs under SunOS. Sundiag displays real-time use of system resources and peripherals.
- *SPARCstation IPC Installation Guide* provides step-by-step instructions on how to install your system’s hardware and software.
- *Sun System & Network Manager’s Guide* provides material of interest to system and network managers. Especially useful are the procedures for halting the system.
- *Sun Diagnostic Executive User’s Guide for the SPARCstations* explains how to run extensive, configurable texts independent of SunOS. The Sun Diagnostic Executive is the tool of choice when you need thorough diagnostics. With the Sun Diagnostic Executive you can determine which field replaceable unit needs to be replaced.
- *Desktop Storage Pack Install Guide* explains how to install and daisy-chain external storage modules.

System Overview

This chapter presents an overview of the SPARCstation IPC system's hardware. This overview is helpful in servicing and maintaining hardware equipment.

The heart of the SPARCstation IPC is contained in a main chassis or *system unit*. The system unit houses the main logic board. A power supply, an optional 3 1/2-inch hard disk drive, a 3 1/2-inch diskette drive, and the speaker are also contained in the system unit. The system is supplied with an on-board monochrome frame buffer. No frame buffer card is necessary in either of the system's two SBus expansion slots when a monochrome video monitor is connected to the system. If a color or grayscale monitor is required, an 8-bit SBus frame buffer card may occupy either slot. See "SBus Cards" later in this chapter for more information. "Mass Storage Devices" later in this chapter provides information on the expansion modules.

Figure 1-1 illustrates the system's configuration with an external storage device. Figure 1-2 presents an open view of the system. Figures 1-3 and 1-4 present the main logic board's layout and a block-level diagram of the main logic board. The balance of the chapter describes the system's components.

Major Components

The system's major components usually consist of the following:

- The system unit
- The keyboard
- The video monitor (or a terminal)
- The mouse
- Optional expansion modules. The following are available:
  - Desktop Backup Pack (1/4-inch 150 megabyte tape drive only)
  - Desktop Disk Pack (3 1/2-inch 104 megabyte, 207 megabyte, or 424 megabyte hard disk drive only)
  - Desktop SunCD™ Pack (CD-ROM Player)
  - Desktop Storage Module (1.3 gigabyte hard disk drive and 2.3 gigabyte tape drive
  - External Storage Module (5 1/4-inch 669 megabyte hard disk drive only)
  - External Storage Module (5 1/4-inch 669 megabyte hard disk drive and 1/4-inch 150 megabyte cartridge tape drive)
  - External Storage Module (dual 5 1/4-inch 669 megabyte hard disk drives)
  - External Storage Module (5 1/4-inch 669 megabyte hard drive and 2.3 gigabyte 8 mm. cartridge tape drive)

See the *Desktop Storage Pack Installation Guide* for installation procedures for the Desktop Disk Pack, Desktop Backup Pack, and Desktop Sun CD Pack, and for information about daisy-chaining external drive units.

Figure 1-1 is a block diagram of one of the workstation's configurations.

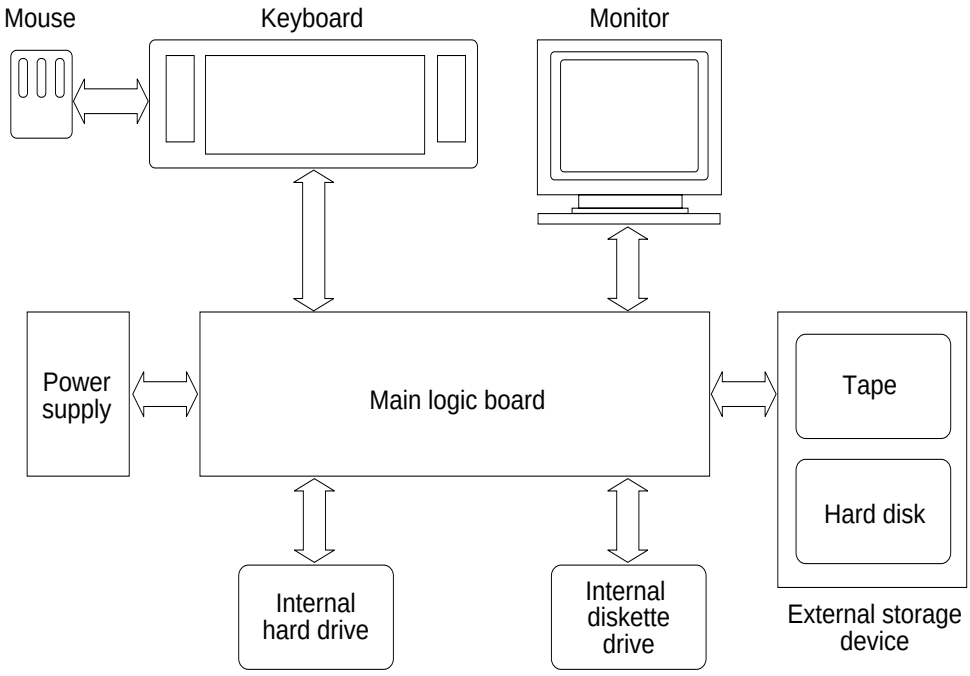


Figure 1-1 SPARCstation IPC With External Storage Device Block Diagram

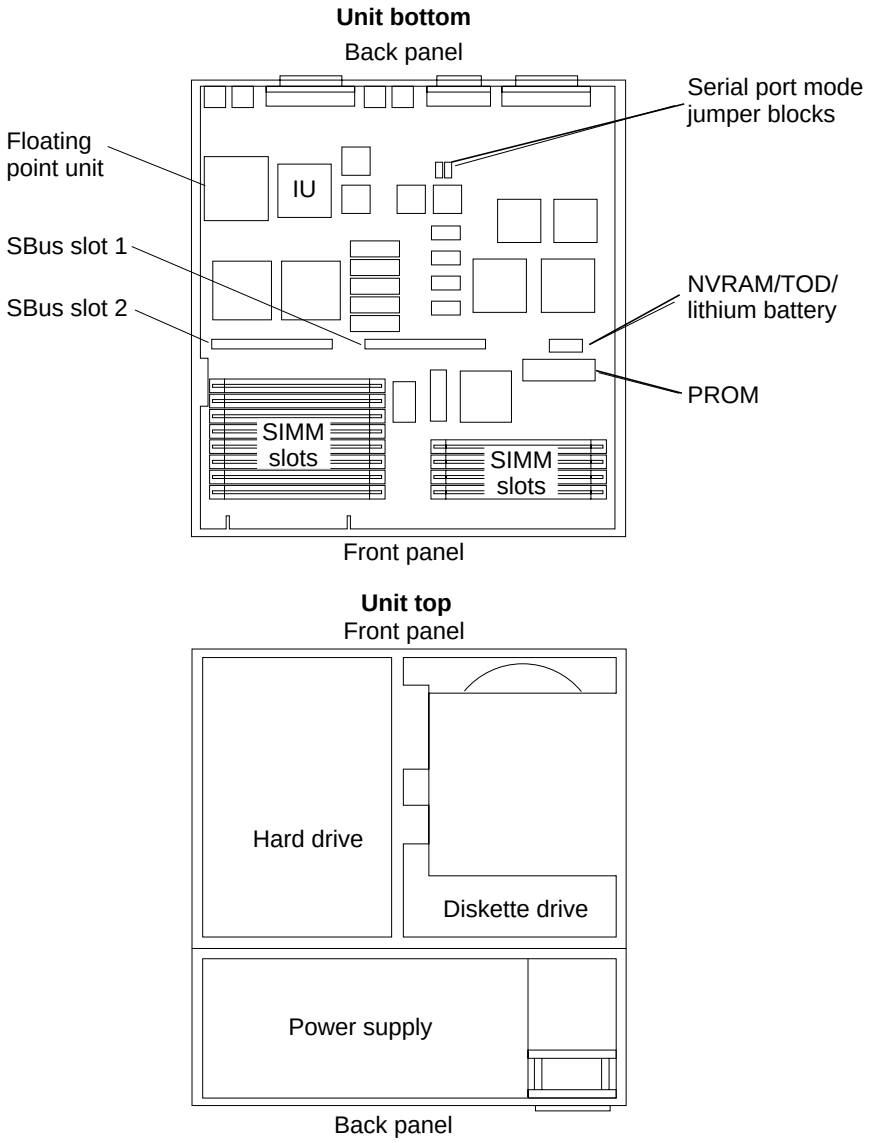


Figure 1-2 Open View of the System

Figure 1-3, on the next page, illustrates the main logic board's layout. All chips discussed in "Main Logic Board," which follows, are illustrated in this figure.

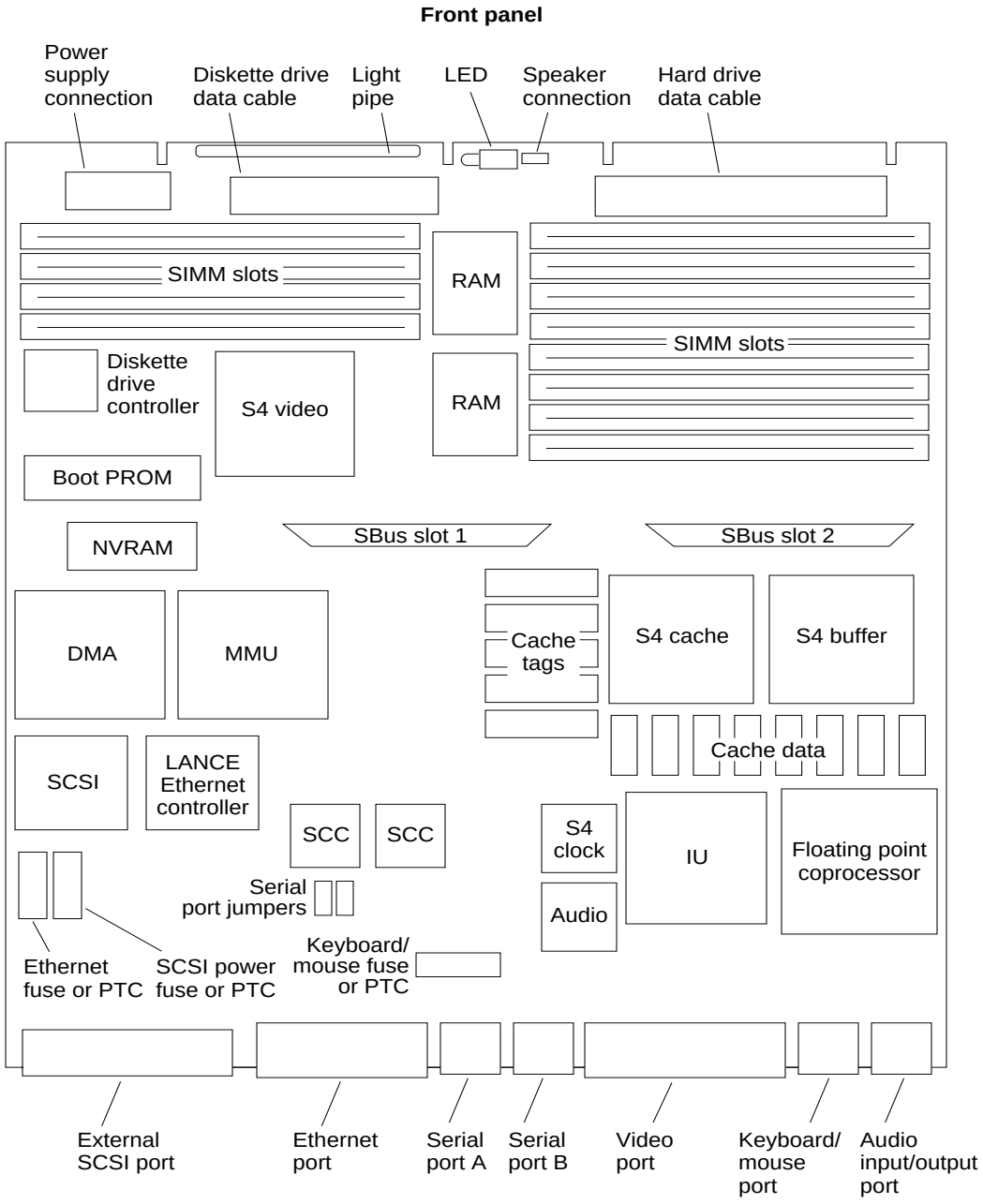


Figure 1-3 The Workstation's Main Logic Board

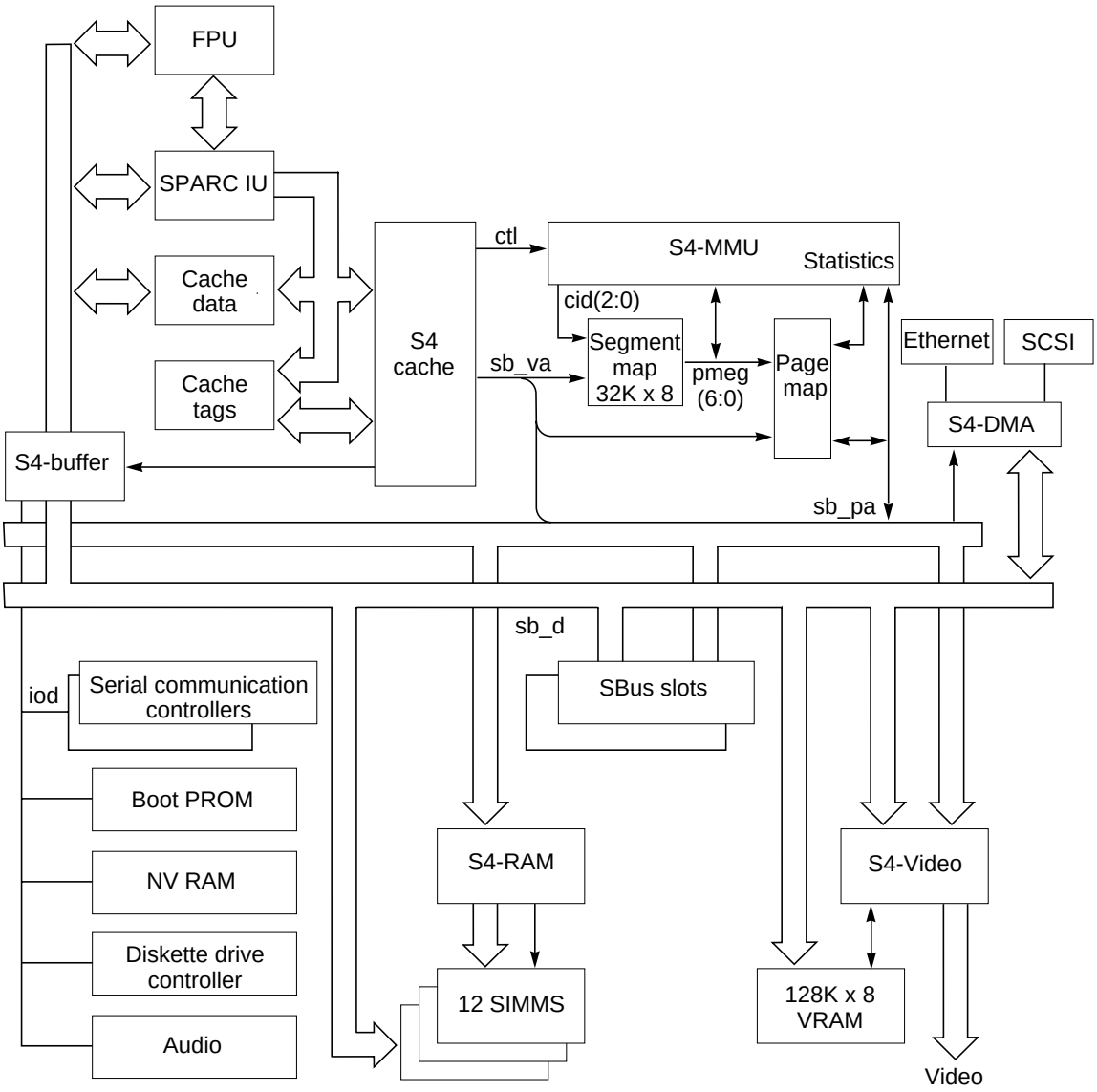


Figure 1-4 A Block Level Diagram of the Main Logic Board

Main Logic Board

The major sections of the main logic board consist of the following:

- CPU Core
- Two SBus Slots
- Memory Management Unit (MMU)
- S4 Direct Memory Access (DMA)
- Dynamic RAM (DRAM)
- Input/Output, such as the Ethernet controller chip, the SCSI controller chip, and the diskette drive controller chip
- Monochrome Video Port
- Eight-bit devices

CPU Core

The CPU core consists of the following:

- Instruction Unit (IU)
- Floating-point coprocessor (FPU)
- Cache memory

These components are discussed in the sections that follow.

Instruction Unit

The basic core of the main logic board is the SPARC Instruction Unit (IU) (see Figures 1-2, 1-3, and 1-4). The IU's clock speed is 25 MHz. Integer operation is approximately 15 Dhrystone MIPs. The IU is supported with the S4 chip set, including the S4 cache, the S4 memory management unit, the S4 buffer, and the S4 clock.

Floating-Point Coprocessor

The floating-point coprocessor (see Figures 1-2, 1-3, and 1-4) delivers approximately 1.75 Mflops double precision Linpack performance.

Cache Memory

Cache memory (see Figures 1-3 and 1-4) is high-speed local memory for the IU. The chips comprising cache memory include the following:

- S4 Cache
- Cache Data RAM
- Cache Tags RAM
- S4 Buffer

The S4 cache chip serves as the SBus controller and the address path. The S4 buffer chip controls the data path through the cache. The S4 cache chip also controls what data is available in the cache data RAM.

The IU asks for data from a specific address. That address is compared against information stored in the cache tags. The S4 cache chip decides if the data the IU is looking for is stored in the cache, based on the information stored in the cache tags.

If the data is in the cache, the cache data RAM transmits data to the IU as fast as the IU can receive data. If the data is not in the cache, this is referred to as a cache miss, and the IU is halted. An SBus cycle is initiated to obtain the required data from main memory. The cache data RAM is filled with the information obtained from main memory and the IU is started again.

The cache design implemented in the SPARCstation IPC is a 64K write-through cache with one level of write buffering. The cache line size is 16 bytes, with one tag for each line.

Eight Bit Devices

The eight-bit devices connected to the I/O data bus consist of the following:

- Boot PROM

  The boot PROM (see Figures 1-3 and 1-4) is connected to the I/O data bus. The boot PROM is 128Kx8 for systems with Open Boot PROM Version 1.x or 256Kx8 for systems with Open Boot PROM Version 2.x and contains the boot code and the Forth Toolkit, signified by the `ok` prompt. The Forth Toolkit does not look like other Sun Monitor programs and does not behave like the older Sun PROMs.

  The boot PROM does the following:

- Runs startup tests.
- Initializes the host machine.
- Reads non-volatile RAM (NVRAM) and executes the boot sequence. Usually, this consists of booting SunOS. In some cases, however, the Sun Diagnostic Executive or standalone programs can also be run. For more information on the boot sequence, see "How it Fits Together" in Chapter 2.
- Supplies program code for the abbreviated system monitor, signified by the > prompt and the Forth Toolkit. If the boot attempt fails, the boot PROM tries to start the abbreviated system monitor.
- Supplies program code for the on-board diagnostics accessible through the Forth Toolkit. For more information on the on-board diagnostics, see "Boot PROM Diagnostics" in Chapter 2.

- Non-volatile RAM (NVRAM) and Time-of-Day Clock
  The NVRAM chip (see Figures 1-3 and 1-4) contains the time-of-day clock and the non-volatile RAM. The NVRAM chip is connected to the I/O data bus.

  The NVRAM chip (timekeeper) contains its own battery. There is no limit on the number of times the timekeeper can be written to.

  The non-volatile RAM stores the default system configuration parameters. This defines how the system will be set up at the lowest level. You can modify these parameters using the Forth Toolkit. If you need to change these parameters, see Appendix C in this book for an abbreviated set of NVRAM parameters. The *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0* provide more information.

- Serial Ports A and B
  Serial ports A and B reside on the main logic board (see Figure 1-3). These serial ports are RS-423 ports, configurable to RS-232, and can connect peripheral equipment such as terminals, printers, and modems by an adapter cable with an 8-pin DIN connector**.** The serial communications controller chips (Figure 1-4) help to implement the serial ports A and B interface.

- Keyboard and Mouse Interface
  A keyboard and mouse port supplied with an 8-pin DIN connector, on the back of the main logic board to the right of the Video port (see Figure 1-3), controls the keyboard and mouse. The serial communications controller chips (Figure 1-4) help to implement the keyboard and mouse interface.

- Diskette Drive Controller
  The internal diskette drive is connected to the I/O data bus by the diskette drive controller chip (see Figures 1-3 and 1-4).
- Audio
  The system speaker is connected to the I/O data bus by the audio chip (see Figures 1-3 and 1-4). There is an audio port on the unit back panel. With a split adapter cable (ISDN connector) for microphone and headphone, you can plug the following devices into the audio input/output port:
  - Dynamic, high-impedance microphone (10,000 ohms to 50,000 ohms impedance)
  - Audio tape player equipped with attenuating adapter
  - Compact disk player equipped with attenuating adapter
  - Headphones (30 ohms to 100 ohms impedance)
  - External amplifier and loudspeaker

Note – Although the SPARCstation IPC was designed for a dynamic, high-impedance microphone (40,000 ohms to 50,000 ohms impedance), in some cases a microphone in the range of 300 ohms to 1,000 ohms may work as well.

The workstation's sound capabilities can be shown with a sound demonstration tool such as Soundtool, a program included with SunOS (4.1). To test the workstation's sound, see "Speaker" in Chapter 4. For additional information, see "Sun Operating System Features" in Chapter 6 of the *SPARCstation IPC Installation Guid*e. "Connecting Audio Devices" in Chapter 2 of the *SPARCstation IPC Installation Guide* illustrates how to connect audio equipment.

Memory Management Unit

The S4 memory management unit (MMU) chip, (see Figures 1-3 and 1-4) is connected to the system bus. The MMU maps the virtual addresses used by user programs, SunOS, and input/output devices to physical memory addresses. This is how virtual memory is implemented. Virtual memory allows a user program to have access to an address space that is larger than the physical memory present on the system.

In addition, it isolates the address space of one process from that of another, preventing errors in a user-level program from bringing the entire system down. It also controls the protections (read-only or read / write) associated with each page of memory, allowing, for example, one copy of a shared library to be used by many running programs.

S4 Direct Memory Access (DMA)

Ethernet is controlled by a Local Area Network Controller for Ethernet (LANCE) controller chip (see Figures 1-3 and 1-4). SCSI disk drive operations are handled through the SCSI controller chip. Both the Ethernet controller and the SCSI controller interface to the SBus through the S4 DMA chip.

Dynamic RAM

The Dynamic RAM (DRAM) is comprised of the following:

- Two S4 RAM chips, illustrated in Figures 1-3 and 1-4
- 12 Single Inline Memory Modules (SIMM) slots capable of accepting either 1-megabyte SIMMs or 4-megabyte SIMMs in groups of four.

Refer to “Single Inline Memory Modules (SIMMs)” later in this chapter for more information.

