SPARCstation 1+
Field Service Manual

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About This Book

The *SPARCstation 1 and SPARCstation 1+ Field Service Manual* describes how to diagnose system problems by running diagnostics and removing and replacing field replaceable units (FRUs).

Who Should Read This Book

This book is written for Sun Field Service representatives, OEMs, VARs, and other customers with self-maintenance contracts.

What This Book Contains

This book contains four chapters and two appendixes:

- System Overview—Chapter 1

  This chapter presents high-level descriptions of the SPARCstation 1 and SPARCstation 1+ systems, 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 how to halt the system, tools you will need, how to disconnect the Desktop Storage Pack and the Extended Storage Module from the system unit, how to remove the system unit's top cover, 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, environmental constraints, and compliance with various electrical and safety regulations.

- Illustrated Parts Breakdown—Appendix B

  This appendix contains illustrations of global views of the system.

- 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 and also should 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 1 Installation Guide* or
- *SPARCstation 1+ Installation Guide*
- Sun System & Network Manager's Guide

Caution – If a system is labeled FCC-A (VCCI-1), you may install parts labeled FCC-B as long as the parts are functionally interchangeable. If a system is labelled FCC-B (VCCI-2), you may only install replacement parts with a like certification status. Care must be taken never to install a replacement part that is FCC-A into a class B system. Doing so negates the class B rating and lowers the system's classification to A.

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 1 is contained in a main chassis or system unit.

  SPARCstation 1 Installation Guide

- `This font` indicates text the system displays on the screen. `This font` also indicates characters and words you enter (as shown within text). Examples follow:

  Syncing file systems... done

  Type `passwd`.

- **`This type`** indicates what you type as illustrated in screen examples. For example:

```
% sync
```

- A round-cornered box around text indicates a key that you press. For example:

  Press the Delete key.

When you see two key names within one rectangular box, press and hold the first key, then type the second character. For example:

To type L1-A, press and hold theL1 key, while typing a.

- 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 manual:

- *Open Boot PROM Toolkit User’s Guide* provides a summary of the Forth Toolkit commands.
- *Sundiag User’s Guide* provides information about Sundiag, a system exerciser that runs under the Sun Operating System. Sundiag displays real-time use of system resources and peripherals.
- *SunDiagnostic Executive User’s Guide for the SPARCstation 1*explains how to run extensive, configurable tests independent of the SunOS. The SunDiagnostic Executive is the tool of choice when you need thorough diagnostics. With the SunDiagnostic Executive, you can determine which FRU needs to be replaced.
- SPARCstation 1 Installation Manual provides step-by-step instructions on how to install your system’s hardware and software.
- SPARCstation 1+ Installation Manual 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.

System Overview

This chapter presents an overview of the SPARCstation 1 and the SPARCstation 1+ system hardware. This overview is helpful in servicing and maintaining hardware equipment.

The heart of each system is contained in a main chassis or *system unit*. The system unit houses the main logic board. A power supply, two optional 3 1/2-inch hard disk drives, one optional 3 1/2-inch diskette drive, and the speaker are also contained in the system unit. A frame buffer card or the GX Graphics Accelerator board must reside in one of the system's three SBus expansion slots when a video monitor is connected to the system. See "SBus Boards" later in this chapter for more information.

You can add expansion modules to increase the system's mass storage capacity. See "Mass Storage Devices" later in this chapter for more information on the expansion modules.

Figure 1-1 illustrates the system's configuration with an external storage device. Figure 1-2 presents the top view of the system unit with the cover removed. 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 (150 megabyte Tape Drive)
  - Desktop Disk Pack (104 megabyte Hard Drive)
  - Desktop SunCD™ Pack (644 megabyte (max.) CD-ROM Drive)
  - External Storage Module (5 1/4-inch 327 megabyte hard disk drive only)
  - External Storage Module (5 1/4-inch 327 megabyte hard disk drive and 1/4-inch 150megabyte cartridge tape drive)
  - External Storage Module (dual 5 1/4-inch 327 megabyte hard disk drives)
  - External Storage Module (669 megabyte hard disk drive* only)
  - External Storage Module (669 megabyte hard disk drive* and 1/4-inch 150 megabyte cartridge tape drive)
  - External Storage Module (dual 669 megabyte hard disk drives*)
  - External Storage Module (2.3 gigabyte cartridge tape drive* only)