SBus Slots

There are two SBus slots on the main logic board (see Figures 1-2 and 1-3). These SBus slots accommodate SBus cards such as a color frame buffer card or a second Ethernet card. The SBus slots are connected to the SBus data bus and the SBus address bus. The SBus is a proprietary 32-bit synchronous bus. See “SBus Cards” later in this chapter for more information on specific SBus boards. “SBus Cards” in Chapter 4 explains how to remove and replace SBus cards.

Input/Output

The following chips, which control input/output devices, are briefly discussed in this section:

- Ethernet (LANCE) controller chip
- SCSI controller chip
- Diskette drive controller chip

Ethernet is controlled by a Local Area Network Controller for Ethernet (LANCE) controller chip (see Figures 1-3 and 1-4).

The SCSI hard disk drives and 150 megabyte and 8 mm tape drives are controlled by the SCSI controller chip (see Figures 1-3 and 1-4).

The diskette drive is controlled by the diskette drive controller chip (see Figures 1-3 and 1-4).

Single Inline Memory Modules (SIMMs)

The system is shipped with eight 1-megabyte Single Inline Memory Modules (SIMMs). Four megabytes of memory, contained in 1-megabyte SIMMs, can be added (see Figures 1-2, 1-3, 1-4). 4-megabyte SIMMs are also available and can be added in increments of 16 megabytes. If the eight standard 1-megabyte SIMMs are replaced with eight 4-megabyte SIMMs and the remaining four SIMM slots supplied with 4-megabyte SIMMs, the capacity can be increased to 48 megabytes maximum.

See “Single Inline Memory Modules (SIMMs)” in Chapter 4 for SIMM installation and removal instructions.

SBus Cards

Various SBus cards can be added to the system’s two SBus slots on the main logic board. Figures 1-2 and 1-3 illustrate the SBus slots. See “SBus Cards” in Chapter 4 for information on how to remove and replace SBus cards. Examples of the types of SBus cards include the following:

- Color Frame Buffer Card
  This card controls the video output from the system unit to a color or grayscale monitor.

- Analog Monochrome Frame Buffer Card
  This card controls the video output from the system unit to a 17-inch monochrome monitor.
- Second Ethernet Card
  This card provides you with an extra Ethernet port. The Ethernet card is used in applications in which the SPARCstation IPC acts as a gateway between two physically distinct Ethernet networks. This card has two connectors: standard (thick) Ethernet and thin Ethernet.

Mass Storage Devices

The mass storage devices available include the following:

- Hard disk drives
  One 3 1/2-inch embedded SCSI 207 megabyte hard disk drive or one 3 1/2-inch embedded SCSI 104 megabyte hard disk drive (see Figure 1-2) can be installed in the system unit. Chapter 4 describes how to install the hard disk drive in the system unit.
- Diskette drive
  A 3 1/2-inch, 1.44 megabyte, internal diskette drive (see Figure 1-2) is standard in the system unit. The drive accepts a 4-pin AMP power connector and a 34-pin data cable. The data transfer rate is 1 Mbit per second. "Diskette Drive" in Chapter 4 describes how to remove and install the diskette drive in the system unit.
- Desktop Storage Packs (DSPs)
  - Desktop Backup Pack (1/4-inch 150 megabyte SCSI-compatible tape drive only)
  - Desktop Disk Pack (3 1/2-inch 104, 207, or 424 megabyte hard disk drive only)
  - Desktop SunCD™ Pack (CD ROM player)
  - Desktop Storage Module (1.3 gigabyte hard disk drive and 2.3 gigabyte tape drive
- External Storage Modules (ESMs)
  - External Storage Module (5 1/4-inch embedded SCSI-compatible 669 megabyte hard disk drive only)
  - External Storage Module (5 1/4-inch 669 megabyte hard drive and 2.3 gigabyte 8 mm. cartridge tape drive)

- External Storage Module (5 1/4-inch embedded SCSI-compatible 669 megabyte hard disk drive and 8 mm tape drive)
- External Storage Module (5 1/4-inch embedded SCSI-compatible dual 669 megabyte hard disk drives)

See the *Desktop Storage Pack Installation Guide* for installation procedures for the Desktop Disk Pack, Desktop Backup Pack, and Desktop SunCD™ Pack, and for information about daisy-chaining external drive units.

Power Supply

The 65-watt power supply (see Figure 1-2) is housed in the unit top. It connects to the system via a 12-pin connector and provides +5, +12, and -12 volts DC. The power supply also supplies the power-on reset signal. It automatically selects the correct AC input voltage range.

Some of the power supply's features include the following:

- Auto sensing
- Output voltage regulation
- Overcurrent protection
- Crowbar feature
- Internal fusing

The external modules have their own power supplies. The External Storage Module's power supply provides +5, +12, and -12 volts DC. The Desktop Storage Pack's power supply provides +5 and +12 volts DC.

Graphics I/O Devices

Each system accepts a keyboard, an optical mouse, and one of several types of video monitors.

The available monitors are listed in Table 1-1.

Table 1-1 Video Monitors

Monitor Type	Voltage
16-inch color monitor (407mm)	115V / 240V
17-inch grayscale monitor (432mm)	115V / 240V
19-inch grayscale monitor (483mm)	115V / 240V

The color frame buffer card controls video output from the system unit with color or grayscale monitors.

Monochrome Video Port

The CPU has a built-in monochrome video frame buffer and an output port for connecting monochrome monitors. The S4 video chip (Figures 1-3 and 1-4) supplies the monochrome video interface to the CPU through the SBus.

Diagnostics Overview

This chapter describes the different types of diagnostic firmware and software tools available to you and how they are related.

Diagnostic Tools

The main categories of diagnostics follow:

- Boot PROM diagnostics
  - Power-On Self-Test (POST)
  - On-Board Diagnostics
- Sundiag System Exerciser
- Sun Diagnostic Executive

Besides these categories of diagnostics, this chapter briefly covers the Forth Toolkit, which is an interactive command interpreter based on the Forth programming language. For a more complete discussion of the Sun Forth Toolkit, see the *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0*.

The Forth Toolkit gives you access to an extensive set of functions for performing the following:

- Hardware development
- Problem determination (fault isolation)
- Software development
- Debugging

All functions available through the Monitor > prompt, except entering the Forth Toolkit, are also available through the Forth Toolkit.

How It Fits Together

The following is a description of how the various diagnostic tools work together in the different power-on modes. This description assumes you are using a graphics monitor to view test results. The flowchart in Figure 2-1 outlines the roles played by various diagnostics during the default boot mode.

When you turn on system power, the low-level POST code, stored in the boot PROM, is executed. Usually, if a test in the POST sequence fails, the system enters a scope loop by repeatedly accessing the failed parameter. See "How to Run the Power-On Self-Test" later in this chapter for more information.

If the POST passes, the system probes for SBus devices and interprets their drivers. Next, high level tests are performed. You will see the word `Testing` while the high level tests are running. After `Testing` is displayed, if you want to enter the Monitor, (indicated by the > prompt), press the L1-A keys simultaneously.

If the autoboot switch parameter is set to false (not the default), you will obtain either the > or `ok` prompt. The > prompt is the default prompt. You can change the default prompt to obtain the `ok` prompt, the Forth Toolkit prompt, as the default. To make the `ok` prompt the default prompt, see the *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0*.

If the autoboot switch parameter is set to true (default), and the diagnostic switch parameter is set to false (default), SunOS will be booted from the program `vmunix`. If the autoboot switch parameter is set to true (default), and the diagnostic switch parameter is set to true (not the default), SunOS will be booted from the command `le()vmunix`.

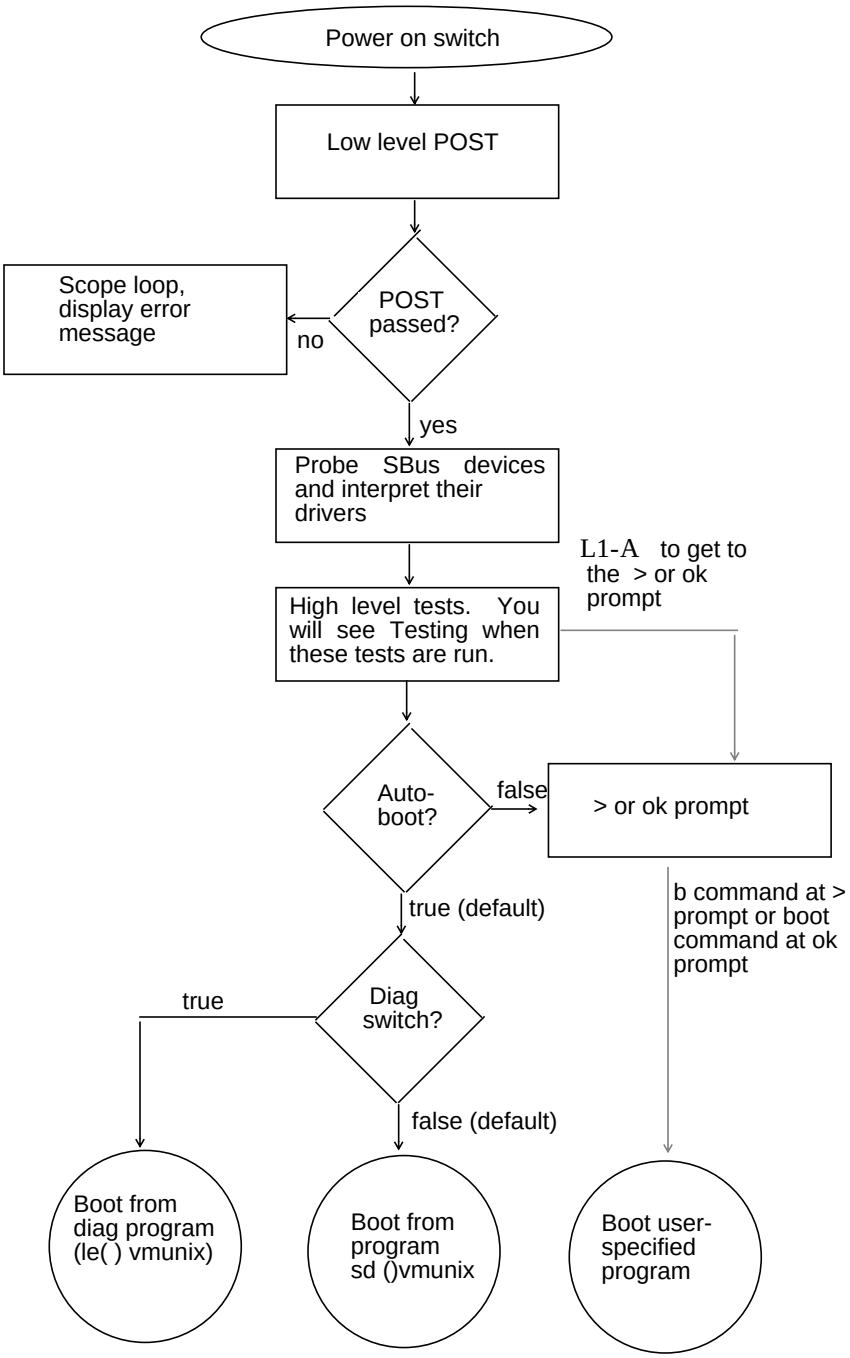

Power on switch
Low level POST
POST passed?
no
Scope loop, display error message
yes
Probe SBus devices and interpret their drivers
High level tests. You will see Testing when these tests are run.
L1-A to get to the > or ok prompt
Auto-boot?
false
> or ok prompt
true (default)
b command at > prompt or boot command at ok prompt
Diag switch?
true
false (default)
Boot from diag program (le( ) vmunix)
Boot from program sd ()vmunix
Boot user-specified program

Figure 2-1 Default Boot Mode

To boot user-specified programs, such as the Sun Diagnostic Executive, you must be at the > or ok prompt. See "On-Board Diagnostics" later in this chapter for a detailed procedure on how to obtain the > and ok prompts.

autoboot switch parameter	**diagnostic switch parameter**	**Result**
false	**(don't care)**	> or ok prompt
true	**false**	*boot SunOS (vmunix) from disk sd ()
true	**true**	*boot SunOS (vmunix) from network le ()

*The boot parameters represented here are default settings. The defaults may be changed by following the procedures listed in the *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0*.

When to Use Diagnostics

You should use each type of diagnostic tool in the appropriate circumstances. Table 2-1 provides a summary of the available diagnostic tools, and lists when to use each diagnostic tool.

Table 2-1 Summary of Available Diagnostic Tools

Diagnostic Tool	When or why to use
Power-On Self-Test	Executes automatically at power-on. The POST code resides in the boot PROM and is driven by the Por signal from the power supply. Described later in this chapter.
On-Board Diagnostics	Tests such as the Ethernet test, memory test, and the diskette drive controller test are available. You must be in the Forth Toolkit to run on-board diagnostics. Enter n from the > prompt to enter the Forth Toolkit. The On-Board diagnostics reside in the boot PROM. Described later in this chapter.
Manufacturing Diagnostics	Runs POST in a continuous loop (see Figure D-1). Used in a manufacturing environment to achieve repetitive *burn-in* testing. Described in Appendix D.
Sundiag System Exerciser	Runs under SunOS. It displays real-time use of system resources and peripherals. The Sundiag System Exerciser tells you if your system is functioning correctly or not. If Sundiag fails, run the Power-On Self-Test. For instructions on how to use the Sundiag System Exerciser see the *Sundiag User's Guide*. If all power-on self-tests pass, then run the Sun Diagnostic Executive to identify the problem.
Sun Diagnostic Executive	Runs extensive, configurable subsystem tests independent of SunOS. Run the Sun Diagnostic Executive if all tests pass when you run POST. Running the Sun Diagnostic Executive allows you to troubleshoot which field replaceable unit needs to be replaced. See the *SunDiagnostic Executive User's Guide for the SPARCstation*s for more information.
Monitor	Enters the Monitor when the operating system crashes. To boot SunOS or another program from the > prompt, enter b. To resume execution of a halted program from the > prompt, enter c. To enter the Forth Toolkit from the > prompt, enter n. Described later in this chapter.
Forth Toolkit	Performs all functions available through the Monitor, except entering the Forth Toolkit. Changing NVRAM parameters. Resetting the system. Running diagnostics. Displaying system information. Redirecting input and output. See the *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0* for more information.

Boot PROM Diagnostics

The diagnostics stored in the boot PROM include the following:

- Power-On Self-Test
- On-Board Diagnostics

The Power-On Self-Test (POST) is the default mode. If there is system trouble, you may want to run extended on-board diagnostics to take advantage of thorough tests including — but not limited to — Ethernet, memory, and diskette drive tests. See Figures 2-2 and 2-3 later in this chapter for an example of the tests comprising on-board diagnostics.

The boot PROM diagnostics are described in the following sections.

Power-On Self-Test (POST)

The Power-On Self-Test (POST) runs automatically when you turn on the system's power switch or reboot the system. The POST code, which resides in the boot PROM, is executed by the CPU (IU) when the Por signal is received from the power supply. The POST is a series of rudimentary tests designed to verify that a viable boot path exists for loading more extensive diagnostic software. The POST checks the system's main logic board and main memory. This test determines if enough of the system is functional so that SunOS can be booted.

Next, the firmware initializes the system, including the memory management unit (MMU), keyboard, mouse, serial ports, frame buffer, and memory. Additional initialization tasks are performed. These include, but are not limited to, setting up interrupt vectors and trap vectors and probing for SBus boards.

Following the system's successful initialization, SunOS is booted automatically, unless the NVRAM configuration options specify not to do so.

Power-On Self-Test Detailed Description

In order for the system to perform the POST, the Instruction Unit (IU) must be functional. The system must be able to fetch instructions from the boot PROM.

The POST includes the following tests:

- EPROM Checksum Test
- Segment Map Address Test
- Page Map Address Test
- Context Register Test
- Synchronous Error Register Test
- Synchronous Error Virtual Address Register Test
- Asynchronous Error Register Test
- Asynchronous Error Virtual Address Register Test
- System Enable Register Test
- Limited Main Memory Address Test
- Cache Tag Memory Test
- Cache Data Memory Test

Powering up the system resets the IU and puts the system in the *boot state*. Boot state forces all instruction fetches to the boot PROM. The Power-On Self-Test begins immediately. If you want to see the results of each test, you may attach a terminal to the system unit. See "How to Run the Power-On Self-Test" later in this chapter.

Usually, if a test in the POST sequence fails, the system enters a scope loop by repeatedly accessing the failed parameter. See "How to Run the Power-On Self-Test" later in this chapter for instructions on how to attach a terminal to the system unit, run POST, and conduct general troubleshooting.

For more information on POST see the *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0*.

How to Run the Power-On Self-Test

The procedure described in this section explains how to view and respond to the POST messages. You may connect a terminal to a serial port in order to view the POST messages. It also covers what to do if all POST tests pass.

Note – If you suspect that the main logic board might be bad but are not sure, do not follow the procedure described in this section. Instead, see "Before Replacing the Main Logic Board" in Chapter 4 for a comprehensive procedure that involves removing SBus boards, unplugging hard disk and diskette drives, and measuring the power supply voltages before running the POST test.

To run the POST and conduct general troubleshooting:

1. **If desired, attach a terminal to the system unit, but this step is not mandatory in order to proceed with troubleshooting.**
   To connect the terminal, see "Connecting Wyse WY-50 and VT-100 Terminals" in the *SPARCstation IPC Installation Guide.*

   The terminal displays some of the POST results as the tests are run.

2. **Turn on the system and the terminal (if attached).**
   The system will start to boot. To interrupt the boot sequence and obtain the `ok` or `>` prompt, press L1-A on the system keyboard.

   If you see the `ok` prompt, go to Step 4. If you see the `>` prompt, go to the next step.

3. **At the `>` prompt, enter `n`.**
   This presents you with the Forth Toolkit prompt, `ok`.

4. **Set the diagnostic switch to true, set the autoboot switch to false, and reset the system.**
   To do this enter the commands shown in bold in the following example:

```
ok setenv diag-switch? true
ok setenv auto-boot? false
ok reset                          The system is rebooted and POST is run
```

5. **If all tests pass, go to the next step. If one or more of the following tests fails, do the following:**
   - If the EPROM Checksum Test fails, replace the main logic board. This situation is very unlikely. If the boot PROM is bad, it is very likely that the system will do nothing and appear dead.
     Replace the main logic board as described in "Removing the Main Logic Board" and "Replacing the Main Logic Board" in Chapter 4.
   - If the Limited Main Memory Address Test fails, numbers of Single Inline Memory Modules (SIMMs) are displayed on the terminal. SIMM numbers are indicated in Figure 4-4. Replace the defective SIMM. See "Single Inline Memory Modules (SIMMs)" in Chapter 4.
   - If you see the following message: `Incorrect configuration checksum; Clearing to default values`, this means that the NVRAM configuration information has become corrupted. In this case, the boot PROM automatically attempts to restore the NVRAM contents to the factory default configuration. If the same message appears the next time the system is reset or powered on, the NVRAM chip may be defective and the main logic board should be replaced.
   - If any other test fails, replace the main logic board. See "Removing the Main Logic Board" and "Replacing the Main Logic Board" in Chapter 4.
   - If you see nothing on the display, look at the green LED indicator at the front of the system unit as you turn on the power switch. If the green indicator does not come on or flash, the main logic board may have failed. If the indicator comes on and there is still nothing on the display, check the graphics monitor and the monitor cable. If the graphics monitor is functional, the frame buffer may have failed. Replace the frame buffer SBus card. See "SBus Cards" in Chapter 4. If the monitor is connected to the on-board frame buffer, replace the main logic board. See "Removing the Main Logic Board" and "Replacing the Main Logic Board" in Chapter 4.

6. **If all POST tests pass, run the Sun Diagnostic Executive with the cache disabled.**
   The Sun Diagnostic Executive is an independent operating system. It runs exhaustive subsystem tests independent of SunOS. See the *SunDiagnostic Executive User's Guide for the Desktop SPARCstations.*

7. **Reset the diagnostic mode changes. Enter the following at the ok prompt:**

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

On-Board Diagnostics

You have access to a number of tests called On-board diagnostics. To invoke these tests, you must enter the Forth Toolkit.

Caution – In order to run On-board diagnostics, you must halt the system in an orderly manner. When the operating system or any other stand-alone program has already booted, do not use the L1-A keys to halt the system. Abruptly aborting program execution may cause damage to data files.

To run On-board diagnostics:

1. **Save all your work and quit all applications.**
2. **As `root`, halt the system by entering**
   `/usr/etc/halt.`

You are presented with either the > prompt or the ok prompt. The > prompt is the default prompt. If you want to change the default prompt to the ok prompt, see the *Open Boot PROM Toolkit User's Guide* or the *Open Boot 2.0*.

If you see the > prompt, go to the next step. If you see the ok prompt, go to Step 4.

3. **Enter `n` to enter the Forth Toolkit.**
   The ok prompt shows that you are in the Forth Toolkit.
4. **Enter `help diag` to get a listing of tests comprising on-board diagnostics.**

Figure 2-2 or 2-3 summarizes the steps you need to take to halt the system, enter the Forth Toolkit, and list the diagnostic tests.

```
#  /usr/etc/halt
   ..... system messages are displayed
>  n
ok help diag
               THIS MENU IS FOR OPEN BOOT PROM 1.X SYSTEMS
     Category:  Diag (diagnostic routines)
test-net       (--)       test network interface
test-cache     (--)       test cache tag and data fields
test-memory    (--)       test main memory ; uses selftest-#megs options
test-floppy    (--)       test floppy disk drive
watch-clock    (--)       show ticks of real-time clock
probe-scsi     (--)       show attached SCSI devices
ok
```

Figure 2-2 Halting the System and Displaying On-Board Diagnostics (Open Boot PROM 1.X Systems

```
#  /usr/etc/halt
   ..... system messages are displayed
>  n
ok help diag
               THIS MENU IS FOR OPEN BOOT PROM 2.X SYSTEMS
     Category:  Diag (diagnostic routines)
test  device-specifier  (--)  run selftest method for specified device
    Examples:
          test /memory     - test memory
          test /sbus/le    - test net
          test net         - test net (device-specifier is an alias)
          test floppy      - test floppy disk drive
watch-clock    (--)       show ticks of real-time clock
probe-scsi     (--)       show attached SCSI devices
ok
```

Figure 2-3 Halting the System and Displaying On-Board Diagnostics (Open Boot PROM 2.X Systems

These on-board tests allow you to test the network controller, the diskette drive system, memory, the cache, and the system clock. See “Diagnostic Routines” in the *Open Boot PROM Toolkit User’s Guide* or the *Introduction to Open Boot 2.0* for a detailed description and step-by-step instructions of the available on-board diagnostic tests.

To return to the Monitor > prompt, enter the following:

```
ok  old-mode
>
```

Sundiag System Exerciser

The Sundiag System Exerciser, which runs under SunOS, displays real-time use of system resources and peripheral equipment such as Desktop Storage Packs and External Storage Modules. The System Exerciser is run in the manufacturing environment as the final test that the system is functioning properly before being shipped.

The exerciser is shipped with SunOS. If it has been selected during the SunInstall (operating system loading) procedure, it can be run at any time.

The Sundiag System Exerciser is found in the `/usr/diag/sundiag` directory. If it is not found on the system hard disk or server, it may be loaded from tape. For information on how to use the Sundiag System Exerciser, see the *Sundiag User's Guide*. Appendix A, "Loopback Connectors" in the *Sundiag User's Guide* explains how to connect the external loopback connectors required for some options.

If Sundiag passes, the system is operating properly. If Sundiag fails, the system is not operating properly. To identify the problem when Sundiag fails, first run the POST. If all POST tests pass, next run the Sun Diagnostic Executive to isolate the problem.

Sun Diagnostic Executive

The Sun Diagnostic Executive is an independent operating system. It runs exhaustive subsystem tests independent of SunOS. Run the Sun Diagnostic Executive if all POST tests pass in order to troubleshoot which field-replaceable unit needs to be replaced. For information on how to run the POST, see "How to Run the Power-On Self-Test" earlier in this chapter. The Diagnostic Executive, which provides you with thorough diagnostics, is described in the *SunDiagnostic Executive User's Guide for the Desktop SPARCstations.*

Monitor and Forth Toolkit

The Monitor is a basic diagnostic utility. If disaster befalls your operating system, the Monitor, indicated by the > prompt, automatically starts. You can also choose to enter the Monitor by halting the system. To enter the Forth Toolkit, indicated by the ok prompt, enter n from the > prompt.

The following procedure explains how to enter the Monitor and the Forth Toolkit.

To enter the Monitor and the Forth Toolkit:

1. **Save all your work and quit all applications.**

2. **As `root`, enter `/usr/etc/halt`.**
   The system syncs the file systems and brings you to either the > or ok prompts. The > prompt is the default prompt. You will see the ok prompt if you reset the system parameters to have the ok prompt, the Forth Toolkit prompt, as the default prompt. For Non-Volatile RAM system configuration parameters used during reset, see Appendix C in this book. To have the ok prompt as the default, see the *Open Boot PROM Toolkit User's Guide*.

   If you see the ok prompt, you are already in the Forth Toolkit and need to do nothing further. If you see the > prompt, go to the next step.

3. **Enter n to enter the Forth Toolkit.**
   The ok prompt shows that you are in the Forth Toolkit.

   Figure 2-4 summarizes the steps you need to take to halt the system and enter the Forth Toolkit.

```
#  /usr/etc/halt
>  n
ok
```

Figure 2-4 Halting the System and Entering the Forth Toolkit

For extensive information on tests you can run from the Forth Toolkit, see the *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0*.

To return to the Monitor > prompt, from the Forth Toolkit:

```
ok old-mode
>
```

Preparing to Work on the System

This chapter explains important steps to be performed before you replace field-replaceable units (FRUs). Topics covered in this chapter include the following:

- How to halt the system
- Tools needed
- How to disconnect the Desktop Storage Pack
- How to disconnect the Extended Storage Module
- How to open the system unit
- How to attach a wrist strap
- System unit and subassemblies

Halting the System

Caution – Before you replace FRUs, you must halt the system in an orderly manner. When the operating system or any other standalone program has already booted, do not use the L1-A keys to halt the system. Abruptly aborting program execution may cause damage to data files.

To halt the system:

1. **Save any files you are presently editing. Quit from any applications that will lose information when the system halts.**
   See the *Sun System User's Guide* for more information about ending a work session.

2. **Enter `/bin/su` to become superuser.**
   Additional information about the superuser command is described in Chapter 2 of the *Sun System & Network Manager's Guide.*

3. **Enter the superuser password.**

4. **Enter `/usr/etc/halt`.**
   The system displays system halt messages followed by the Monitor prompt, `>`.

```
tutorial% /bin/su
Password:
tutorial# /usr/etc/halt
Syncing file systems... done
Halted

Type b (boot), c (continue), or n (new command mode)
>
```

5. **Turn off the power in this order:**
   a. **External module (if you have one)**
   b. **System unit**
   c. **Monitor**

Caution – Make sure your system is shut off. The green LED at the front of the system unit should not be lit, and the fan should not be running. Do not disconnect the power cord from the system unit's power outlet or the wall socket, unless and until you remove the power supply. This connection provides the ground path necessary to safely remove and install the printed circuit boards and components.

To halt a system that is hung, or frozen, and unresponsive to commands:

On some keyboards, L1 appears on the front face of the Stop key. On a system that has a terminal as a console, rather than a Sun keyboard and bitmapped monitor, you must press Break instead of L1-A to obtain a boot prompt.

1. **Press** L1-A**.**

   The system displays the system boot prompt.

2. **Enter** `n`**.**

   The system displays a help message and an `ok` prompt.

3. **Enter `sync`.**
   The system displays panic and boot messages.

   The sync command helps prevent the system from losing data that was not preserved when the system hung.

4. **Wait until the system boots and displays a system login prompt.**

5. **Turn off the power in this order:**

   a. **External drive unit (if you have one)**

   b. **System unit**

   c. **Monitor**

The following example shows how to halt a hung system:

```
(Press L1-A.)
>n
Type help for more information
ok sync
(System panic and boot messages.)
tutorial login:
```

For additional information on the halt procedure see Chapter 1 of the *Sun System & Network Managers Guide* and also the *System & Network Administration* manual.

Caution – Make sure your system is shut off. The green LED on the front of the system unit should not be lit, and the fan should not be running. Do not disconnect the power cord from the system unit's power outlet or the wall socket. This connection provides the ground path necessary to safely remove and install the printed circuit boards and components.

Tools Needed

To remove and replace FRUs, you will need the following tools and materials:

- Phillips head screwdriver
- Flat blade screwdriver
- Hex head nutdriver, 3/16 inch
- Wrist strap
- SIMM extractor
- Container for screws
- Anti-static mat for the SIMMs and the main logic board
- A Volt-ohmmeter (VOM) for checking voltages and fuses

Disconnecting Desktop Storage Packs or External Storage Modules

If your system unit has Desktop Storage Packs connected to it, detach the Desktop Storage Pack's SCSI connector from the back of the system unit.

To detach the Desktop Storage Pack from the system unit:

♦ **Press in on the finger clips on the connector connecting the Desktop Storage Pack to the system unit and pull the connector off.**
This action disconnects the SCSI cable from the system unit.

Opening the System Unit

Figure 3-1 shows how to open the system unit. The latch buttons at the sides allow the unit top and unit bottom to disengage.

To open the unit and gain access to the FRUs inside the system unit:

1. **Make sure that the power is turned off to your system unit, but that the power cord remains plugged in to the system unit and to the power source.**
   See "Halting the System" earlier in this chapter.
2. **Remove the top section from the system unit.**
   Do the following in sequence (see Figure 3-1):
   a. **Remove the screw holding the lock block to the back panel.**
   b. **Position the system on the table so that there is enough space to lay the top section of the unit flat in front of the bottom.**
   c. **Grasp the unit top with your fingers over the latch buttons at the sides. Press down on the unit top and depress the latch buttons.**
   d. **Rotate the unit top up and toward the front panel. Lay the unit top flat on the table. The unit top and bottom are still connected by the power and data cables leading from the disk drive(s) and power supply in the unit top to the main logic board in the unit bottom.**

Note – The unit top contains the power supply and disk drives (see Figure 3-2) and is the heavier of the two sections.

Warning – Before powering up your system again, be sure to close the unit. See "Closing the System Unit" towards the end of Chapter 4.

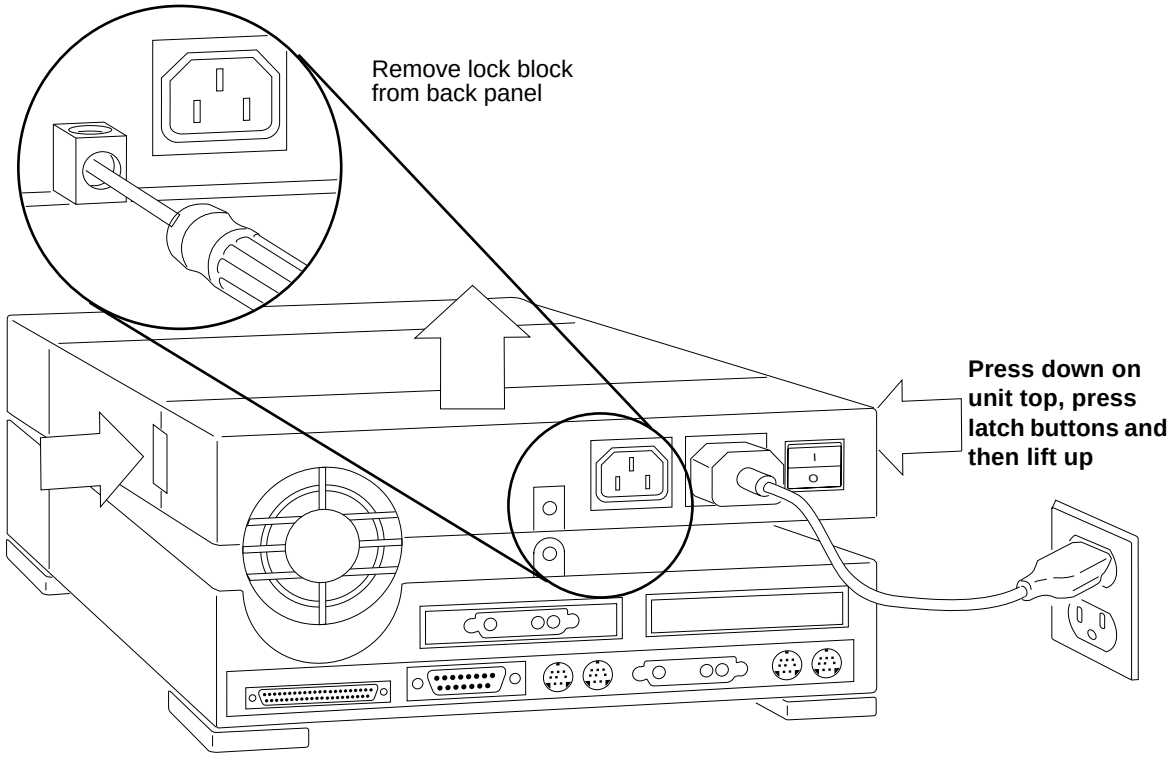


Figure 3-1 Opening the System Unit

Warning – The lithium battery molded into the NVRAM, located on the main logic board next to the Boot PROM, may explode if mishandled or attempts are made to recharge it or disassemble it. In addition, electronic parts may be damaged by static electricity if touched by a person not wearing a properly grounded wrist strap.

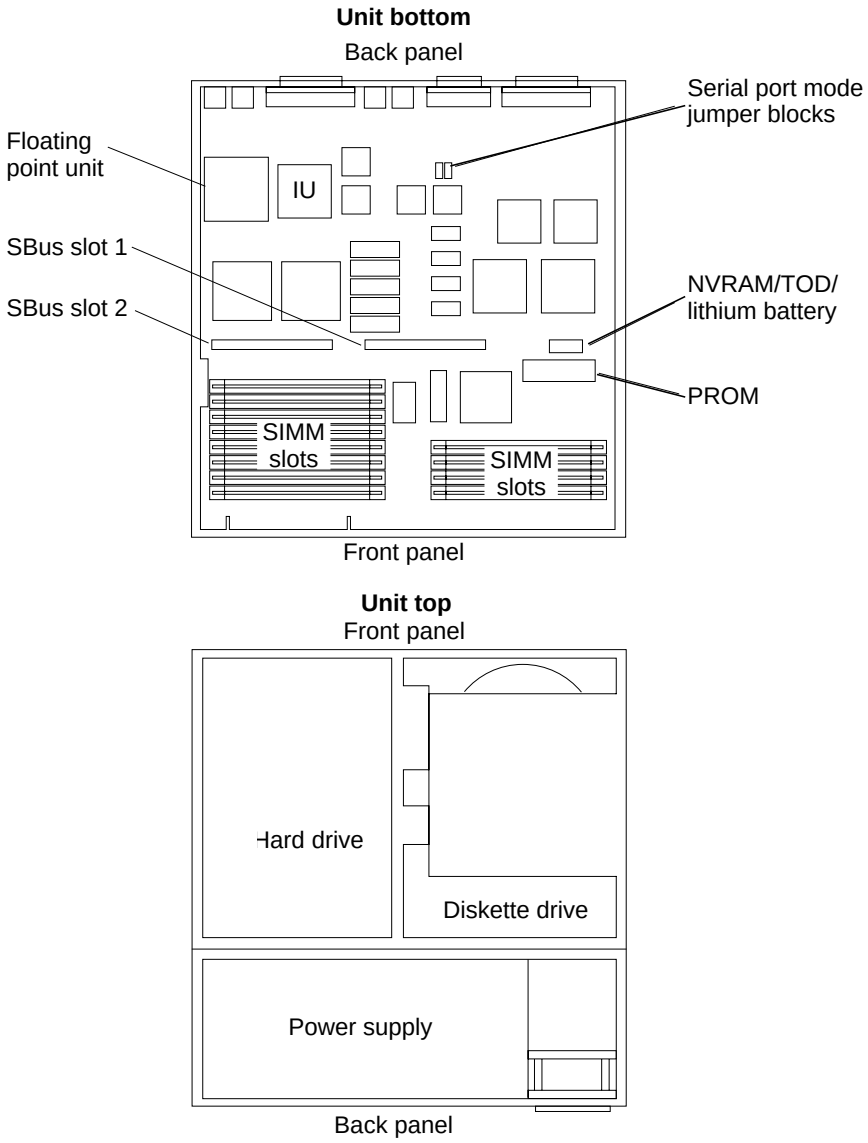


Figure 3-2 Top View of System Unit and Subassemblies

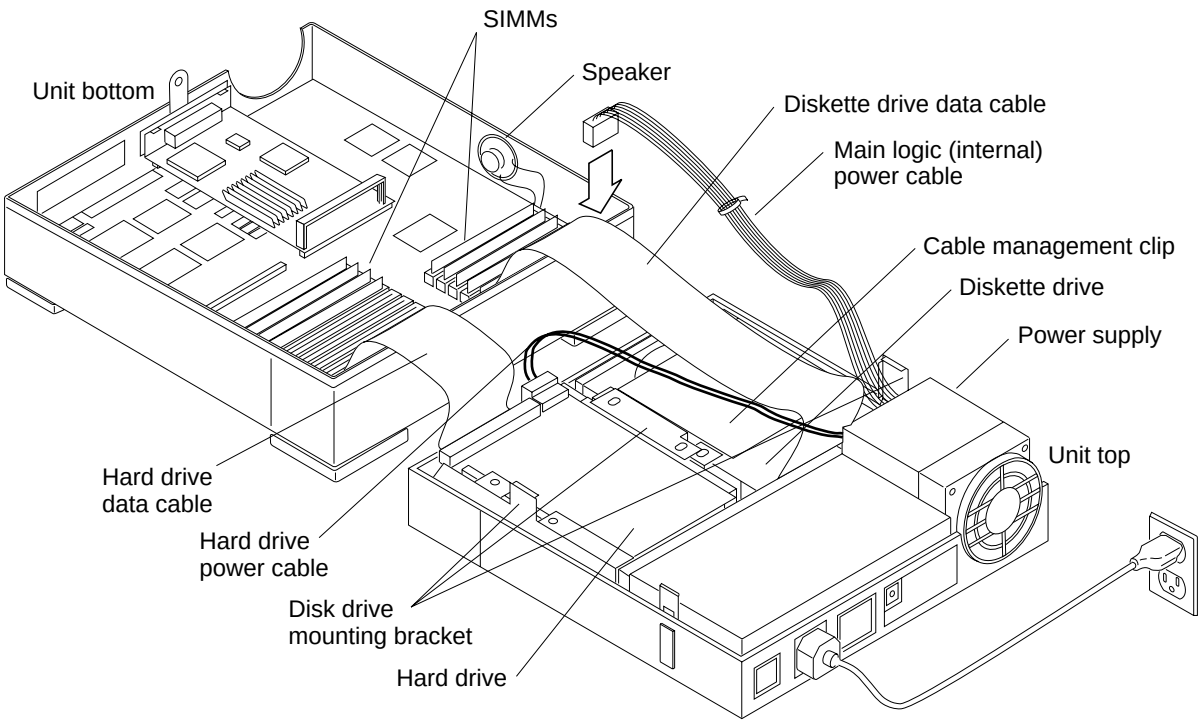


Figure 3-3 System Unit and Subassemblies

Attaching a Wrist Strap

Figure 3-2 and Figure 3-3 show the various components of the system unit. The main logic board occupies the unit bottom. The SBus cards plug into the main logic board. Twelve slots on the main logic board accept the Single Inline Memory Modules (SIMMs).

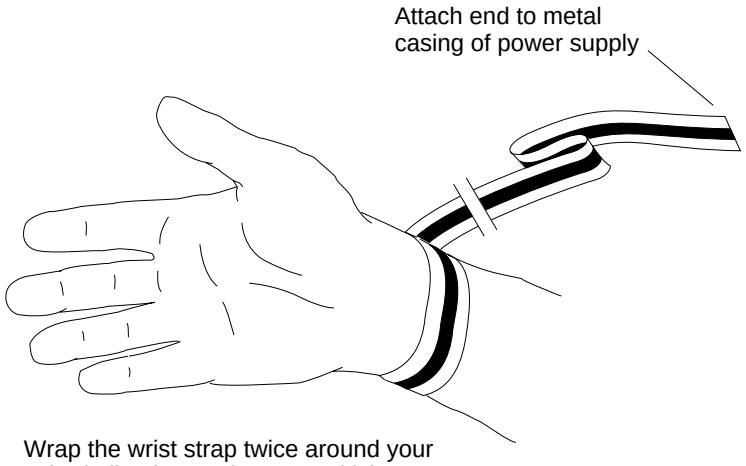
The unit top contains the power supply in the rear of the top section. Mounted just in front of the power supply is the bracket for both the hard disk drive and the diskette drive.

The wrist strap is a device that provides grounding for static electricity between your body and the system unit's chassis. Electric current and voltage do not pass through the wrist strap. Attach the wrist strap to your wrist and to the metal casing of the power supply. Parts that require the use of a wrist strap are packed with one.

Caution – Boards, cards, PROMs, and modules can be damaged by harmful electrical charges if you do not wear a wrist strap.

To attach the wrist strap:

1. **Wrap the grounding strap with the conductive adhesive tape twice around your wrist.**
   Make sure the adhesive side is against your skin.



Wrap the wrist strap twice around your wrist (adhesive against your skin).

2. **Attach the end with the adhesive copper strip to the metal casing of the power supply in the unit top.**
   Make sure the internal power cable from the power supply to the main logic board and the external power cord between the power supply and the wall remain connected when you work on the main logic board components.

FRU Replacement

This chapter explains how to remove defective FRUs and install new ones. Part numbers for the FRUs are given in Appendix B. The following units are field-replaceable:

- Main logic board
- Power supply
- Diskette drive
- Hard disk drives
- Single Inline Memory Modules (SIMMs)
- SBus boards
- Speaker assembly
- Video monitor
- Keyboard
- Mouse, mouse pad, and cable
- Latch button assemblies
- LED light pipe

In addition, the following cables are field-replaceable:

- Diskette drive data cable
- Hard disk drive data cable
- Video cable
- AC power cable for the system unit
- AC power cable for the video monitor
- Audio cable
- Keyboard cables
- Serial port adapter cable

How to replace FRUs in the Desktop Storage Pack and in the External Storage Module are not covered in this manual.

Before You Begin

Before you replace FRUs, make sure you have done the following:

- Halted your system
- Verified that you have the proper tools
- Removed the expansion units (if any)
- Opened the system unit
- Attached a wrist strap

Chapter 3 describes these instructions.

Removing and Replacing FRUs

This section describes how to remove and replace FRUs. Please read through the entire set of instructions before removing and replacing a FRU.

Caution – Make sure your system is shut off. The green LED should not be lit and the fan in the power supply should not be running. Do not disconnect the power cord from the system unit's power outlet or from the wall socket. This connection provides the ground path necessary to safely remove and install the printed circuit boards and components.

FRU Identification

Before you attempt to replace or install a new board or module, make sure that you have the right unit. Figure 4-1 shows a top view of the open system unit. Part identification is printed on the part being replaced. Part Numbers are presented in Appendix B.

Caution – Printed circuit boards and cards are made of delicate electronic components that are extremely sensitive to static electricity. Ordinary amounts of static from your clothes or work environment can destroy them.

Caution – Handle cards only by the non-conducting edges. Do not touch the components themselves or any metal parts. Wear a grounding (wrist) strap when handling the cards. Attach the wrist strap to the metal casing of the power supply at the rear of the unit top.

Do not disconnect the power cord from the system unit's power outlet or from the wall socket. This connection provides the ground path necessary to safely remove and install the printed circuit cards and components. In addition, keep the internal power supply cable connected to the main logic board.

Make sure that the system unit's power is turned OFF by checking to make sure that the green light-emitting diode (LED) at the front of the chassis is not lit and the fan in the power supply is not running.

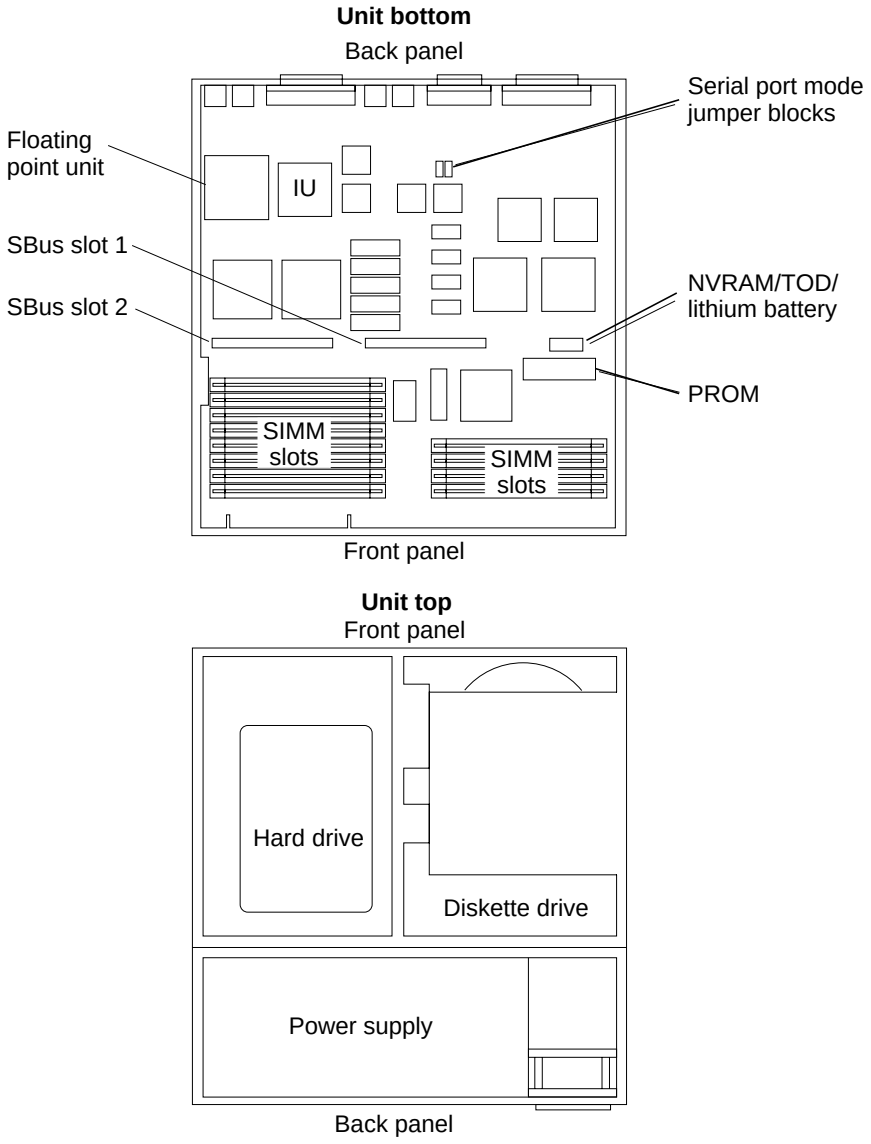


Figure 4-1 Top View of the Unit

Single Inline Memory Modules (SIMMs)

The system comes equipped with eight megabytes of Dynamic Random Access Memory (DRAM) in eight 1-megabyte SIMMs. Physically, DRAM chips are grouped together in Single Inline Memory Modules (SIMMs). Each 1-megabyte SIMM plugs into one of the 12 SIMM slots on the system unit's main logic board. Additional SIMMs may be added to the system unit as needed, up to a maximum of 12 SIMMs. In addition, 4-megabyte SIMMs may be substituted for a maximum of 48 megabytes of Dynamic Random Access Memory. Although 1-megabyte SIMMs may be mixed with 4-megabyte SIMMs, each slot group (see Figure 4-4) must contain the same kind of SIMMs.