These units may be daisy-chained together. To install the expansion modules, see the *Desktop Storage Pack Installation Guide* and the *Sun External Storage Module Installation Manual.*

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

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*Use with SPARCstation 1 or SPARCstation 1+ with SunOS 4.1 or later

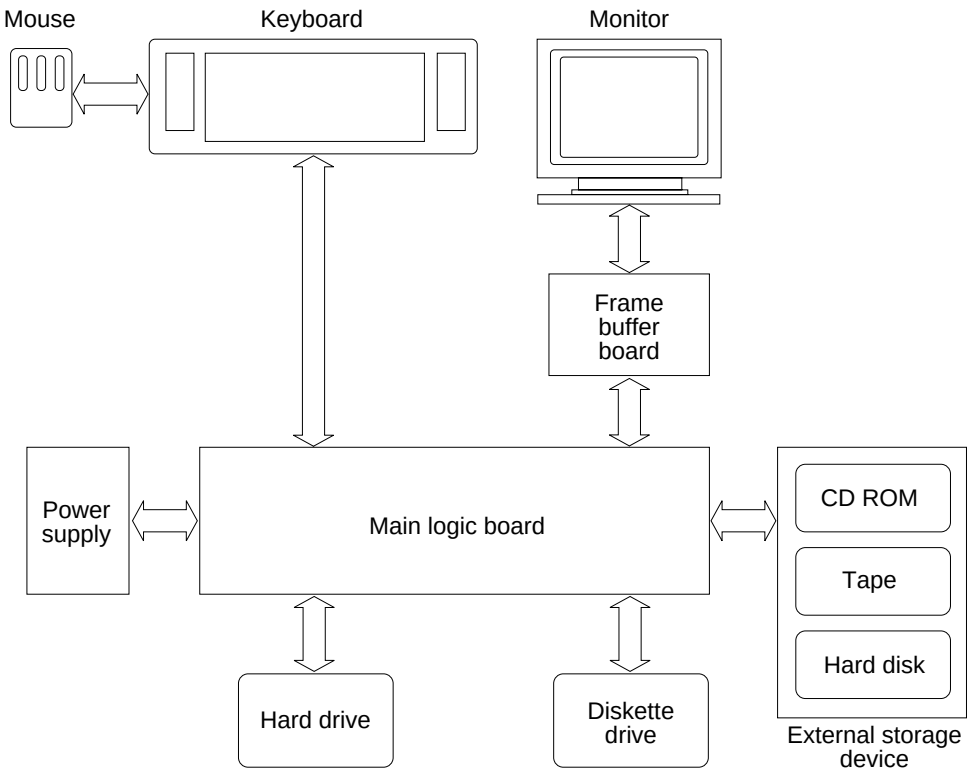


Figure 1-1 SPARCstation 1 and SPARCstation 1+ Block Diagram

Figure 1-2 shows the top view with the cover removed.