If you are installing additional memory, you should have an upgrade kit that contains additional SIMMs in sets of four. Memory must be added in increments of four SIMMs, either four 1-megabyte SIMMs or four 4-megabyte SIMMs.

Determining Faulty SIMM Locations

Sun OS, the Sundiagnostic System Exerciser, Sun Diagnostic Executive, and POST diagnostics can report memory errors encountered during program execution. Memory error messages on the system monitor display usually include a physical memory address of the error.

Depending on the diagnostic program you are running and the Sun OS release loaded, a SIMM location number ("U" number) may be displayed. If the location number is present in the error message, follow the instructions later in this chapter for removing the defective SIMM at that location and installing a replacement (see Figure 4-4 for SIMM location numbers).

If no location number is displayed but a physical memory address is shown, refer to the following table to locate the SIMM group in which the defective SIMM is installed.

For example, if an error is detected at physical memory address 12fe958, the defective SIMM is in slot group 2. If you also know the failing byte at that address, the table shows the "U" number location of the failing SIMM. Follow the instructions later in this chapter for removing the defective SIMM at that location and installing a replacement (see Figure 4-4 for SIMM location numbers).

SIMM Slot Group	Physical Memory Address Ranges with 1 MB SIMMs	Physical Memory Address Ranges with 4MB SIMMs	SIMM Location Byte	SIMM Location SIMM #
1	00000 through 3fffff	00000 through ffffff	3 2 1 0	U0585 U0586 U0587 U0588
2	1000000 through 13fffff	1000000 through 1ffffff	3 2 1 0	U0589 U0590 U0591 U0584
3	2000000 through 23ffffff	2000000 through 2ffffff	3 2 1 0	U0677 U0683 U0676 U0678

Memory Word

Byte 0	Byte 1	Byte 2	Byte 3
Bits 31 to 24	Bits 23 to 16	Bits 15 to 8	Bits 7 to 0
Most significant			Least Significant

A memory word is 4 bytes (32 bits) long. Byte 3 is the least significant byte and Byte 0 is the most significant.

Caution – SIMMs are made of delicate electronic components that are extremely sensitive to static electricity. Ordinary amounts of static from your clothes or work environment can destroy the modules.

Handle boards only by the edges. Do not touch components themselves or any metal parts. Always wear a grounding strap when handling the modules. To replace SIMMs (or any of the components in the unit bottom) attach the wrist strap to the metal casing of the power supply in the unit top.

Do not disconnect the power cord from the system unit's power outlet or from the wall socket. This connection provides the ground path necessary to safely remove and install the modules. In addition, be sure the internal power cable from the power supply in the unit top is plugged into the main logic board to complete the ground.

Make sure that the system unit's power is turned OFF by checking to make sure that the green light-emitting diode (LED) at the front of the chassis is not lit and that the fan in the power supply is not running.

Removing a SIMM

To remove a SIMM, follow these steps:

1. **See and follow Chapter 3 instructions on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   Do not disconnect the power cord from the system unit or from the wall outlet.

3. **Locate the SIMM slots on the main logic board (see Figure 4-1).**
4. **Orient the board with the label side of the SIMMs facing you.**
5. **Use the tool to lift the edge of the SIMM closest to the center of the main logic board first.**
6. **Position the tool with the crossbar section vertical to the SIMM.**

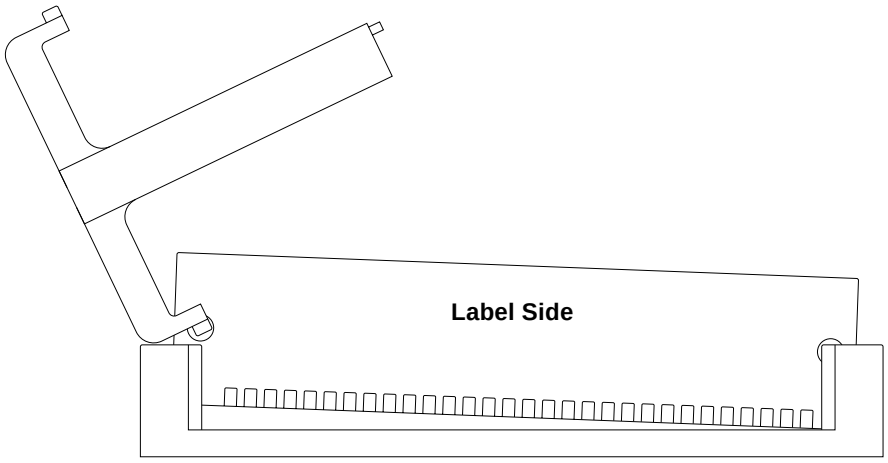


Figure 4-2 Inserting the SIMM extraction tool on the left side

7. **Insert the hook on the end of the crossbar into the left edge of the label side of the SIMM.**
8. **Rotate the tool away from the socket to lift the SIMM.**

9. **Insert the hook on the other end of the crossbar into the hole on the right edge of the SIMM.**

10. **Rotate the tool away from the socket to lift the SIMM.**
    You will hear a click when the SIMM has disengaged from the socket.

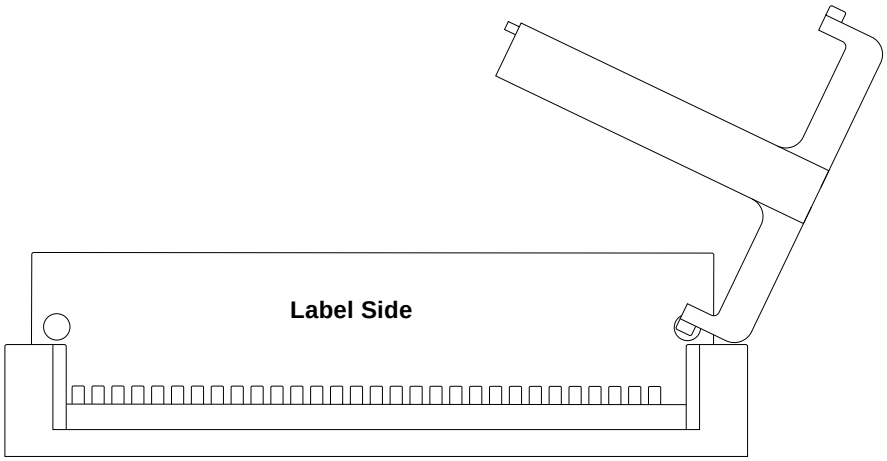


Figure 4-3 Inserting the SIMM Extraction Tool on the right side

11. **Remove the tool.**

12. **Holding the SIMM by the left and right edges, continue to lift the SIMM until it is free of the socket.**
    Place the SIMM on an antistatic mat.

Installing SIMMs

To install a SIMM, follow these steps:

If you have removed a SIMM because it was defective (causing parity errors, and so on), install the replacement SIMM into the same slot from which the defective one was removed.

You must install additional SIMMs in unoccupied slots so that the slots are filled by groups: 0–3, 4–7, and 8–B (see Figure 4-4). Slots 0-3 (Group 1) and 8-B (Group 3) should be filled first.

For example, slots 0–3 and 8-B are already filled. Slots 4-7 do not have SIMMs installed (factory configuration). You want to add four SIMMs. You must install the additional SIMMs in slots 4-7.

In another example, you want to replace the eight 1-megabyte SIMMs with eight 4-megabyte SIMMs and retain four 1-megabyte SIMMs (for a total of 36 megabytes). Replace the 1-megabyte SIMMs in Group 1 and Group 3 and plug four of the 1-megabyte SIMMs into the remaining Group 2 slots. **Do not mix 1-megabyte SIMMs and 4-megabyte SIMMs in the same group.**

Note – In a system with a mixture of 4-megabyte SIMM groups and 1-megabyte SIMM groups, Group 1 must be filled with 4-megabyte SIMMs.

Caution – SIMMs are made of delicate electronic components that are extremely sensitive to static electricity. Ordinary amounts of static from your clothes or work environment can destroy the modules.

Do not remove the SIMMs from the antistatic envelope until told to do so. Handle the modules only by the edges. Do not touch components themselves or any metal parts. Always wear a grounding strap when handling the modules.

---

1. **See and follow instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**

2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   Do not disconnect the power cord from the system unit or from the wall outlet. Make sure the internal power cable from the power supply in the unit top is connected to the main logic board to complete the ground.

3. **Locate the SIMM slots on the main logic board (see Figure 4-1).**

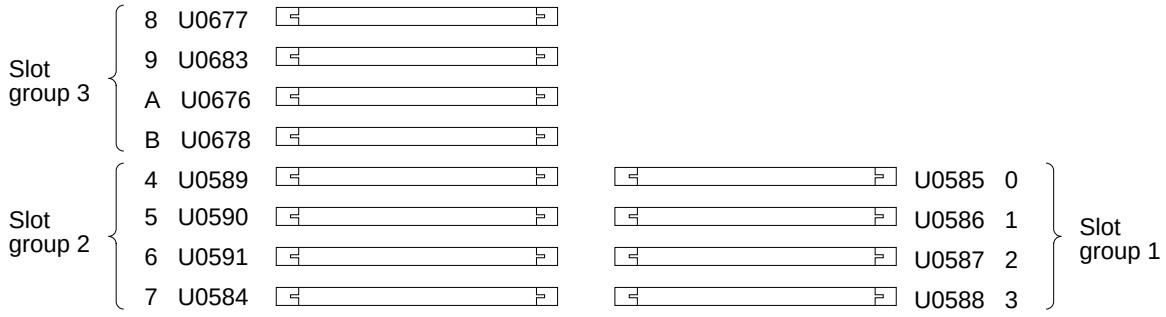


Figure 4-4 SIMM Slots

4. **Place an antistatic mat, shiny side up, next to the system unit.**

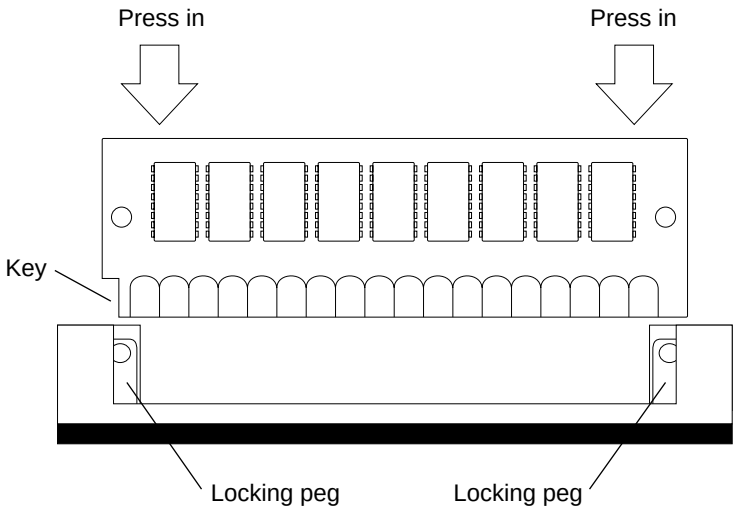
5. **Make sure the wrist strap is securely attached to your wrist and to the metal casing of the power supply in the unit top.**
   See Chapter 3 for instructions describing how to attach a wrist strap.

6. **Open the antistatic envelope and take out the SIMMs.**

7. **Place the SIMMs on the antistatic mat.**

8. **Holding a SIMM at its edges, insert it into the plastic guides.**
   The SIMM should rest loosely in the slot. The SIMMs are keyed to allow installation in only one direction. The SIMM is oriented correctly when the DRAM components on the SIMM face the back panel of the system. (The SIMM shown in the following figure is a one megabyte SIMM.)

9. **Place your thumbs on opposite corners of the SIMM and press firmly until the SIMM snaps into place.**



10. **Close the system unit. See "Closing the System Unit" near the end of this chapter.**

11. **Turn the system unit's power on and check for proper operation of the system unit and the installed SIMMs.**
    See "How to Turn the Power Back On" at the end of this chapter.

SBus Cards

The system can be equipped with a variety of optional printed circuit cards. The following are examples of cards that plug into the SBus slots on the system's main logic board.

- Color Frame Buffer Card
  This card controls the video output from the system unit to a color or grayscale monitor.
- Analog Monochrome Frame Buffer Card
  This card controls the video output from the system unit to a 19-inch monochrome monitor.
- Ethernet Card
  This card provides you with an extra Ethernet port. The Ethernet card is used in applications in which your SPARCstation IPC acts as a gateway between two physically distinct Ethernet networks.

  This card has two connectors to connect either the standard (thick) Ethernet or the thin Ethernet.

SBus cards may be installed in either SBus slot.

Removing SBus Cards

To remove an SBus card from the system unit:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet. The internal power cable to the power supply in the unit top should be connected to the main logic board to complete the ground.

3. **Locate the SBus card you want to remove.**
4. **Remove the external connectors attached to the SBus card.**
5. **Put your index fingers or thumbs underneath the corners of the SBus card where it is plugged into the slot.**
   Pull up on the card (see Figure 4-5).

Caution – The plastic SBus card retainer is *not* a handle. Pulling on the SBus card retainer can cause it to break.

This action releases the SBus card from the SBus slot.

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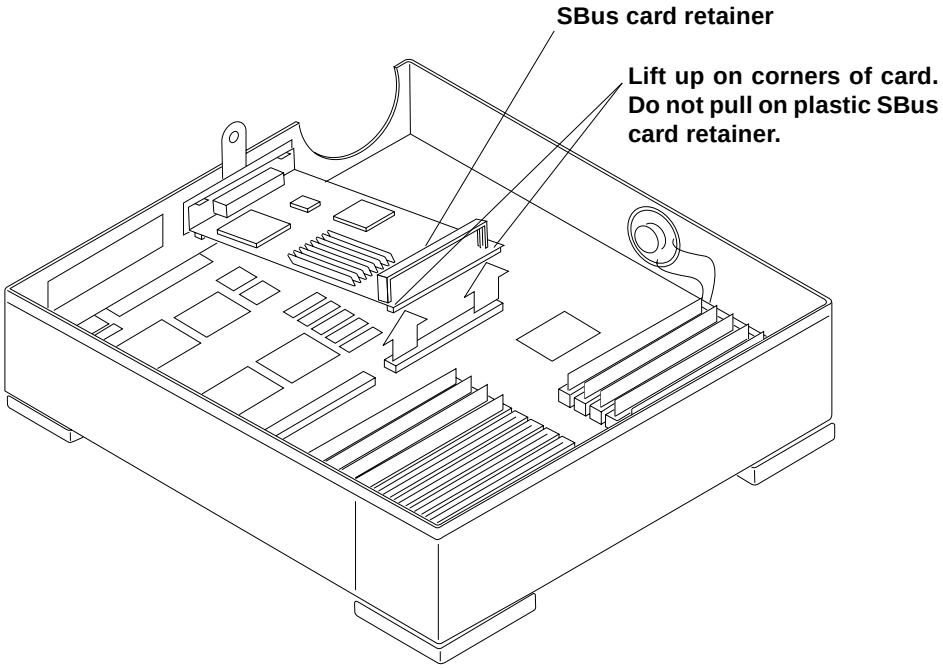


Figure 4-5 Removing an SBus Card

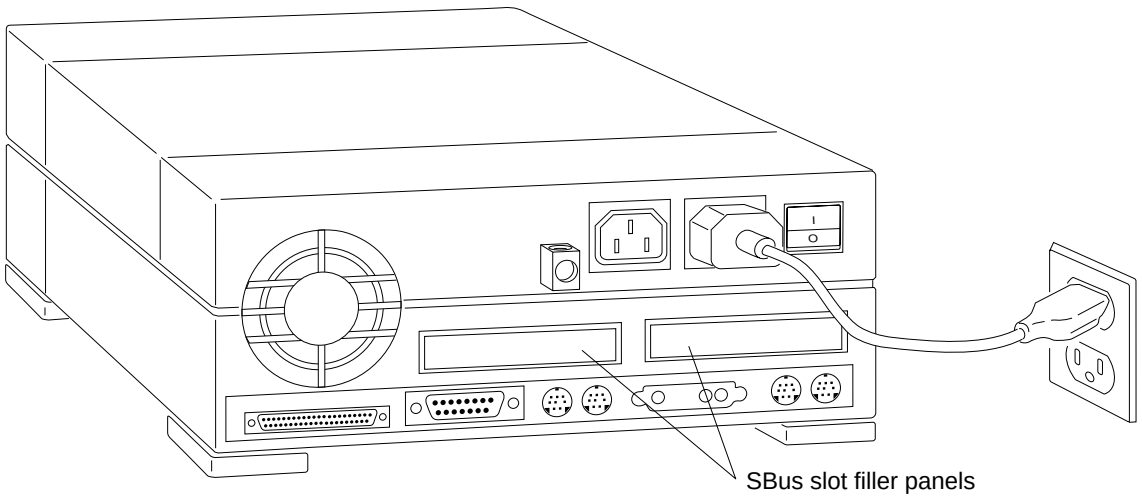
Installing SBus Cards

To install an SBus card in the system unit:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**

2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet. The internal power cable to the power supply should remain connected to the main logic board to complete the ground.

3. **Remove the sheetmetal SBus slot filler panels(s) for the desired slot(s) from the inner surface of the back panel of the system unit.**
   If you are replacing a defective SBus card, of course, the filler panel will not be present.



4. Slide the SBus card at an angle into the back panel of the system unit (see the Figure 4-6).

The mounting slots are above the rectangular opening for the connector in the back panel.

Make sure that the mounting plate on the SBus card hooks upward into the holes at the back panel of the system unit.

Caution – When replacing the SBus card, do not press down on the SBus card retainer. The SBus card retainer is *not* a handle. Pressing down on it may break the retainer.

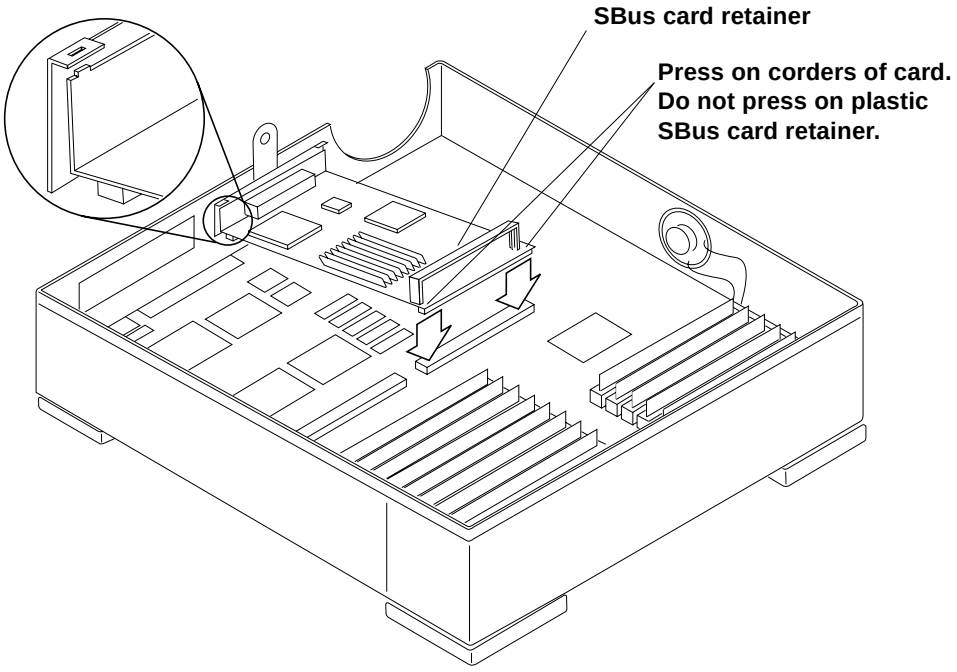


Figure 4-6 Installing an SBus Card

5. Push the SBus card against the back panel.

Align the plug with the socket of the SBus slot and gently press the plug into the socket by pressing with your fingers on the corners of the SBus card.

Caution – Using excessive force may bend or damage the pins.

6. **Close the system unit.**
   To do this, see "Closing the System Unit" near the end of this chapter.
7. **Replace the external cables to the SBus cards.**
8. **Turn the system unit's power on, and check for proper operation of the system unit and the installed SBus card.**
   See "How to Turn the Power Back On" at the end of this chapter.

Disk Drive Bracket

The disk drive bracket resides in the top part of the system unit in front of the power supply (see Figure 4-7). It houses the diskette drive supplied with the unit and has space for an optional hard disk drive. You *must* remove the disk drive mounting bracket before removing either the diskette drive or hard drive. Refer to Figures 4-7, 4-8, and 4-9 for the location of the disk drive mounting bracket and the screw securing it to the system.

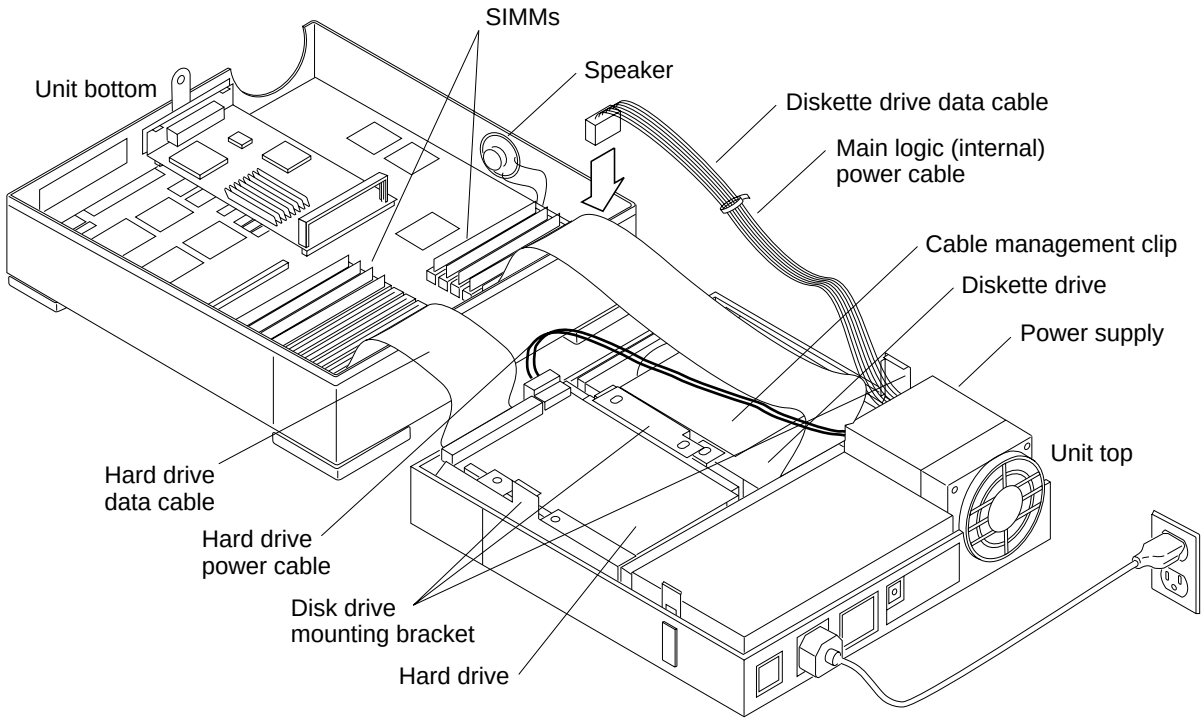


Figure 4-7 Open View of the Unit

Removing the Disk Drive Mounting Bracket

To remove the disk drive mounting bracket, follow these steps:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
   When removing the disk drive bracket, the wrist strap should be attached to the metal casing of the power supply.

2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet.

3. **Place an antistatic mat, shiny side up, near the unit.**
4. **Detach the cables from the cable securing guides on the cable management clip over the diskette drive (see Figure 4-8).**
5. **Disconnect the power cable leading from the hard disk (if a hard disk is present).**
6. **Disconnect the internal power cable leading from the main logic board.** Press the clip on the plug to release it from the main logic board.
7. **Disconnect the diskette drive data cable and the hard disk data cable (if a hard disk is present) from their connectors on the main logic board. (See Figures 4-7 and 4-10).**

Note – When pulling up on pull tabs, brace the main logic board near the socket to minimize board flex.

---

8. **Back off the captive Phillips head screw in the center rear of the bracket (closest to the power supply). See Figures 4-8 and 4-9.**
9. **Tilt the bracket toward the front of the unit and disconnect the power cable from the diskette drive.**
10. **Lift the bracket out of the system unit and place it on an antistatic mat.** The data cables can remain connected to the hard drives.

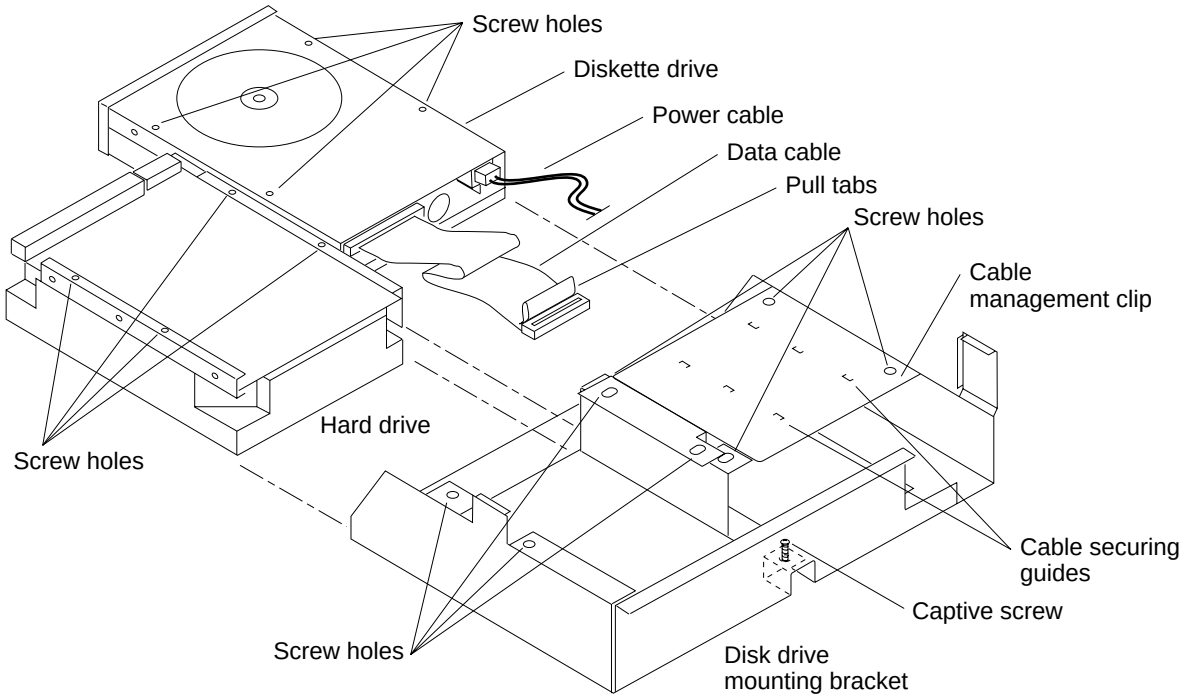


Figure 4-8 Disk Drive Mounting Bracket

Replacing the Disk Drive Mounting Bracket

To replace the disk drive mounting bracket follow these steps:

1. **Before setting the disk drive bracket flat in the unit top, connect the power and data cables to the diskette drive and the data cable to the hard drive, if one is present.**

2. **Tilt the disk drive bracket toward the front of the unit. Gently lower the bracket into position in front of the power supply. (See Figure 4-10).**

Note – The disk drive bracket must engage a securing ridge at the inside front of the unit top. If installed incorrectly, you will not be able to insert diskettes into the diskette drive.

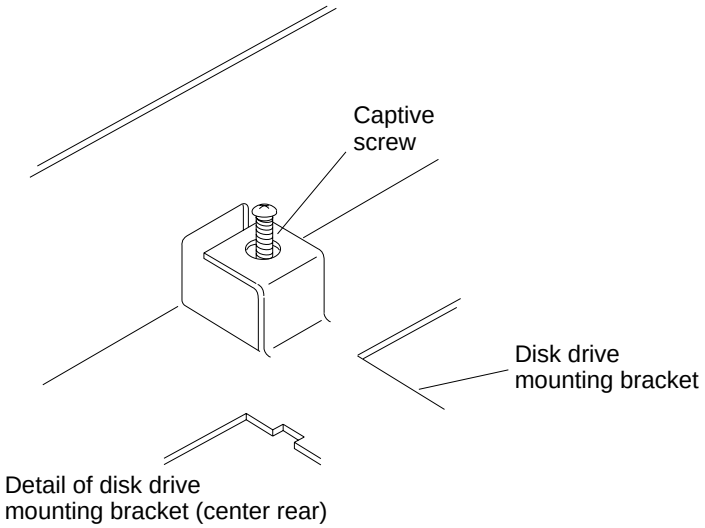


Figure 4-9 Detail of Disk Drive Mounting Bracket

3. **Tighten the captive Phillips head screw at the center rear of the bracket it to secure the bracket to the chassis.**
4. **If a hard drive is present, connect the power cable to it.**
5. **Secure the cables to the cable management clip over the diskette drive (see Figure 4-8 for the location of the clip and the cable securing guides).**
6. **Connect the diskette drive data cable and the hard disk data cable (if a hard disk is present) to their respective connectors on the main logic board. (See Figure 4-15).**
7. **Connect the internal power cable to its connection on the main logic board.**
8. **Close the system unit.**
   To do this, see “Closing the System Unit” near the end of Chapter 4.

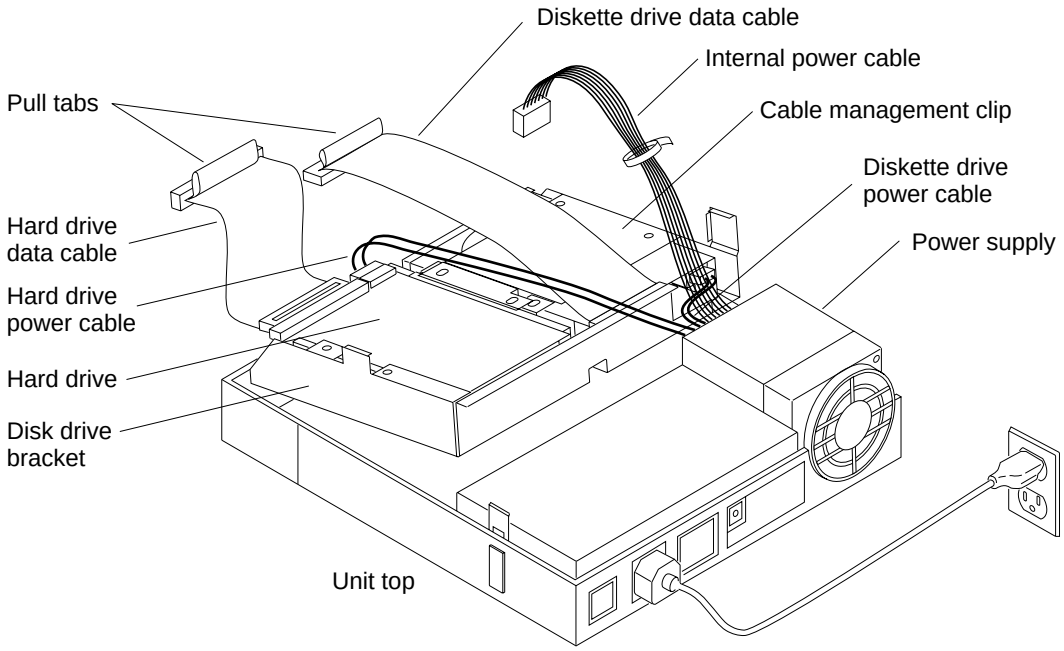


Figure 4-10 Removing and Replacing the Disk Drive Mounting Bracket

Hard Disk Drive

One 3 1/2-inch half-height hard disk drive can be installed in the top section of the system chassis. A 50-pin SCSI data cable and a 4-pin power cable connect to the rear of the drive. The hard disk drive is mounted beside the diskette drive in the system top.

Caution – The hard disk drive contains electronic components that are extremely sensitive to static electricity. Ordinary amounts of static from your clothes or work environment can destroy the components.

Do not touch the components themselves or any metal parts. Wear a grounding strap when handling the drive. See "Attaching a Wrist Strap" in Chapter 3. Attach the wrist strap to the metal casing of the power supply.

Do not disconnect the power cord from the system unit's power outlet or from the wall outlet. This connection provides the ground path necessary to safely remove and install the hard disk drive.

Make sure that the system unit's power is turned OFF by checking to make sure that the green light-emitting diode (LED) at the front of the chassis is not lit and that the fan in the power supply is not running.

Removing the Hard Disk Drive

To remove a hard disk drive:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
   When working with the disk drives, attach the wrist strap to the metal casing of the power supply.
2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet.

3. **Follow the instructions for removing the disk drive mounting bracket earlier in this chapter.**
   The power cables leading from the hard disk and the diskette drive should already be disconnected.
4. **Remove the four Phillips head screws securing the hard drive to the bracket (see Figure 4-8).**
5. **Slide the hard disk drive out of the bracket and set it on the anti-static mat.**
6. **Remove the data cable from the hard drive and set it aside for use with another drive.**

This completes the hard disk drive removal process.

Preparing the Hard Disk Drive

To prepare a hard disk drive for replacement:

Before replacing a hard disk drive, you must verify that the jumpers on the drive controller board are set correctly.

To gain access to the hard drive's controller board, turn the hard driver over gently on the antistatic mat. The drive controller board and the jumpers are on the bottom.

The number of jumpers and their location on the drive's controller board depends on the drive shipped with your system. Use Figures 4-11 through 4-14 to verify the jumper settings on your hard drive.

The drive shown in Figure 4-11 has six jumpers located near the lower right corner of the drive. The jumpers are in two blocks of three jumpers, separated by an empty jumper slot (no pins).

The drive shown in Figure 4-12 has five jumpers located in one block near the lower left corner of the drive.

Note – The labels for the jumpers on the drive shown in Figure 4-11 are etched onto the drive's controller board. The jumpers on the drive shown in Figure 4-12 are not labeled.

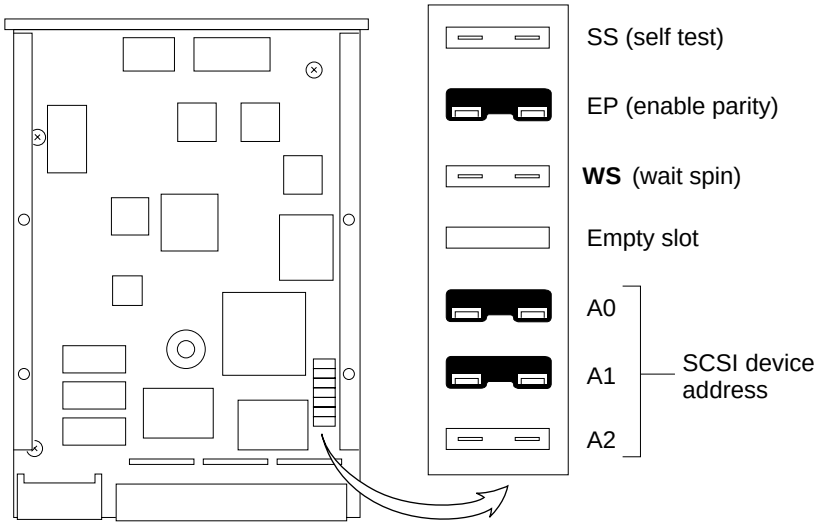


Figure 4-11 Jumper Settings for Hard Drives with Six Jumpers (settings labeled)

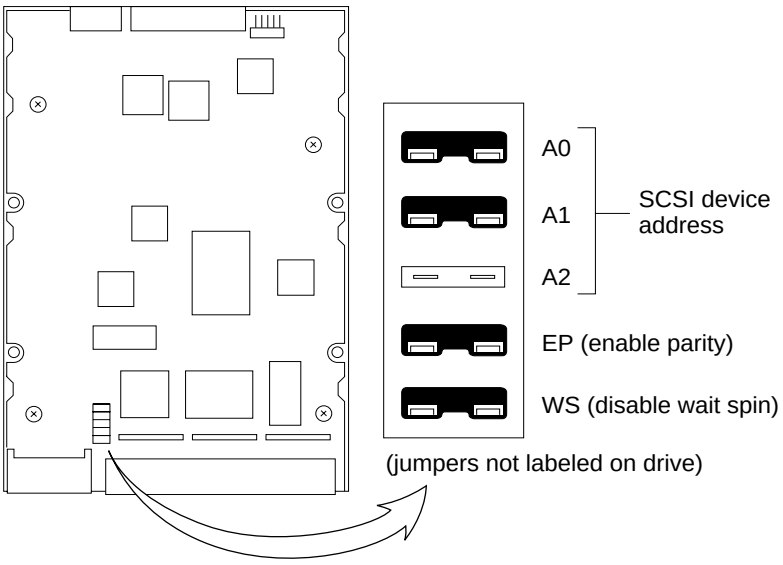


Figure 4-12 Jumper Settings for Hard Drives with Jumpers Near the Lower Left Corner (settings not labeled)

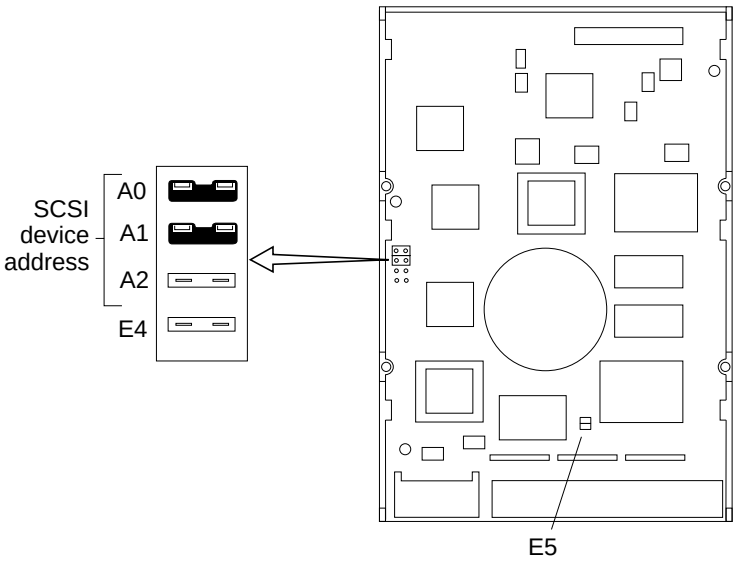


Figure 4-13 Low Profile 207 MB Drive —Jumper Settings (on the left)

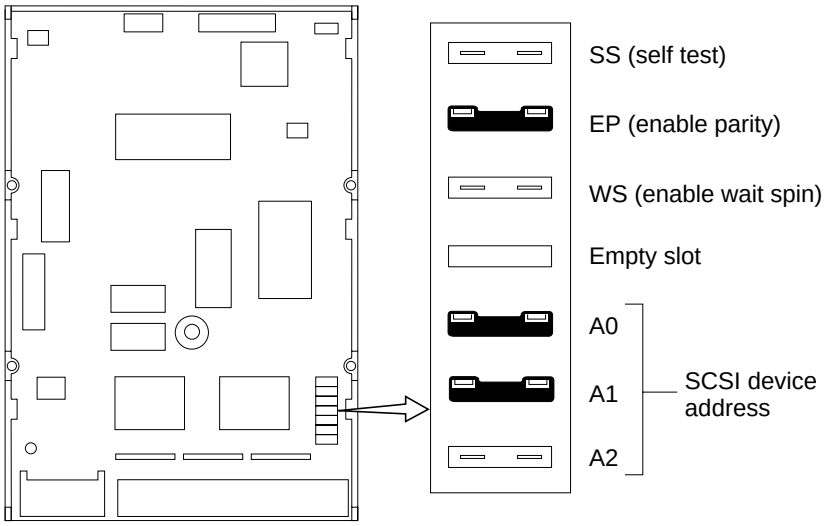


Figure 4-14 Low Profile 207 MB Hard Disk Drive—Jumper Settings (on the right)

Installing the Hard Disk Drive

To install a hard disk drive:

1. **Make sure you have followed the previous procedure on preparing the hard disk drive for replacement.**
2. **If you have not already done so, remove the disk drive mounting bracket as instructed earlier in this appendix.**
3. **Slide the hard disk drive into the bracket with the power and data cable connections facing the front of the unit.**
4. **Align the four screw holes in the hard drive with those in the bracket. Insert the screws and tighten them with a Phillips head screwdriver.**
5. **Connect the data cable leading to the hard drive.**
6. **Follow the directions earlier in the appendix for replacing the disk drive mounting bracket.**
7. **If you have not already reconnected the data cable to the main logic board, do so now.**
8. **Close the system unit.**
   See “Closing the System Unit” near the end of Chapter 4.
1. **Turn the system unit’s power on, and check for proper operation of the system unit and the installed hard disk drive.**
   See “How to Turn the Power Back On” in Chapter 4.

Diskette Drive

The diskette drive is in the unit top at the front right side (see Figure 4-8). A 34-pin data cable and a 4-pin power cable connect to the rear of the drive. Four Phillips head screws attach the diskette drive to the mounting bracket. The drive and the mounting bracket (described above) are secured to the chassis by a single captive Phillips head screw at the center rear of the bracket. See Figures 4-8 and 4-9.

Caution – The diskette drive contains electronic components that are extremely sensitive to static electricity. Ordinary amounts of static from your clothes or work environment can destroy the components

Do not touch the components themselves or any metal parts. Wear a grounding strap attached to the metal casing of the power supply when handling the drive. See “Attaching a Wrist Strap” in Chapter 3.

Do not disconnect the power cord from the system unit’s power outlet or from the wall socket. This connection provides the ground path necessary to safely remove and install the diskette drive.

Removing the Diskette Drive

To remove the diskette drive:

1. **See and follow the instructions earlier in this chapter for removing the disk drive mounting bracket.**
2. **Remove the four Phillips head screws holding the diskette drive to the disk drive mounting bracket.**
   (See Figure 4-8.)
3. **Slide the diskette drive out of the bracket as shown in Figure 4-8 and place it on an antistatic mat.**
4. **Remove the data cable from the diskette drive and set it aside for use with the replacement drive.**

This completes the diskette drive removal process.

Replacing the Diskette Drive

To replace the diskette drive:

1. **Follow the instructions earlier in the chapter for removing the disk drive bracket if you have not already done so.**
2. **Remove the defective diskette drive as instructed earlier in this chapter.**
3. **Connect the data cable to the replacement diskette drive.**
4. **Thread the data cable under the cable management clip so that it can be folded back over the clip for connection to the main logic board.**
5. **Slide the replacement drive under the cable management clip into the disk drive mounting bracket.**
6. **Align the four screw holes in the mounting bracket with the holes in the diskette drive, insert the screws, and fasten the diskette drive securely in the bracket.**
7. **Replace the disk drive mounting bracket in the unit top.**
   See “Replacing the Disk Drive Mounting Bracket” earlier in this chapter.
8. **Secure the cables in the cable management clip over the diskette drive.**
9. **Close the system unit.**
   To do this, see “Closing the System Unit” near the end of in this chapter.
10. **Turn the system unit’s power on, and check for proper operation of the system unit and the installed diskette drive.**
    See “How to Turn the Power Back On” at the end of this chapter.

Power Supply

The power supply is a self-contained metal assembly in the system unit top just behind the disk drive mounting bracket (see Figures 4-1 and 4-7).

The power supply is held in place by four hooks in the unit top that mate with four holes in the power supply, and a PEM screw. The PEM screw is inserted through the rear of the system unit after it engages the lock block on the outside of the unit.

A 12-pin power cable connects the power supply to the main logic board just in front of the SIMM slots in the right front corner. (See Figure 4-17). Four-pin power cables connect the diskette drive and hard drive to the power supply for DC power.

The power supply is auto sensing and will operate with input voltage 100-120 Vac or 200-240 Vac without adjustment. If the power supply fails to operate, replace it.

Warning – Make sure that the system unit is *unplugged* from the AC power outlet and the power switch is in the off position before you remove, replace, or install the power supply in the system unit. Failure to take this precaution may result in severe electrical shock.

Figure 4-15 shows how to remove and replace the power supply.

Removing the Power Supply

To remove the power supply follow these steps:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should **NOT** be attached to the system unit and to the wall outlet. The monitor power cable should also be disconnected from the system unit.

3. **The disk drive mounting bracket must be removed before the power supply can be lifted out of the system unit.**
   Follow the directions earlier in this chapter for removing the disk drive mounting bracket.

4. **Disconnect the internal power cable from the 12-pin connector on the main logic board.**

5. **Grasp the power supply firmly and slide it about 1/4 inch toward the front of the unit to disengage it from the four hooks in the bottom of the system unit.**
   Lift the power supply straight up and out. If the power supply does not lift easily, be sure that it has cleared the hooks.