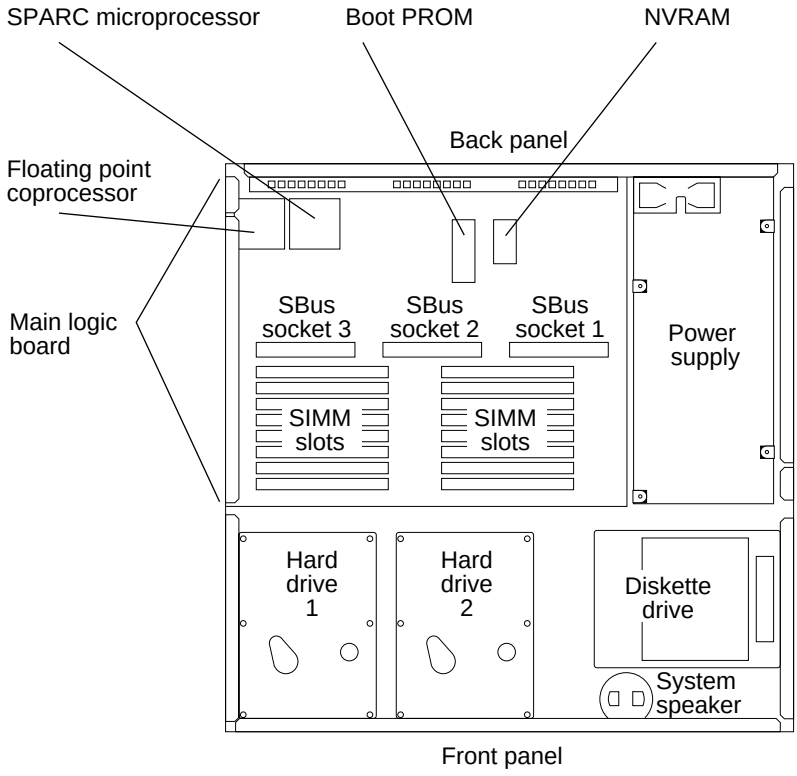


Figure 1-2 Top View With the Cover Removed

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

Figure 1-3 presents a block-level diagram of the system's main logic board.