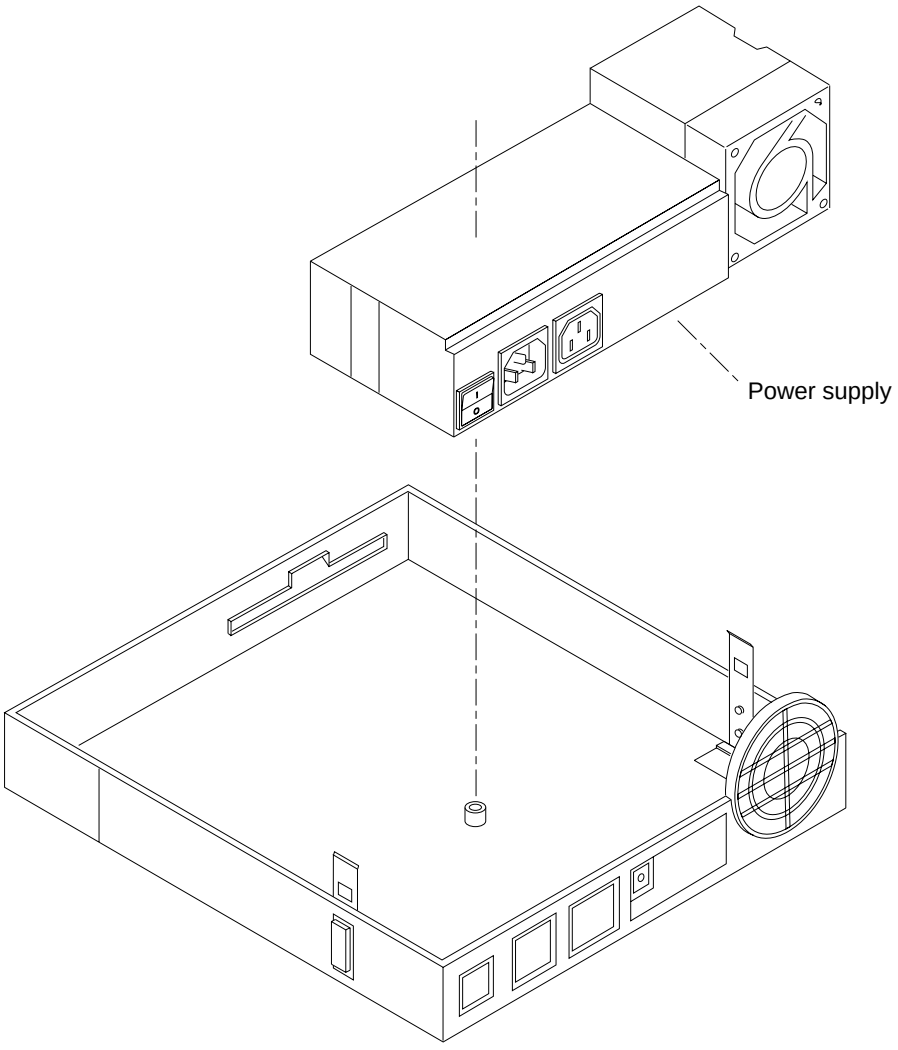


Figure 4-15 Removing and Replacing the Power Supply

Replacing the Power Supply

To install a new power supply follow these steps:

1. **Make sure that the power cord is NOT attached to the system unit or to the wall outlet.**
2. **See Figure 4-7 for the position of the power supply.**
   Align the holes in the bottom of the power supply with the hooks in the system unit top.
3. **Lower the power supply into the unit top as shown in Figure 4-15.**
4. **Properly position the power supply by pushing it firmly toward the rear of the unit (about 1/4 inch) until it engages with the hooks.**
5. **Be sure the power switch is in the OFF (O) position and connect the system power cord to the AC power outlet.**
   The power cord provides the necessary ground path for the wrist strap.
6. **Reattach the wrist strap to the metal casing of the new power supply.**
7. **Reinstall the disk drive mounting bracket in front of the power supply.**
   To do this follow the directions for replacing the disk drive mounting bracket earlier in this chapter.
8. **Connect the internal power cable to the white 12-pin connector on the main logic board.**
   The connector is keyed so that the power cable will fit only one way.
9. **Close the system unit.**
   See “Closing the System Unit” near the end of this chapter.
10. **Connect monitor power cord to the AC power outlet.**
11. **Turn the system unit’s power on, and check for proper operation of the system unit and the newly installed power supply.**
    See “How to Turn the Power Back On” towards the end of this chapter.

12. **If the newly installed power supply still does not work properly, a problem exists in the system unit, such as a blown component or a short circuit.**

Note – Make sure the power supply is connected to the main logic board before making any voltage measurements.

Main Logic Board

The main logic board contains the IU, the floating point coprocessor, the boot PROM, the NVRAM, SIMMs, SBus boards, two RS423/232 ports, an Ethernet port, a SCSI port, an audio in/audio out connector, and keyboard/mouse, as well as many other ICs and 3 fuses (see Figure 4-17). See Chapter 1 for an overview of the main logic board.

In addition, a 12-pin connector terminates the power cable for the main logic board and the disk drives. The 34-line diskette drive data cable connects to the main logic board to the left of the white 12-pin connector. The 50-line SCSI data cable power cable connects along the front of the main logic board to the left of the diskette data cable connections.

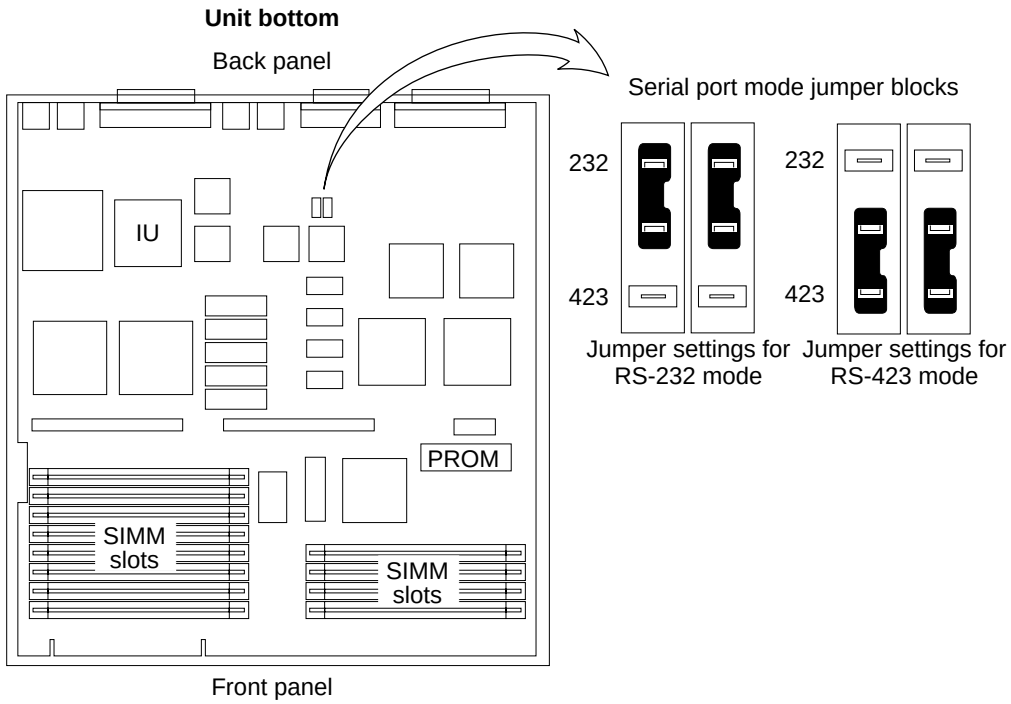


Figure 4-16 Serial Port Jumpers on the Main Logic Board

Serial Port Jumpers on the Main Logic Board

There are two serial port jumpers to set on the main logic board (see Figures 4-1 and 4-16). They reside in front of the Ethernet connector behind one of the SCC chips. The ports can be set either as RS-232 ports or as RS-423 ports, but both must be set the same. The jumpers are preset from the factory in asynchonous 423 mode, with the shunt between posts 1 and 2 on both jumpers. To change them to 232 ports, change the shunts on both jumpers to the position between posts 2 and 3.

Main Logic Board Voltage Test Points

There are no voltage test points on the main logic board. If you need to measure voltages, the safest place is at the power connector on the main logic board (see Figure 4-15). See “Before Replacing the Main Logic Board” later in this chapter for the connector wiring and voltages.

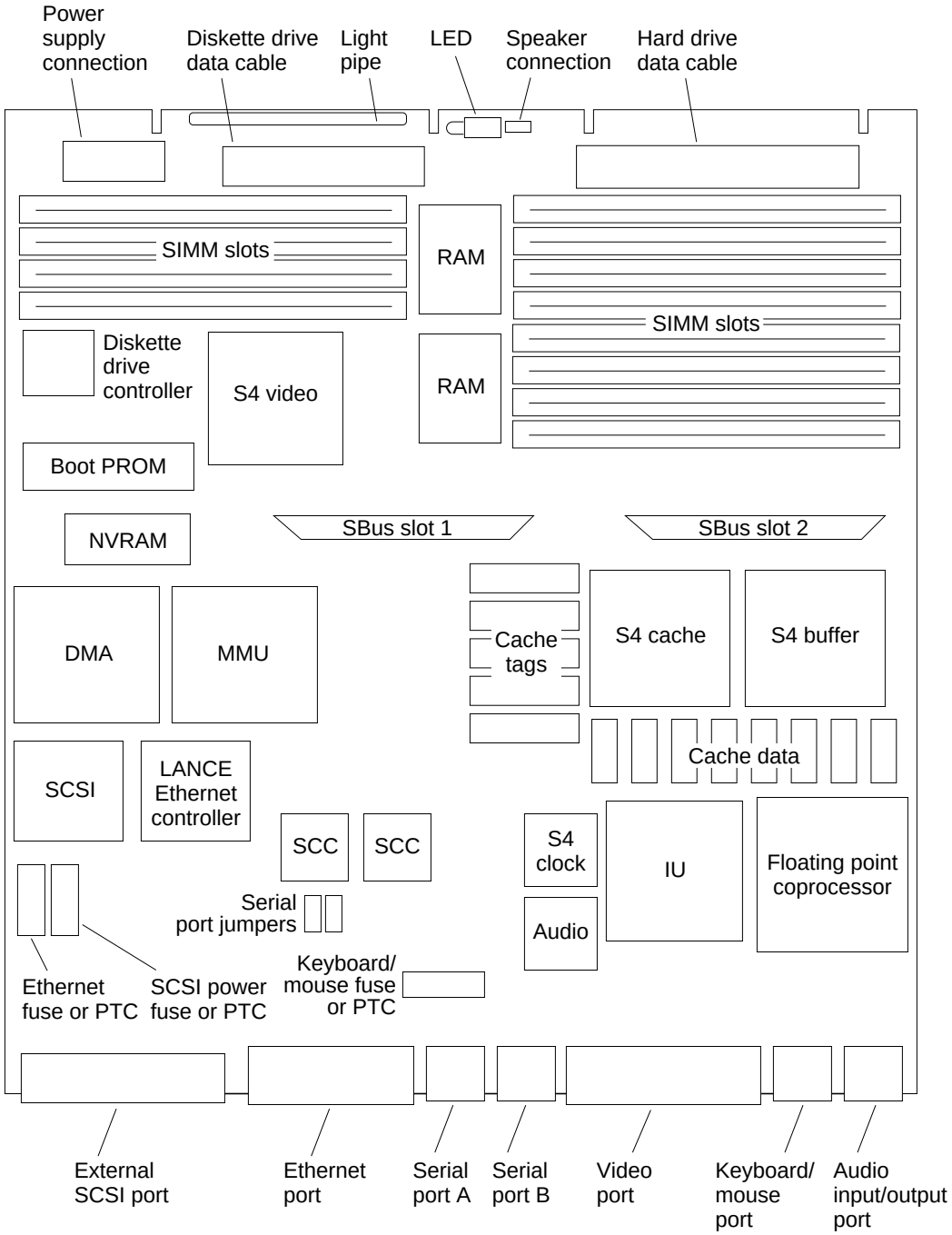
Caution – Printed circuit boards are made of delicate electronic components that are extremely sensitive to static electricity. Ordinary amounts of static from your clothes or work environment can destroy the boards.

Handle boards only by the non-conducting edges. Do not touch components themselves or any metal parts. Always wear a grounding strap when handling the boards.

Do not disconnect the power cord from the system unit’s power outlet. This connection provides the ground path necessary to safely remove and install the boards. I**n addition, the internal power cable from the power supply in the unit top should be plugged in to complete the ground**.

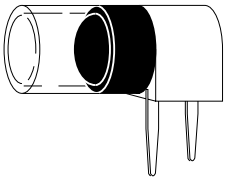
Make sure that the system unit’s power is turned OFF by checking to make sure that the green light-emitting diode (LED) at the front of the chassis is not lit and that the fan in the power supply is not running.

Figure 4-17 Main Logic Board Layout

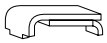

Power supply connection
Diskette drive data cable
Light pipe
LED
Speaker connection
Hard drive data cable
SIMM slots
RAM
SIMM slots
Diskette drive controller
S4 video
RAM
Boot PROM
NVRAM
SBus slot 1
SBus slot 2
DMA
MMU
Cache tags
S4 cache
S4 buffer
Cache data
SCSI
LANCE Ethernet controller
SCC
SCC
S4 clock
IU
Floating point coprocessor
Serial port jumpers
Audio
Ethernet fuse or PTC
SCSI power fuse or PTC
Keyboard/ mouse fuse or PTC
External SCSI port
Ethernet port
Serial port A
Serial port B
Video port
Keyboard/ mouse port
Audio input/output port

Main Logic Board Fuses

This section provides general information about the fuses and explains how to remove and replace the fuses on the main logic board. Positive Temperature Coefficient devices (PTCs) may be on the main logic board in place of fuses. These devices are self-healing; they reset after a fault occurs and do not require replacement. For the fuse locations see Figure 4-17.



Fuse



PTC

The keyboard and mouse fuse, located near the serial port A connector, protects the keyboard and mouse from overvoltages. If you power up the system and any of the following occurs, the keyboard and mouse fuse may need to be changed:

- The keyboard speaker does not beep.
- The four LEDs on the top right side of the keyboard do not flash when power is turned on to the system unit.
- The LED on the bottom of the mouse is not lit.
- A message is displayed on the system monitor:
  `No keyboard connected.`

The Ethernet fuse, located near the external SCSI connector, protects the Ethernet transceiver from overvoltages. If you plug the Ethernet cable into the main logic board and the Ethernet transceiver LED does not light, the Ethernet fuse may need to be replaced.

Note – The Ethernet transceiver is not a part of the workstation. It is connected to the main Ethernet network cable.

Other possible problems, if the Ethernet transceiver does not light, include:

- the transceiver may be bad

- the connection on the Ethernet cable may be bad
- the Ethernet cable or transceiver may have a problem such as a bad connection, shorted center conductor to the shield, or a broken cable segment.

The SCSI termination fuse, located next to the Ethernet fuse by the external SCSI connector, protects an external SCSI device from overvoltages. To determine if the SCSI termination fuse is bad, use a VOM and test the fuse using an open test for lack of continuity.

Checking the Fuses

To check the fuses, follow these steps:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
   The wrist strap should be attached to the metal casing of the power supply in the unit top.

2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet. Be sure the power cord from the power supply in the unit top is still connected to the main logic board to complete the ground.

3. **Remove the SBus card from SBus slot 1. Figure 4-17 illustrates the location of the SBus slots.**
   See "SBus Cards" earlier in this chapter for details on removal.

4. **Attach a VOM probe to the leads from the fuse holder. Check each of the fuses for continuity.**
   Figure 4-17 illustrates the fuse locations on the main logic board.

5. **If the fuse is bad, remove the fuse from the board by prying it loose from the socket with a small, flat-blade screwdriver.**
   The fuses are not soldered in.

6. **Insert a new fuse into the fuse socket and press it in until it is fully seated.**

7. **Replace the SBus card.**
   See “SBus Cards” earlier in this chapter.

8. **Close the system unit.**
   See “Closing the System Unit” later in this chapter.

9. **Turn the system unit’s power on, and check for proper operation of the system unit and the installed fuse.**
   See “How to Turn the Power Back On” at the end of this chapter.

   - If the fuse blows again, the associated cable might be bad. Disconnect the cable and check for shorts between the power pin and any of the other pins.
   - If the fuse blows with just the cable plugged in (no device connected at the other end), replace the cable.
   - If the fuse blows only when a device is plugged in to the far end of the cable, replace that device.

Before Replacing the Main Logic Board

This section explains what steps to perform before removing and replacing the main logic board. Removing and replacing the main logic board is a drastic step to take. Therefore, it is important to try to troubleshoot all other possibilities before removing and replacing the main logic board.

To check for and eliminate other possible problems before you replace the main logic board:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
   The wrist strap should be attached to the metal casing of the power supply in the unit top.

2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet. The internal power cable from the power supply in the unit top should also be connected to complete the ground.

3. **Attach a terminal to the system unit.**
   For details, see the *SPARCstation IPC Installation Guide*.This enables you to view output of the POST test results as they are run.

4. **Disconnect the graphics monitor, the keyboard, and the Ethernet connector.**

5. **Remove the SBus cards from the system.**
   To do this see "SBus Cards" in this chapter.

6. **Unplug the hard disk drives and the diskette drive from their data and power cables.**
   See Figures 4-7 and 4-17 in this chapter for the location of the data and power cables.

7. **Make sure all SIMMs are correctly seated (see Figure 4-17 for the location of the SIMM slots), the power supply cable is attached, and all chips on the main logic board correctly seated in their sockets.**

8. **Follow the directions later in this chapter for turning the power on.**

9. **With a VOM, measure the power supply voltages.**

Caution – Measuring voltages without connecting the DC cable will result in inaccurate readings. Without load, the power supply will not regulate.

The wire colors are the following:

Red	+5V
Blue	+12V
Brown	-12V
Gray	Por (Power on reset)
Black	Return

Note – The Por Signal is a TTL open collector and pull up is on the main logic board.

The limits for the voltages are:

+5V	4.90 to 5.10
+12V	11.16 to 12.84
-12V	-11.6 to -13.20 with a hard drive
-12V	-10.2 to -13.8 without a hard drive

If the voltages are correct, you have ruled out that the power supply is defective.

10. **Close the system unit.**
    To do this see "Closing the System Unit" towards the end of this chapter.

11. **Turn on the system and the terminal.**
    The system will start to boot. To interrupt the boot sequence, press Break on the terminal keyboard.

    The default prompt is the > prompt. You can reset the default prompt to be the ok prompt. To make the default prompt the ok prompt, see the *Open Boot PROM Toolkit User's Guide* or the *Introduction to Open Boot 2.0*.

    If you see the ok prompt, go to step 12. If you see the > prompt, go to the next step.

12. **At the > prompt, enter n.**
    This enters the Forth Toolkit and displays its ok prompt.

13. **Use the commands shown below to set the diagnostic switch to true, set the autoboot switch to false, and reset the system.**

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

As POST tests run, view the results on the terminal screen.

14. **If all POST tests pass, go to the next step.**
    If one or more of the following POST tests fails, take one of the following actions:

    - If the EPROM Checksum Test fails, replace the main logic board.
      See “Removing the Main Logic Board” and “Replacing the Main Logic Board” later in this chapter.
    - If the Limited Main Memory Address Test fails, numbers of Single Inline Memory Modules (SIMMs) are displayed on the terminal (see Figure 4-4). Replace the defective SIMM.
      See “Single Inline Memory Modules (SIMMs)” earlier in this chapter.
    - If any other test fails, replace the main logic board.
      See “Removing the Main Logic Board” and “Replacing the Main Logic Board” later in this chapter.
    - If you see nothing on the display, and the system appears dead, replace the main logic board.
      See “Removing the Main Logic Board” and “Replacing the Main Logic Board” later in this chapter.

15. **At the > or ok prompt, turn off the system’s power switch.**

16. **Open the system unit.**
    See “Opening the System Unit” in Chapter 3.

17. **Replace the SBus cards. See “SBus Cards” earlier in this chapter.**

18. **Reconnect the power and data cables to the hard disk drives and the diskette drive.**
    See Figures 4-7 and 4-17 in this chapter for the location of the data and power cables.

19. **Close the system unit.**
    See “Closing the System Unit” towards the end of this chapter.

    If you have identified the problem, go to the next step. If you have not identified the problem, go to Step 21.

20. **Disconnect the terminal and reconnect the graphics monitor, the keyboard, and the Ethernet connector.**
    To reconnect the graphics monitor see “Installing Your Monitor” in Chapter 2 of the *SPARCstation IPC Installation Guide*.

This completes the procedure.

21. **Turn the system and the terminal on and run the Sun Diagnostic Executive with the cache disabled** *only* **if all POST tests passed.**
    The Sun Diagnostic Executive is an independent operating system. It runs exhaustive subsystem tests independent of the SunOS Operating System. See the *SunDiagnostic Executive User's Guide for the Desktop SPARCstations.*

22. **At the > or ok prompts, turn off the system's power switch.**

23. **Disconnect the terminal and reconnect the graphics monitor, the keyboard, and the Ethernet connector.**
    To reconnect the graphics monitor see the *SPARCstation IPC Installation Guide.*

Removing the Main Logic Board

This section explains how to remove the main logic board from the system unit.

Figure 4-16 shows how to replace the main logic board.

To remove the main logic board:

1. **Removing and replacing the main logic board is a drastic step to take.**
   See "Before Replacing the Main Logic Board" for troubleshooting information.

2. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
   Attach the wrist strap to the metal casing of the power supply in the unit top.

3. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet.

4. **Disconnect all of the cables from the connectors at the rear of the system unit.**

5. **Place an antistatic mat next to the system unit.**

6. **Remove the SBus cards.**
   See "SBus Cards" earlier in this chapter.

7. **Remove the SIMMs from the main logic board.**
   Note carefully the slots in which the individual SIMMs were installed so that they may be installed properly in the replacement main logic board.

8. **Disconnect the 12-pin power supply cable from the connector in the right front corner of the main logic board by squeezing the clip at the end of the cable and pulling straight up.**
   See Figure 4-17 for the connector's location.

9. **Disconnect the speaker cable from the connector in the center front of the main logic board.**
   Remove the speaker from the channels securing it to the side of the system enclosure.

Caution – Do not touch or press on the speaker cone. You may damage the speaker or the sound quality.

10. **Disconnect the 34-line diskette data cable from the connector on the main logic board by pulling firmly on the tabs attached to the cable.**
    See Figure 4-17 for the connector's location. Fold them out of the way.

11. **Disconnect the hard disk drive data cable from the data connectors on the main logic board.**
    Fold them out of the way.

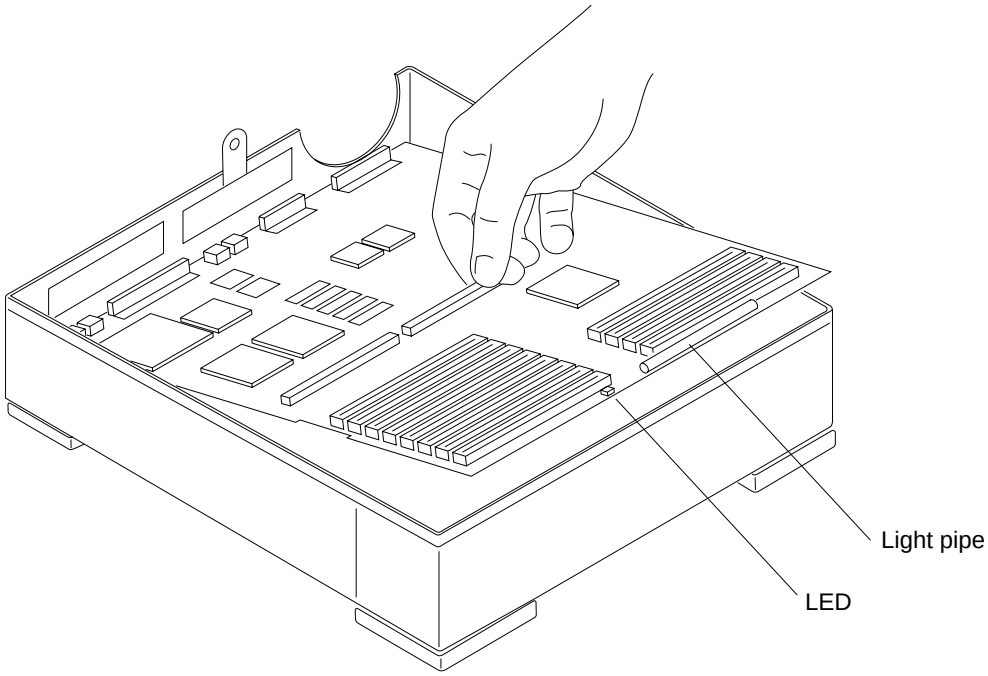


Figure 4-18 Removing and Replacing the Main Logic Board

Note – Steps 12 and 13 are optional, subject to the customer's request.