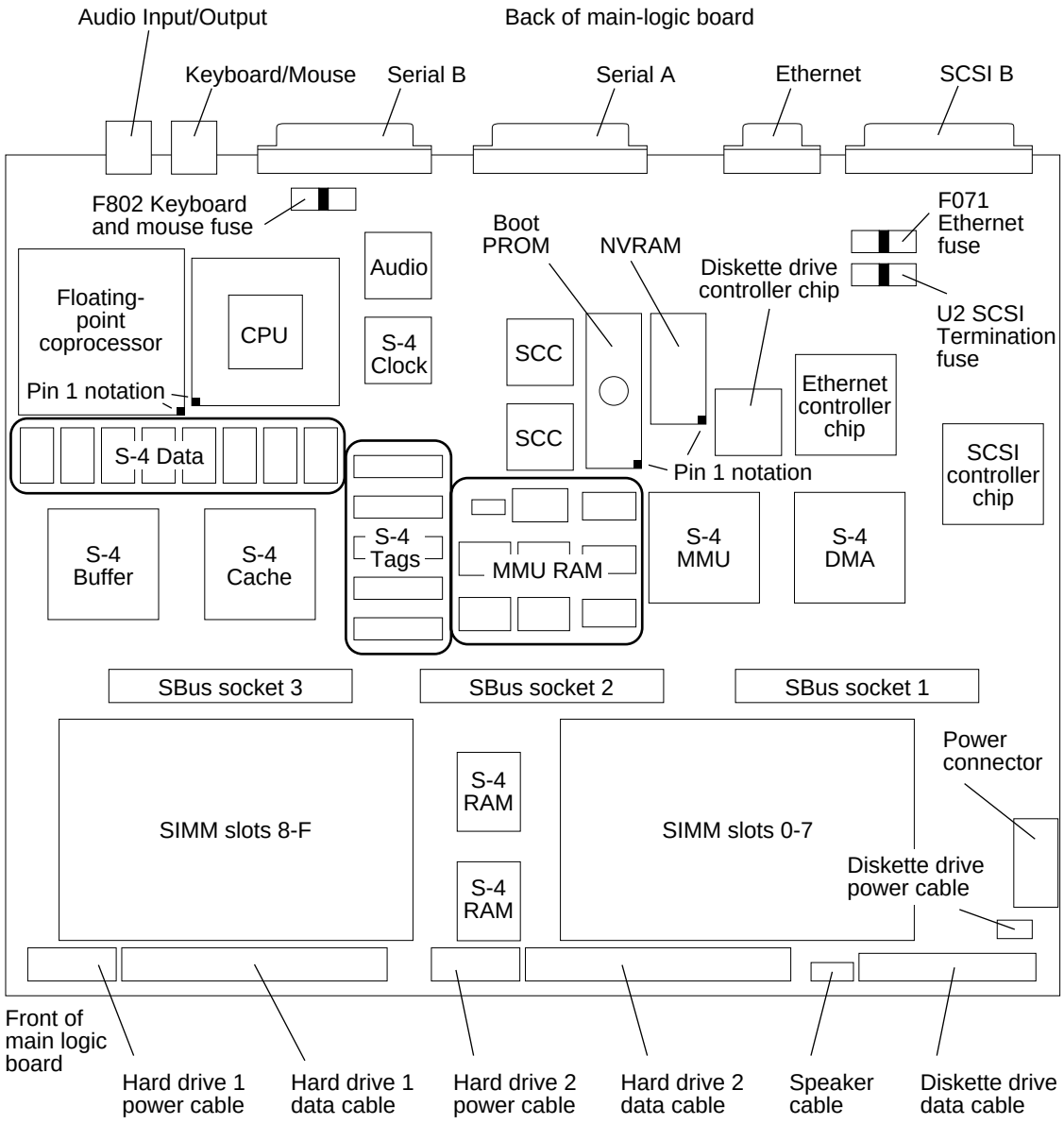


Figure 1-3 The Main Logic Board

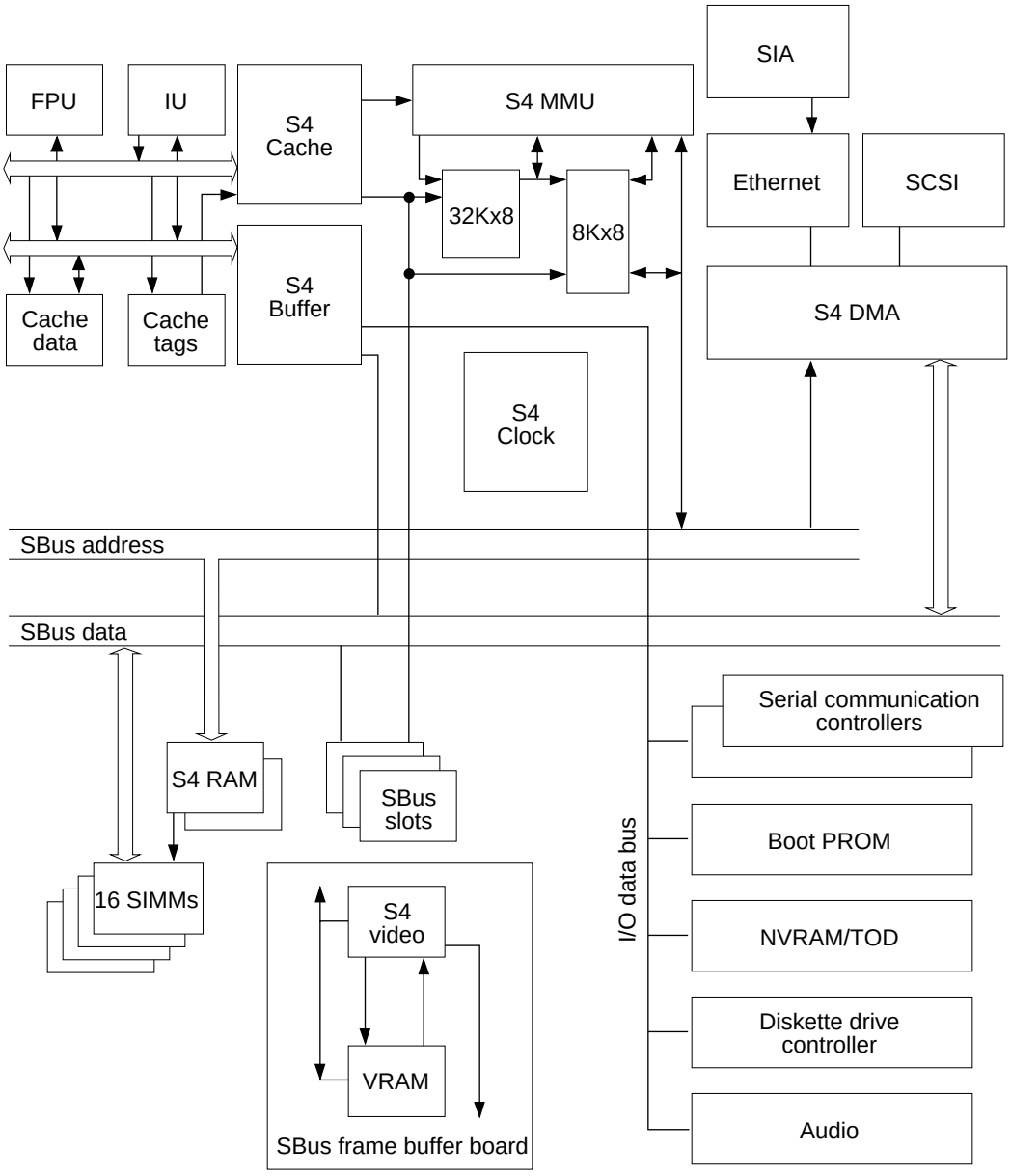


Figure 1-4 A Block Level Diagram of the Main Logic Board

Main Logic Board

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

- CPU core
- Three SBus Slots
- Memory Management Unit
- S4 DMA
- DRAM
- Input/Output such as the Ethernet controller chip, the SCSI controller chip, and the diskette drive controller chip
- Eight-bit devices