12. **With an IC extractor, remove the NVRAM chip from its socket slowly and evenly.**
    See Figure 4-17 for the location of the NVRAM chip.

13. **Store the NVRAM chip in conductive foam to prevent damage from electrostatic discharge.**
    Save the NVRAM chip for re-use.

14. **Remove the two Phillips head screws from the SCSI connector with a small Phillips head screwdriver.**
15. **Remove the slide lock from the Ethernet connector with a small flat blade screwdriver.**
16. **Remove the two hexhead screws from the video connector with a 3/16 inch hex head nutdriver.**
17. **Slide the main logic board toward the front of the chassis to release it from the three hooks in the bottom of the chassis.**
18. **Grasp the board by the SBus connectors with both hands. Raise the front of the board and lift it out toward the front of the unit (see Figure 4-18).** Avoid handling any of the delicate electronic components or touching any of the main logic board's traces.
19. **Remove the LED light pipe located at the front of the main logic board for reinstallation on the replacement board (see Figure 4-16).**
20. **Place the main logic board on an antistatic mat.**

Replacing the Main Logic Board

This section explains how to replace the main logic board into the system unit.

To replace the main logic board:

Note – If it is necessary to reuse of the NVRAM chip from the defective main logic board, be sure you have removed the NVRAM chip from the defective board. Insert it in the new board at the same location. Be sure to match the pin 1 indicator on the NVRAM chip with the indicator on the socket.

---

1. **Follow the instructions for installing the LED light pipe later in the chapter.**
2. **Insert the connectors on the rear of the replacement board into the back panel.**
3. **Align the board so that the three mounting holes align with the hooks in the bottom of the chassis.**
   After the board is properly positioned, slide it toward the rear bezel until the hooks lock into the mounting holes.
4. **Install the screws for the Ethernet, Video, and SCSI in the back panel of the system.**
   See Figure 4-17 in this chapter and Figure B-1 in Appendix B for their locations.
5. **If the NVRAM chip has been removed for reuse, install the NVRAM chip removed from the old main logic board on the new main logic board.**
   Match the pin 1 indicator on the NVRAM chip with the indicator on the socket. Holding the NVRAM chip at the edges, carefully align the pins and insert the NVRAM chip in the socket. Figure 4-17 shows the location of the NVRAM chip.
6. **Remove SIMMs taken from the old main logic board and install them in the corresponding SIMM slots of the new logic board.**
   See instructions earlier in this chapter for removing and replacing SIMMs.
7. **Connect the 12-pin power cable from the power supply to the white connector (see Figure 4-17) in the right front corner of the main logic board.**
   The connector is keyed so that the power cable will fit only one way.

8. **Connect the 34-line diskette drive data cable to the connector on the main logic board (see Figure 4-17).**
   The connector is keyed so it will fit only one way.
9. **Connect the hard disk drive data cable to the data connector on the main logic board (see Figure 4-17).**
   The connector is keyed so that it will only fit one way.
10. **Re-install the SBus cards as directed in "SBus Cards" earlier in this chapter.**
11. **Install the speaker into the channels in the side of the system enclosure and connect the speaker cable to the plug on the main logic board (see Figure 4-17).**

Caution – Do not touch or press on the speaker cone. You may damage the speaker or the sound quality.

12. **Connect all of the cables to the ports at the rear of the system unit.**
13. **Close the system unit. See "Closing the System Unit" later in this chapter.**
    Turn the system unit's power on, and check for proper system operation. See "How to Turn the Power Back On" at the end of this chapter.

LED Light Pipe

The LED light pipe clips onto the front of the main logic board between the power supply connection and the LED (see Figures 4-17 and 4-18). First, follow the instructions for removing the main logic board earlier in this chapter. Pull the light pipe gently from the edge of the main logic board. Replace the light pipe by aligning its locating tabs with the edge of the board and pushing it gently into place. When it is properly installed inside the system enclosure, one end of the light pipe should extend up to the small indicator hole in the system unit front panel. The other end should sit next to the LED.

Speaker

The speaker is mounted at the right side of the system on the right hand side (see Figure 4-7).

Testing the Speaker

To test if the speaker assembly needs to be replaced:

1. **Locate the speaker assembly (see Figure 4-7).**
2. **To test if sound is heard when sound is being sent to the speaker, first close the system unit.**
   To do this see “Closing the System Unit” later in this chapter.
3. **Bring up the system and boot SunOS.**
   To do this, see “Booting Your System” in Chapter 1 of the *Sun System & Network Manager’s Guide*.
4. **To generate sound enter either of the following:**

```
% cat /usr/demo/SOUND/sounds/sample.au > /dev/audio   The system plays back a spoken message
            or

% cat /vmunix > /dev/audio                           The system plays back garbage, which is
                                                     louder
Press Control-C  to abort the message
```

5. **If either of the sound tests fails, replace the speaker assembly as directed in the following procedures.**
   If either of the sound tests passes, do not replace the speaker.

Removing the Speaker

To remove the speaker, follow these steps:

1. **See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap.**
   The wrist strap should be attached to the metal casing of the power supply in the unit top.
2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of the chassis is not lit and that the fan in the power supply is not running.**
   The power cord should be attached to the system unit and to the wall outlet. The internal power cable from the power supply in the unit top should be connected to the main logic board to complete the necessary ground.
3. **Locate the speaker assembly on the right side of the open unit bottom and its 2-pin connector at the center front of the main logic board near the LED (see Figures 4-7 and 4-17).**
4. **Unplug the 2-pin connector from the main logic board.**
5. **Slide the speaker up and out of the mounting slots.**

Caution – Do not touch or press on the speaker cone. You may damage the speaker or the sound quality.

Replacing the Speaker

To replace the speaker, follow these steps:

1. **Slide the speaker into the mounting slots and push it down.**
2. **Plug the 2-pin connector onto the main logic board.**
   The connector is keyed so it will fit only one way.
3. **Close the system unit.**
   See "Closing the System Unit" later in this chapter.

4. **Turn the system unit's power on, and check for proper operation of the system unit and the installed speaker.**
   See "How to Turn the Power Back On" towards the end of this chapter.

Latch Button Assemblies

The latch button assemblies attach to the inner sides of the unit top near the rear and directly adjacent to the power supply. A latch button assembly consists of a corrugated white plastic latch button and a metal latch spring. (See Figure 4-19). The button itself fits into the latch spring holes by the molded plastic tabs projecting from the inner, non-corrugated side of the button. The latch button amd metal latch spring are shipped assembled.

Figure 4-19 shows how to replace the latch button assemblies.

Note – In order to reach the latch button assemblies, the components in the unit top must be removed. It is best to replace them, if needed, when operations are to be performed on the disk drives or power supply.

Removing the Latch Button Assemblies

To remove the latch button assemblies:

See and follow the instructions in Chapter 3 on halting your system, tools needed, removing expansion units, opening the system unit, and attaching a wrist strap. The wrist strap should be attached to the metal casing of the power supply in the unit top to complete the ground.

1. **To remove the latch button assemblies, first follow the instructions earlier in this chapter for removing the disk drive mounting bracket and the power supply.**

2. **Press on the latch button at the top.**
   With the unit top inverted, of course, this will appear to be the lowermost portion. The assembly should detach from the unit side panel on the inside.

Replacing the Latch Button Assemblies

To replace the latch button assemblies:

1. **Place the pre-assembled latch button and latch spring in the empty, inverted unit top next to the rectangular holes in the unit side panels; fit the latch button loosely into the opening.**
2. **With your finger press the latch spring firmly into the corner angle of the unit top. Then push down.**
   You will hear it click when it snaps into place.

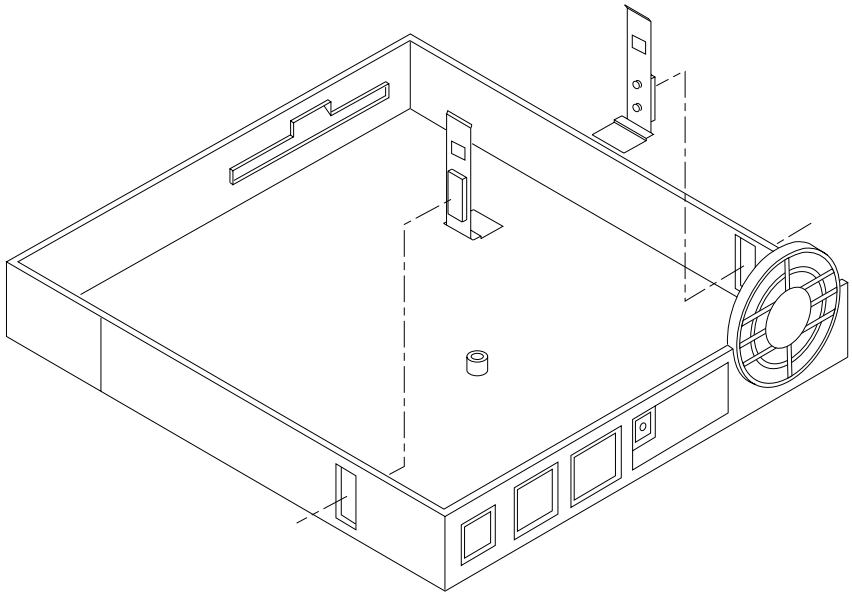


Figure 4-19 Installing the Latch Button Assemblies

Closing the System Unit

To close the system unit:

1. **Grasp the unit top (see Figure 4-18).**
   Rotate the unit top at a 15 degree angle and rotate your hand position so that thumbs and fingers point up and the five interlock hooks can be lined up.

Note – The interlock hooks do not engage until the unit is lowered to a 45 degree angle. Continue to hold the cover with your hands.

---

2. **Rest the front edges together to connect the interlock hooks by pushing gently toward the back of the unit.**
   As you lower the unit top, continue to push back to secure the connection. The unit top will rest slightly forward. Push it gently back a few millimeters. As the unit top moves back, the latch buttons should click, securing the unit top to the unit bottom.

3. **Attach the lock block by inserting the PEM screw through the block on the outside, the security loop on the inside, and into the power supply (see Figure 3-1).**
   Tighten the screw with a screwdriver. Be careful not to overtighten the screw.

4. **Power up the system.**
   See “How to Turn the Power Back On” later in this chapter.

Warning – Do not power up the system unit without closing it. Failure to do so may result in personal injury and system damage.

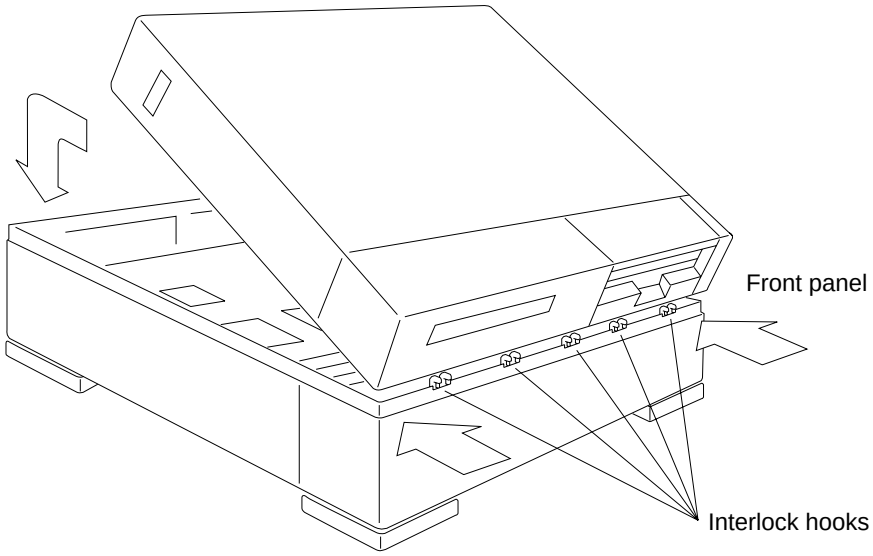


Figure 4-20 Closing the System Unit

Connecting the Ethernet Cable

To connect the Ethernet cable to the system unit:

1. **Connect the Ethernet cable to the port at the rear of the system unit (see Figure 4-17 for location).**
2. **Push the slide lock on the system unit to lock the cable to the system.**

Connecting the Desktop Storage Pack

To connect the Desktop Storage Pack (DSP) to the system unit:

- **Connect the connector on the SCSI cable to the SCSI port on the system unit's back panel.**
  See *The Desktop Storage Pack Installation Guide* for further instructions.

Connecting the External Storage Module

To connect the External Storage Module (ESM) to the system unit, follow these steps:

- **Connect the SCSI connector on the SCSI adapter cable to the SCSI port on the system unit's back panel.**
  See "Installing an ESM" in the manual provided with it.

Video Monitors

There are several different types of monitors and cabling. The monitors have 13W3 connectors. See the *SPARCstation IPC Installation Guide* for more specific information on monitors and monitor cables. Part numbers for the various monitors are listed in Appendix B.

Caution – Monitors with bases the same size or smaller than the system unit can be placed safely on top of the unit. Monitors with larger bases may be unstable. For example, the 17-inch grayscale monitor is stable on top, but the 19-inch monitor is not.

Table 4-1 Video Monitors

Monitor Type	Voltage
16-inch color monitor (407mm)	240V
16-inch color monitor (407mm)	115V
17-inch grayscale monitor (432mm)	115V
19-inch grayscale monitor (483mm)	115V

Mouse

The optical mouse connects to one of two jacks in the back of the keyboard. The mouse can be connected on either the left or right side to accommodate either left-handed or right-handed users. Connect the mouse to the keyboard before you connect the keyboard to the system unit.

Keyboard

A cable connects the keyboard to the system unit. The keyboard port is located at the left rear of the system unit. Connect the keyboard cable on either the left or right side of the keyboard, then to the port on the back of the system unit.

Audio

An audio cable may be connected to the Audio input/output port next to the keyboard/mouse port (see Figure 4-17).

How to Turn the Power Back On

After turning off the power to replace FRUs, turning the power on again is relatively simple.

Warning – This device is equipped with two 3-wire grounded power cords. To reduce the risk of electrical shock, always plug the power cords into a properly grounded power outlet.

Caution – Always allow 10 seconds between turning off the power and turning it back on again to prevent possible damage to power supply components in your system unit.

Turn the power switches on in this order:

- Monitor
- External drive (if you have one)
- System Unit

After a minute or so, you should see the login prompt.

```
system messages
system messages
system messages
system messages
system messages
hostname login:
```

When you see the login screen, you can log in to the system. For more information on logging in, see Chapter 2 of the *Sun System User's Guide.*

System Specifications

This appendix contains system specifications, including dimensions, electrical and power requirements, and environmental requirements.

Input Power Requirements

Figure A-1 lists the input power requirements for the system unit. The maximum power dissipated is less than or equal to 120 watts. The power supply automatically selects the correct AC voltage range.

Table A-1 Table of Input Power Requirements and Power Dissipation for the System Unit

Operating Voltage Range	Maximum Input Current	Maximum Input Power	Maximum Input Volt-Amps	Thermal Dissipation	Operating Frequency Range
100-120 Vac	5.0 A rms	119 watts	600	406 BTU	47-63Hz
200-240 Vac	2.5 A rms	119 watts	600	406 BTU	47-63Hz

Environmental Requirements

Figure A-2 lists the environmental requirements for the operating environment and the non-operating environment.

Table A-2 Table of Environmental Requirements

Operating Environment:	
Temperature	0 degrees C to 40 degrees C between 32 and 104 degrees F
Humidity	5 to 80% relative noncondensing at 40 degrees C
Wet Bulb	25 degrees C (77 degrees F) maximum
Altitude	0m to3048m (0 to10000 ft.)
Vibration	5-22Hz, 0.01 inches p-p; 22-500Hz, 0.25 g p-p
Shock	5g pk, 10msec 1/2 sine wave
Non-Operating Environment:	
Temperature	between -20 and 75 degrees C; between -4 and167 degrees F
Humidity	5 to 90% relative noncondensing at 40 degrees C
Wet Bulb	46 degrees C (115 degrees F) maximum
Altitude	3049m to 12,192m (10000 to 40000 ft)
Vibration	5-22Hz, 0.02 inches p-p; 22-500Hz, 0.5 g p-p
Shock	20g pk, 30msec

Physical Specifications

Figure A-3 lists the physical specifications for the system unit, the keyboard, the optical mouse, and selected monitors.

Table A-3 Table of Physical Specifications

Component	Height	Width	Depth	Net Weight
System Unit	4.6 in (11.75 cm)	9.6 in (24.45 cm)	10.4 in (26.35 cm)	11 lbs (4.95 kg)
Keyboard	2 in (5 cm)	19 in (48 cm)	8 in (20 cm)	2 lbs (1 kg)
Mouse	2 in (5 cm)	4 in (10 cm)	3 in (8 cm)	0.3 lbs (0.14 kg)
Monitor, 16 in color	15.8 in (40 cm)	15.5 in (39.4 cm)	17.3 in (43.8 cm)	70 lbs (31.8 kg)
Monitor, 17 in grays.	14.5 in (36.7 cm)	16.1 in (40.9 cm)	15.6 in (39.5 cm)	37 lbs (16.8 kg)
Monitor, 19 in grays.	17.5 in (44.5 cm)	18.1 in (46.0 cm)	15.9 in (45.2 cm)	52 lbs (23.6 kg)

Illustrated Parts Breakdown

This appendix illustrates how to connect the system's component parts, presents global views of the system, and gives part numbers referenced in the manual.

System Interconnection

Figure B-1 illustrates system interconnection.

Exploded Views

Figures B-2, B-3 and B-4 illustrate global views of the system.

Part Numbers

The part numbers for field replaceable units, other hardware, and books follow the illustrations.