CPU Core

The CPU core consists of the following items:

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

These components are discussed in the sections that follow.

Instruction Unit

The basic core of the main logic board is the SPARC microprocessor (see Figures 1-2, 1-3, and 1-4). The IU's clock speed in the SPARCstation 1 is 20 MHz. The IU's clock speed in the SPARCstation 1+ is 25 MHz. Integer operation in the SPARCstation 1 is approximately 12.5 MIPs. Integer operation in the SPARCstation 1+ is approximately 15 MIPs. The IU is supported with the S4 chip set including the S4 cache, the S4 memory management unit (MMU), the S4 buffer, and the S4 clock.

Floating-Point Coprocessor

The floating-point coprocessor (see Figures 1-2, 1-3, and 1-4) in the SPARCstation 1 delivers approximately 1.4 Mflops double-precision Linpack performance. The floating-point coprocessor (see Figures 1-2 and 1-3) in the SPARCstation 1+ delivers approximately 1.75 Mflops

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 RAMs
- Cache Tags RAMs
- 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 RAMs.

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 RAMs transmit 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 RAMs are filled with the information obtained from main memory and the IU is started again.

The cache design implemented in the SPARCstation 1 and SPARCstation 1+ 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 in size and contains the boot code consisting of a 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 the SunOS Operating System. In some cases, however, the SunDiagnostic 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.

- Non-volatile RAM (NVRAM) and Time-of-Day Clock (TOD).

  The NVRAM/TOD 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/TOD 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 B: NVRAM Configuration Parameters Summary" of the *Open Boot PROM Toolkit User's Guide.*

- Serial Ports A and B

  Serial ports A and B are provided on the main logic board (see Figure 1-3). These serial ports are RS-232 ports and can connect peripheral equipment such as terminals, printers, and modems. The serial communications controller chips help to implement the serial interface.
- Keyboard and Mouse Interface

  A keyboard and mouse port, on the back of the main logic board to the left of the Serial B port (see Figure 1-3), controls the keyboard and mouse. The serial communications controller chips 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 (Early SPARCstation 1 system units)

The system speaker is connected to the I/O data bus by the audio chip (see figures 1-3 and 1-4). There are two audio ports on its back panel. You can plug the following devices into the audio input or audio output ports:

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

You can plug the following devices into the audio output port:

Headphones (30 ohms to 100 ohms impedance)

External amplifier and loudspeaker

The workstation's sound capabilities can be demonstrated using Soundtool, an audio demonstration program included with Sun Operating System. To test the workstation's sound, see "Speaker" in Chapter 4. For additional information, see "SunOS Operating System Features" in Chapter 7 of the *SPARCstation 1 Installation Guid*e. "Identifying the Audio Ports" in Chapter 1 of the *SPARCstation 1 Installation Guide* illustrates how to connect audio equipment.

- Audio Input/Output Port (SPARCstation 1 systems manufactured in late 1989 and early 1990 and all SPARCstation 1+ systems). Early units of the SPARCstation 1 main logic board had two ports rather than one for Audio Input/Output.

  The SPARCstation 1+ system unit and later-released SPARCstation 1 has an audio input/output port on its back panel. (See Figure 1-3.)

  You can plug the following devices into the audio input/output port through the audio input/output port cable which is supplied with the system unit:

  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 – Early units of the SPARCstation 1+ may not include an audio input/output cable. You may order this cable from Sun Microsystems, Inc.

The sound capabilities of your SPARCstation 1 and SPARCstation 1+ can be shown with Soundtool, an audio demonstration program included with SunOS 4.1. See Appendix C "About Sound" in the *Sun System User's Guide* for additional information.

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, Sun Operating System, 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 DMA

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

Dynamic RAM

The Dynamic RAM (DRAM), illustrated in Figures 1-3 and 1-4, is comprised of the following:

- Two S4 RAM chips
- 16 megabytes of memory contained in the 4 1-megabyte Single Inline Memory Modules (SIMMs).

"Single Inline Memory Modules (SIMMs)" in Chapter 4 describes how to install SIMMs.

SBus Slots

There are three SBus slots on the main logic board (see Figure 1-2 and 1-3). These SBus slots accommodate SBus boards. 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 Boards" later in this chapter for more information on specific SBus boards. "SBus Boards" in Chapter 4 explains how to remove and replace SBus boards.

Input/Output

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

- Ethernet (LANCE) controller chip
- SCC (Serial Communication Controller) chips
- Audio chip
- SCSI controller chip
- Diskette drive controller chip

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

The internal SCSI hard disk drives and optional external SCSI devices 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).

The Serial A and B ports and the keyboard and mouse are controlled by the SCC chips (see Figures 1-3 and 1-4).

Single Inline Memory Modules (SIMMs)

At present, up to 16 megabytes of memory, contained in 1 megabyte Single Inline Memory Modules (SIMMs), can be added in increments of 4 megabytes (see Figures 1-2, 1-3, and 1-4). See “Single Inline Memory Modules (SIMMs)” in Chapter 4 for SIMM installation and removal instructions.

SBus Boards

Various SBus boards can be added to the system’s three SBus slots on the main logic board. Figure 1-2 illustrates the SBus slots. See “SBus Boards” in Chapter 4 for information on how to remove and replace SBus boards. Some types of SBus boards include the following:

- GX Graphics Accelerator Board

  This board controls the video output from the system unit, and accelerates the generation of graphic images. It occupies two slots (either slots 1 and 2 or slots 2 and 3).

- Analog Monochrome Frame Buffer Board

  This board controls the video output from the system unit to a 17-inch monochrome monitor.

- Color Frame Buffer Board

  This board controls the video output from the system unit to a color monitor.

- ECL Monochrome Frame Buffer Board

  This board controls the video output from the system unit to standard (1152 x 900 pixels) and high-resolution (1600 x 1280 pixels) 19-inch monochrome monitors. This board is used in early SPARCstation 1 systems only.

- Second Ethernet Board

  This board provides you with an extra Ethernet port. The Ethernet board is used in applications in which your SPARCstation 1 or SPARCstation 1+ acts as a gateway between two physically distinct Ethernet networks. This board has two connectors: standard (thick) Ethernet and thin Ethernet.

Mass Storage Devices

The mass storage devices available include the following:

- Hard disk drives
  Two optional 3 1/2-inch SCSI 104 megabyte hard disk drives (see Figure 1-2) can be installed in the system unit. Chapter 4 describes how to replace the optional hard disk drives in the system unit.

- Optional expansion modules. The following are available:

  Desktop Storage Packs (DSPs)

  Desktop Backup Pack (150 megabyte Tape Drive)

  Desktop Disk Pack (104 megabyte Hard Drive)

  Desktop SunCD™ Pack (644 megabyte (max.) CD-ROM Drive)

  External Storage Modules (ESMs)

  External Storage Module (5 1/4-inch 327 megabyte hard disk drive only)

  External Storage Module (5 1/4-inch 327 megabyte hard disk drive and 1/4-inch 150megabyte cartridge tape drive)

  External Storage Module (dual 5 1/4-inch 327 megabyte hard disk drives)

  External Storage Module (669 megabyte hard disk drive* only)

  External Storage Module (669 megabyte hard disk drive* and 1/4-inch 150 megabyte cartridge tape drive)

  External Storage Module (669 megabyte hard disk drive* and 2.3 GB cartridge tape drive)

  External Storage Module (dual 669 megabyte hard disk drives*)

*Use with SPARCstation 1 or SPARCstation 1+ with SunOS 4.1 or later

These units may be daisy-chained together. By attaching optional expansion units, you can increase the system's mass storage capacity. See the Installation Guide for your particular system for instructions describing how to install the expansion modules, or see the *Desktop Storage Pack Installation Guide.*

- Diskette drive
  An optional 3 1/2-inch 1.44 megabyte internal diskette drive (see Figure 1-2) can be installed 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 megabyte per second. "Diskette Drive" in Chapter 4 describes how to remove and replace the optional diskette drive in the system unit.