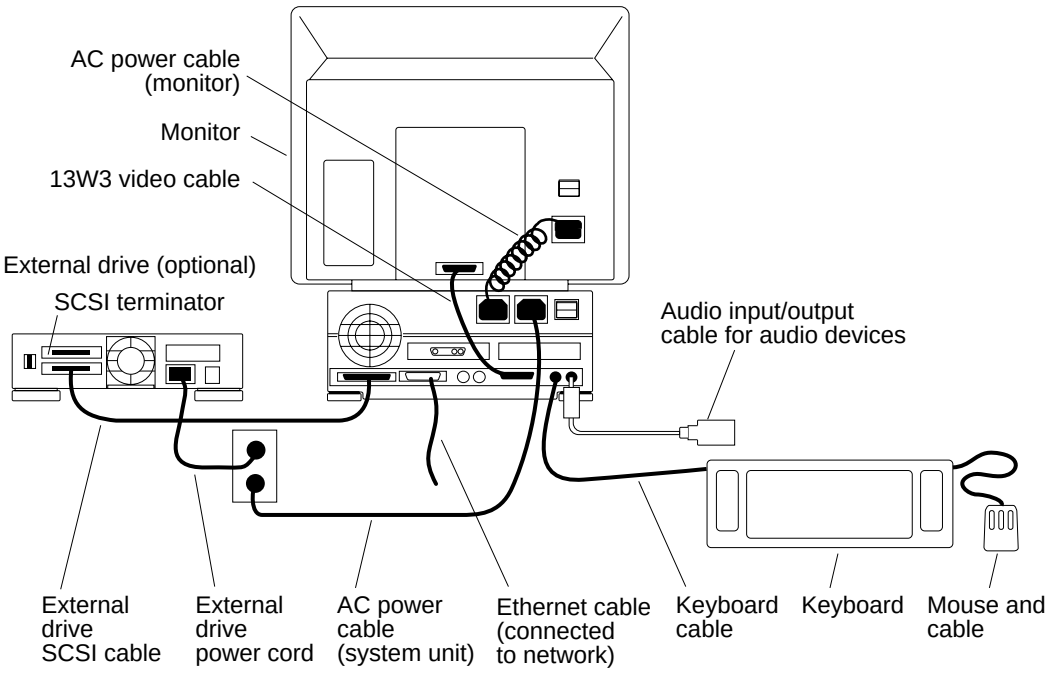


Figure B-1 System Interconnection

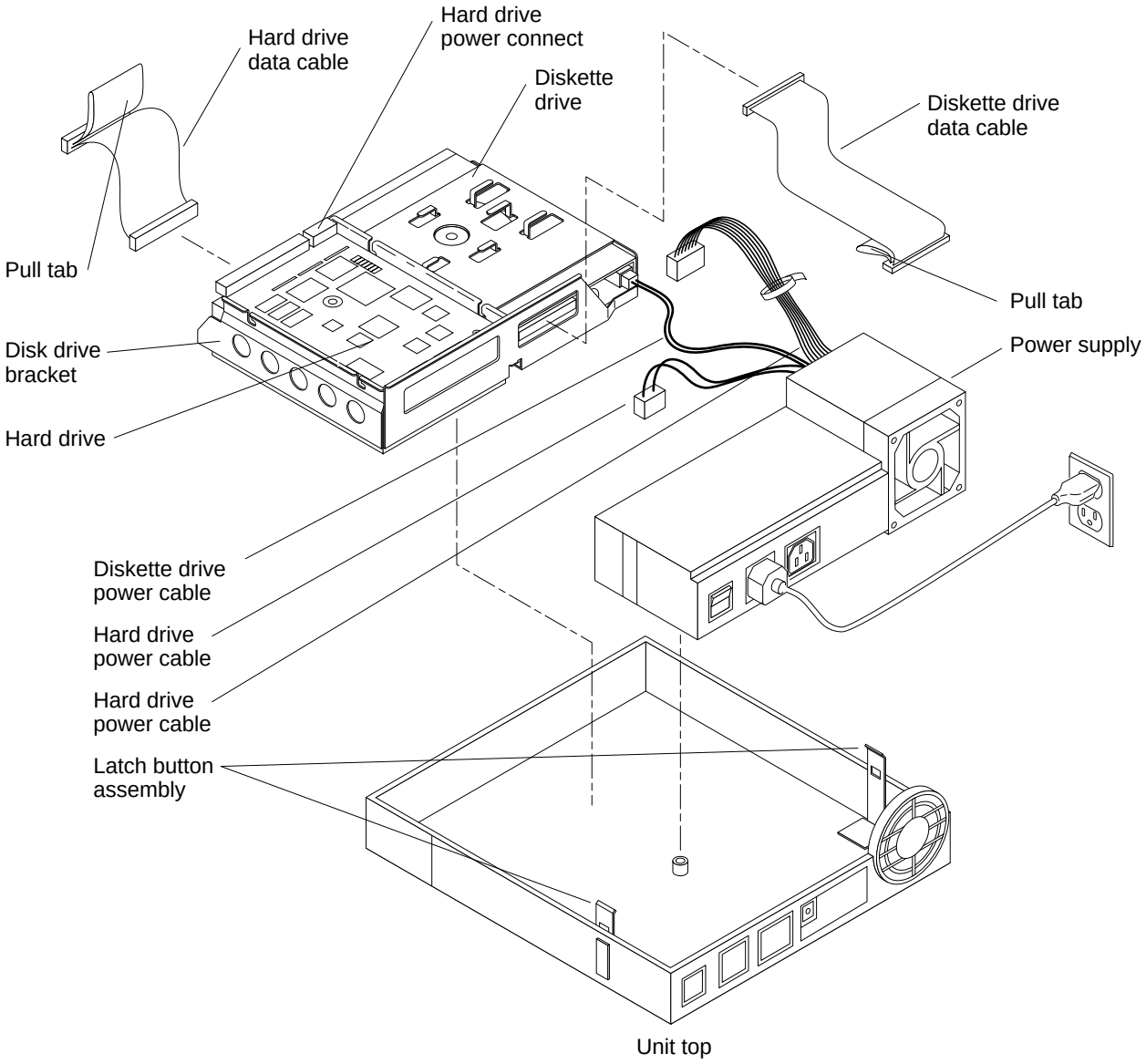


Figure B-2 Exploded View of the Unit Top

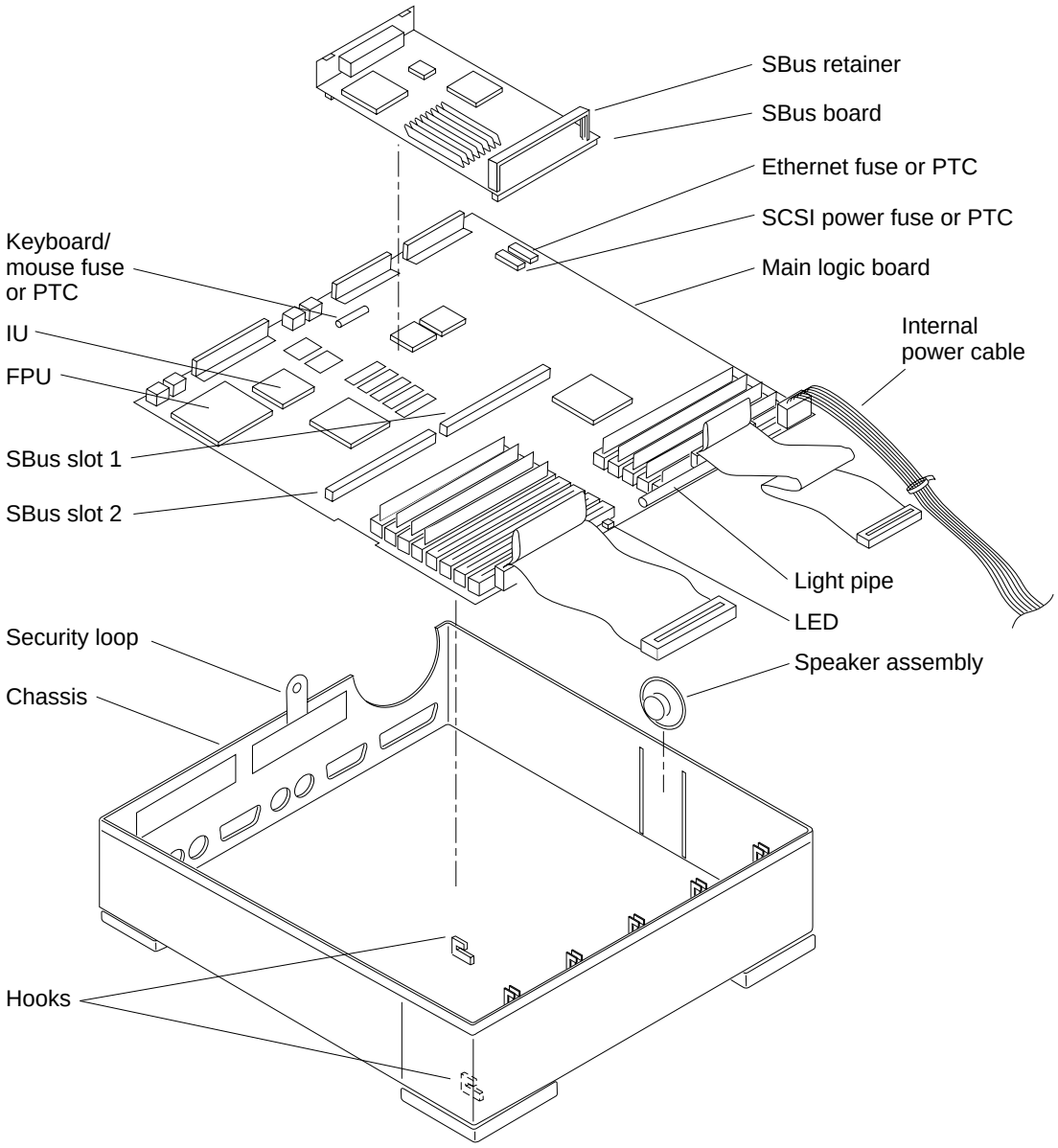


Figure B-3 Exploded View of the Unit Bottom

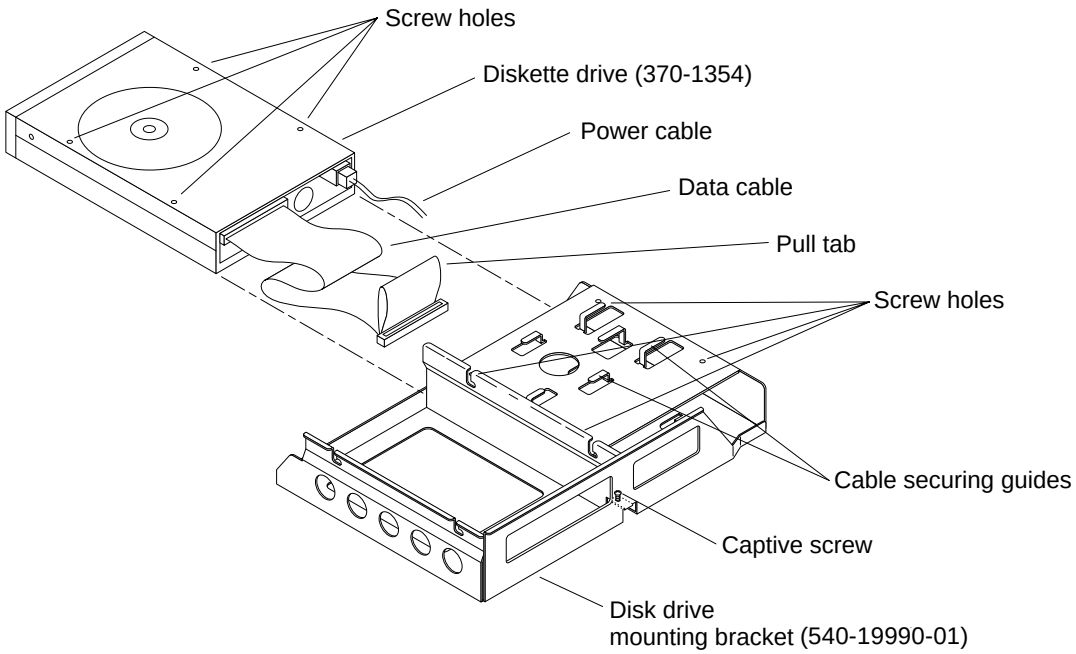


Figure B-4 Exploded View of the Disk Drive Mounting Bracket

Part Numbers

Field Replaceable Units

Item	Description	Sun PN
1	104MB Disk Drive	370-1200-08
2	207 MB Disk Drive	370-1327-01
2a	207 MB Disk Drive - Low Profile	370-1417-xx
3	Floppy Drive	370-1354-01
4	65 Watt Power Supply	300-1055-03
5	LED Light Pipe	330-1304-02
6	CPU Assembly (8 MB) FCC Class A	501-1689-09
	CPU Assembly (8 MB) FCC Class A	501-1835-03
7	CPU Assembly (8 MB) FCC Class B	501-1870-01
8	1 MB SIMM Module	501-1408-01
9	Speaker Assembly	540-1973-01
10	3.5 inch Floppy Cable	530-1643-02
11	Hard Drive Cable	530-1678-01
12	Color Frame Buffer	501-1718-01
13	Audio Cable	530-1594-01
14	Serial Cable	530-1662-xx
15	Sun4 Keyboard	320-1005-02
16	Sun4 Mouse/Pad	370-1215-01
17	17" Mono Monitor	365-1055-01
18	16" Color Monitor 115V	365-1079-01
19	16" Color Monitor 240V	365-1080-01
20	19" Mono Monitor	365-1071-01
21	Second Ethernet Board	595-2116-01
22	Analog Monochrome Frame Buffer Board	501-1561-01
23	System unit power cord (USA)	180-1117-01
24	System unit power cord (Swedish, French, German)	180-1177-02
25	System unit power cord (Swiss/French, Swiss/German)	180-1178-02
26	System unit power cord (UK)	180-1176-02
27	Monitor convenience power cord	180-1179-01
28	Keyboard cables	530-1442-01
		530-1443-01
29	Latch button assembly	540-1983-01
30	Ethernet fuse	150-1174-01

31	SCSI power fuse	150-1174-01
32	Keyboard / mouse fuse	150-1174-01
33	16 MB SIMM (four 4MB SIMMs)	595-2109-01
34	Lockblock Assembly	540-1982-01
35	Disk drive bracket	340-1999-01
36	Foot	330-1214-xx

Other Hardware

37	SIMM Extraction tool	345-1184-02
38	Wrist strap	250-1007-xx
39	Vertical stand	540-2034-01
40	Anti-Static Mat	330-1145-xx

Books

41	*Desktop Storage Pack Installation Guide*	800-4109-03
42	*SPARCstation IPC Installation Guide*	800-5037-10
43	*Open Boot PROM Toolkit User's Guide*	800-4251-10
44	*Sundiag User's Guide*	800-3804-10
45	*Sun System & Network Manager's Guide*	800-4098-10
46	*SunDiagnostic Executive User's Guide for the SPARCstations*	800-4826-10
47	*Introduction to Open Boot 2.0*	800-5674-10
48	*Open Boot 2.0 Command Reference*	800-6076-10
49	*Open Boot 2.0 Command Reference Summary*	800-5675-10

NVRAM Parameters

This appendix contains the Non-Volatile system configuration parameters used during reset. Tables for both Open Boot 1.0 and Open Boot 2.0 follow.

NVRAM Parameters for Open Boot 1.0

Parameter	Default:	Description
auto-boot?	true	If true, boot automatically after reset
boot-from	vmunix	Boot device (sd() implied) and file
boot-from-diag	le()vmunix	Boot device for diagnostic mode
diag-switch?	false	If true, power-up in diagnostic mode
fcode-debug?	false	If true, compile Fcode name fields
hardware-revision	(none)	System version information
input-device	keyboard	Input source (**ttya ttyb keyboard**)
keyboard-click?	false	If true, enable keyboard click
last-hardware-update	(none)	System update information
mfg-switch?	false	If true, perform repeated self-tests
oem-banner	(empty)	Custom power-on text banner
oem-banner?	false	If true, enable custom **oem banner**
oem-logo	(empty)	Custom power-on graphic logo
oem-logo?	false	If true, enable custom **oem-logo**
output-device	screen	Output source (**ttya ttyb screen**)
sbus-probe-list	0123	Sbus slot probe ordering
screen-#columns	80	Screen width (chars/line) (decimal)
screen-#rows	34	Screen height (text lines) (decimal)
scsci-initiator-id	7	SCSI bus address of host adapter
sd-targets	31204567	Map SCSI disk units
security-mode	none	Security (**none command full**)
security-password	(empty)	Security password (not displayed)
selftest-#megs	1	Megabytes of RAM to test at reset
st-targets	45670123	Map SCSI tape units
sunmon-compat?	true	If true, start with old-style prompt '>'
testarea	0	One-byte scratch area, for testing
ttya-ignore-cd	true	If true, SunOS ignores carrierdetect
tty-mode	9600,8,n,1,-	Baud, #bits, parity,#stop handshake
ttya-rts-dtr-off	false	If true, SunOS won't assert dtr/rts
ttyb-ignore-cd	true	If true, SunOS ignores carrierdetect
ttyb-mode	9600,8,n,1,-	Baud,#bits,parity,#stop,handshake
ttyb-rts-dtr-off	false	if true, SunOS won't assert dtr/rts
version2?	False	If false, run in Open Boot Prom 1.0 mode
watchdog-reboot?	false	If true, reboot after watchdog reset

NVRAM Parameters for Open Boot 2.0

Parameter Name	Value	Default: Value
selftest-#megs	1	
oem-logo		
oem-logo?	false	false
oem-banner		
oem-banner?	false	false
output-device	screen	screen
input-device	keyboard	keyboard
sbus-probe-list	0123	0123
keyboard-click?	false	false
keymap		
ttyb-rts-dtr-off	false	false
ttya-rts-dtr-off	false	false
ttya-ignore-cd	true	true
ttyb-mode	9600,8,n,1,-	9600,8,n,1,-
ttya-mode	9600,8,n,1,-	9600,8,n,1,-
fcode-debug?	false	false
diag-file		
diag-device	net	net
boot-file		
boot-device	disk	disk
auto-boot?	true	true
watchdog-reboot?	false	false
local-mac-address?	false	false
use-nvramrc?	false	false
nvramrc		
screen-#columns	80	80
screen-#rows	34	34
sunmon-compat?	true	true
security-mode	none	none
security-password		
security-#badlogins	0	7
scsi-initiator-id	7	7
version2?	true	true
hardware-revision		
last-hardware-update		
testarea	0	0
mfg-switch?	false	false
diag-switch?	false	false

Manufacturing Diagnostics

This appendix contains instructions for using Manufacturing Diagnostics.

Manufacturing Diagnostics

You will seldom, if ever, need to use this mode. It is used in a manufacturing environment to achieve repetitive *burn-in* testing. The Manufacturing Diagnostics mode runs POST in a continuous loop (see Figure D-1).

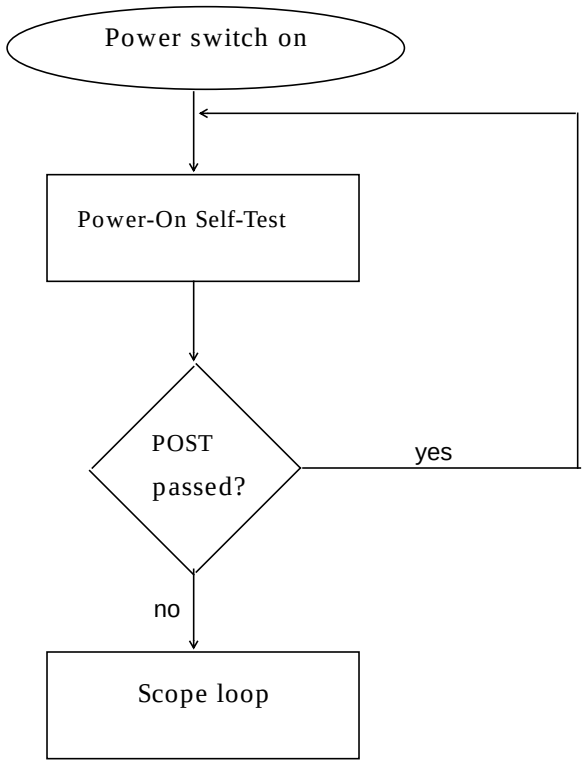


Figure D-1 Flowchart Illustrating Manufacturing Diagnostics

Caution – In order to run manufacturing diagnostics, you must halt the system in an orderly manner. When the operating system or any other stand-alone program has already booted, do not use the L1-A keys to halt the system. Abruptly aborting program execution may cause damage to data files.

To halt the system in an orderly manner and enter the Forth Toolkit:

3. **Save all your work and quit all applications.**
4. **As `root`, halt the system by entering** `/usr/etc/halt`.

You are presented with either the > or the ok prompt. If you see the > prompt, go to the next step. If you see the ok prompt, go to next procedure.

5. **Enter n to enter the Forth Toolkit.**
   The ok prompt shows that you are in the Forth Toolkit.

```
# /usr/etc/halt
> n
ok
```

To run Manufacturing Diagnostics:

1. **As root, halt the system in an orderly manner.**
   To do this, see the previous procedure.
2. **Enter setenv mfg-switch? true to set the manufacturing switch to true.**
3. **To view the Manufacturing Diagnostics results, attach a terminal to a serial port.**
   To do this, see the *SPARCstation IPC Installation Guide*.
4. **Enter reset to reboot the system.**

```
ok setenv mfg-switch? true
ok reset the system is rebooted and Manufacturing
Diagnostics run
```

At this point, the Manufacturing Diagnostics are run. These diagnostics consist of POST run in a continuous loop as shown in the flowchart in Figure D-1.

To leave Manufacturing Diagnostics and boot SunOS:

1. **Press the Break key to leave Manufacturing Diagnostics.**
   This step assumes you have connected a terminal to the system. If you did not attach a terminal to the system, press the L1-A keys simultaneously.

Either the > or the ok prompts appears. The > prompt is the default prompt. You will see the ok prompt if you reset the system to have the ok prompt as the default prompt. To have the ok prompt as the default, see the *Open Boot PROM Toolkit User's Guide*.

If you see the > prompt, go to the next step. If you see the ok prompt, go to Step 3.

2. **Enter n to enter the Forth Toolkit.**
   The ok prompt shows that you are in the Forth Toolkit.
3. **Enter `setenv mfg-switch? false` to set the manufacturing switch to false.**
4. **Enter `reset` to reboot the system.**

Figure D-4 summarizes the steps you need to take to leave Manufacturing Diagnostics and boot the SunOS Operating System.

Press the L1-A *keys simultaneously (graphics monitor) or press the* Break *key (terminal)*

```
> n
ok setenv mfg-switch? false
ok reset                          The system is rebooted
```

Figure D-2 Leaving Manufacturing Diagnostics and Rebooting the System.

Glossary

A RMS

Amps root mean square. RMS is often used in power measurements for electronic equipment.

boot

The initial load of system software from an I/O device.

boot PROM

A term referred to for the EPROM chip on the main logic board. This chip contains boot code consisting of a Forth Monitor program. The boot PROM is connected to the I/O data bus.

boot PROM diagnostics

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

buffer

The auxiliary data-storage device which holds data temporarily and which may also perform other functions in conjunction with various input/output machines.

cache

A buffer type of high-speed memory that is filled at medium speed from main memory, often with instructions and programs.

CPU

Central Processing Unit.

Desktop Backup Pack

An external unit containing a tape drive that can be connected to a SPARCstation IPC.

Desktop Disk Pack

An external unit containing a disk drive that can be connected to a SPARCstation IPC.

Desktop Sun CD Pack

An external unit containing a CD-ROM player.

Desktop Storage Pack (DSP)

A generic name for an external unit containing a tape drive, a disk drive, or a CD-ROM player that can be connected to a SPARCstation IPC. The external unit containing the tape drive is referred to as the Desktop Backup Pack. The external unit containing a disk drive is referred to as the Desktop Disk Pack. The external unit containing a CD-ROM is referred to as the Desktop Sun CD™ Pack.

Diagnostic Executive

An independent operating system running exhaustive subsystem tests independent of SunOS. Use the Diagnostic Executive after you have run POST and need to troubleshoot which FRU needs to be replaced.

DMA

Direct Memory Access.

DRAM

Dynamic Random Access Memory.

DSP

Desktop Storage Pack. A generic name for an external unit containing a tape drive, a disk drive, or a CD-ROM player that can be connected to a SPARCstation IPC. The external unit containing the tape drive is referred to as the Desktop Backup Pack. The external unit containing a disk drive is referred to as the Desktop Disk Pack. The external unit containing a CD-ROM player is referred to as the Desktop Sun CD Pack.

EPROM

Erasable programmable read-only memory. The EPROM on the main-logic board is referred to as the boot PROM.

ESM

External Storage Module.

External Expansion Module

An external unit that contains a disk drive and can be connected to a SPARCstation IPC.

Forth

A programming language which offers high-level means of expressing solutions to a wide range of problems. The major feature of Forth is that user-defined operators can be used just as though they were primitives.

Forth Toolkit

An interactive command interpreter based on the Forth programming language. While in the Toolkit, you will see the `ok` prompt. The Toolkit gives you access to an extensive set of functions for performing hardware development, fault isolation, software development, and debugging.

frame buffer board

A printed circuit board installed in an SBus slot of the system unit that controls a video display.

FRU

A field-replaceable unit.

IC

Integrated Circuit.

ID

Identification.

I/O

Input/Output. For example, an input/output device.

IU

Instruction Unit

LANCE

Local Area Network Controller for Ethernet.

LED

Light Emitting Diode.

lock block

A security device attached to the rear of the SPARCstation IPC to prevent unwanted entry into the system unit.

light pipe

The light pipe transfers light from the LED on the main logic board to the indicator hole.

Manufacturing Diagnostics

These diagnostics are used primarily in a manufacturing environment to achieve repetitive *burn-in* testing. Manufacturing Diagnostics runs POST in a continuous loop.

Monitor

Indicated by the > prompt. From the > prompt, you can boot the system, continue the execution of a halted program, or enter the Forth Toolkit. If disaster befalls your operating system, the Monitor automatically starts.

MMU

Memory Management Unit.

NVRAM

Non-Volatile RAM.

On-Board Diagnostics

To run On-Board Diagnostics, you must enter the Forth monitor, signified by the `ok` prompt. The on-board tests allow you to test the control registers, the network controller, the diskette drive system, memory, the cache, the system clock, and watch the network for valid packets. Enter `help diag` to get a list of all on-board diagnostic tests.

Por

Power-On reset TTL open collector signal from the power supply, which is activated after DC voltages have risen.

POST

Power-On Self-Test. The POST runs automatically when you turn on the system's power switch or reboot the system. The POST, stored in the boot PROM, is a series of rudimentary tests designed to verify that a viable boot path exists for loading more extensive diagnostic software, such as the Diagnostic Executive.

PROM

Programmable read-only memory.

PTC

Positive Temperature Coefficient. A self healing device that replaces a fuse. After an error occurs, the PTC resets.

RAM

Random Access Memory.

ROM

Read Only Memory.

SBus board

A printed circuit board installed in an SBus slot of the system unit.

security loop

An internal metal loop used in conjunction with the lock block to provide protection from unwanted system access.

SCC

Serial Communications Controller.

SCSI

Small Computer System Interface.

SIA

Serial Interface Adapter.

SIMM

Single Inline Memory Module. This is a small printed circuit board that contains RAM chips.

Sundiag System Exerciser

The Sundiag System Exerciser, which runs underSunOS, displays real-time use of system resources and peripheral equipment such as Desktop Storage Packs and External Storage Modules.

system Monitor

See Monitor.

TOD

Time of Day clock.

UART

Universal Asynchronous Receiver/Transmitter.

VOM

Voltage ohm meter. An instrument for measuring potential differences in volts.

VRAM

Video Random Access Memory.

wrist strap

A device that provides grounding for static electricity between your body and the system unit's chassis. Electric current and voltage do not pass through the wrist strap.

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