Power Supply

The power supply (see Figure 1-2) is housed in the system unit. It connects to the system via a 12-pin connector and provides +5, +12, and -12 volts DC. Voltages are not adjustable. 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:

- Switching power supply
- 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

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

The available monitors are listed in Figure 1-5.

Note: The 19-inch standard (1152 x 900) monochrome monitor (483mm), 115V, is no longer supported. Beginning April 2, 1990, Sun replaced this monitor with an analog monitor.

Table 1-1 Video Monitors

Monitor Type	Voltage	Part Number
16-inch color monitor (407mm)	115V	365-1020
17-inch monochrome monitor (432mm)	115V	365-1055
19-inch color monitor (483mm)	115V	365-1056
19-inch standard analog monitor (483mm)	115V	365-1071
19-inch high-resolution (1600 x 1280) monochrome monitor (483mm)	115V	365-1047
17-inch greyscale OCLI (432mm)	90-240V	365-1062
19-inch color monitor(483mm)	115V	365-1038
19-inch monochrome OCLI monitor (483mm)	115V	365-1044
16-inch color monitor (407mm)	240V	365-1022
19-inch color monitor (483mm)	240V	365-1054
19-inch standard(1152 x 900) monochrome monitor (483mm)	240V	365-1043
19-inch high-resolution (1600 x1280) monochrome monitor (483mm)	240V	365-1050
19-inch high-resolution (1600 x 1280) OCLI monitor (483mm)	240V	365-1049
19-inch monochrome OCLI monitor (483mm)	240V	365-1045
19-inch color monitor (483mm)	240V	365-1039

The color frame buffer card or GX graphics accelerator board (used only in SPARCstation 1 systems) controls video output from the system unit with a 16-inch (407mm) color monitor or a 19-inch (483mm) high-resolution monochrome monitor. The GX graphics accelerator board also accelerates the generation of graphic images.

The analog monochrome frame buffer board controls video output from the system unit with a 17-inch (432mm) monochrome monitor.

The ECL monochrome frame buffer board controls video output from the system unit with a 19-inch (483mm) standard monochrome monitor. Beginning April 2, 1990, Sun replaced the ECL monochrome frame buffer card with an analog frame buffer board.

Diagnostics Overview

This chapter describes the different types of diagnostic firmware and software tools available to you and how they are related. The main categories of diagnostics are the following:

- Boot PROM diagnostics
  - Power-On Self-Test (POST)
  - On-Board Diagnostics
- Manufacturing Diagnostics
- SunDiag System Exerciser
- SunDiagnostic 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.*

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.

2

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 auto-boot switch parameter in NVRAM is set to false (not the default), you will obtain either the > or `ok` prompts. 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.*

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` on SCSI disk sd0. 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 using the parameter `le()vmunix`. If you want, you can change the boot sequence by modifying the NVRAM parameters. For a more in-depth explanation, refer to the *Open Boot PROM Toolkit User's Guide.*

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

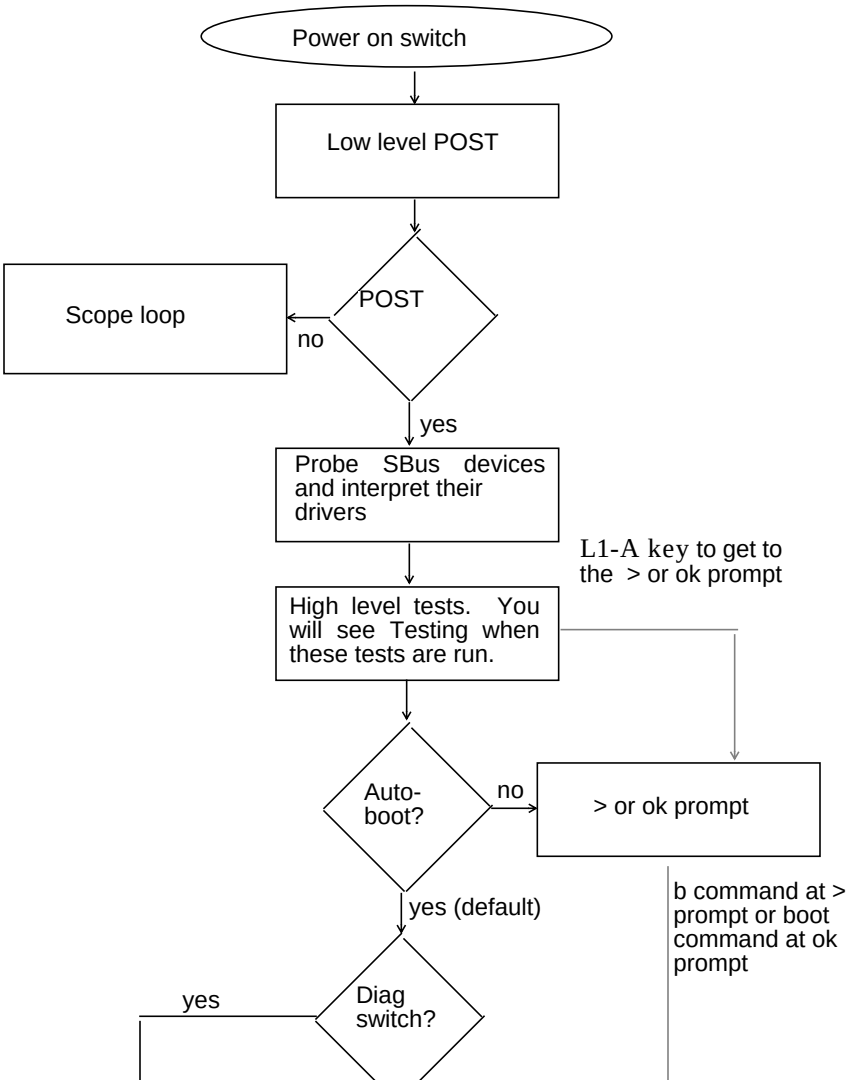


Figure 2-1 Default Boot Mode

When to Use Diagnostics

You should use each type of diagnostic tool in the appropriate circumstances. Figure 2-2 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	Runs thorough tests such as the Ethernet test, memory test, and the diskette drive controller test. 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 2-4). Used in a manufacturing environment to achieve repetitive *burn-in* testing. Described later in this chapter.
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. If all power-on self-tests pass, then run the SunDiagnostic Executive to identify the problem. See the *Sundiag User's Guide* for more information.
SunDiagnostic Executive	Runs extensive, configurable subsystem tests independent of the SunOS Operating System. Run the SunDiagnostic Executive if all tests pass when you run POST. Running the SunDiagnostic Executive allows you to troubleshoot which field replaceable unit needs to be replaced. See the *SunDiagnostic Executive User's Guide for the SPARCstation 1* for more information.
Monitor	Enters the Monitor when the operating system crashes or when you type L1-A on the keyboard. To boot the SunOS Operating System 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* 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 Figure 2-3 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 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 when the IU receives the Por signal 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 the 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, the 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" which is located in the next section.

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" in the next section for instructions on how to run POST, and conduct general troubleshooting.

For more information on POST see "Power On Self-Tests (POST)" in Chapter 2 of the *Open Boot PROM Toolkit User's Guide*.

How to Run the Power-On Self-Test

Theprocedure 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.

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 which involves removing SBus boards and cards, 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. To do this, see "Connecting Wyse WY-50 and VT-100 Terminals" in Chapter 5 of the** *SPARCstation 1 Installation Guide* **or the** *SPARCstation 1+ Installation Guide***.**

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

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

   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 parameter switch to true, set the autoboot parameter 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.**

Note – To see the results of these initial POST tests, you need a terminal attached to the serial port. The remainder of the test displays will go to the system monitor.

If one or more of the following tests fails, do the following:

- If the EPROM Checksum Test fails, replace the boot PROM. See "Boot PROM" in Chapter 4. This situation is very unlikely. If the boot PROM is bad, it is very likely that the system will do nothing and appear dead.
- If you replace the boot PROM and rerun the POST, and the PROM tests fails again, a component between the IU and the boot PROM on the main logic board is defective. Put the old boot PROM back in. See "Boot

PROM” in this Chapter 4. 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, the SIMM location on the Main Logic Board ("U" number) is displayed on the terminal. The "U" numbers are listed in Figure 4-3. 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 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, and the system appears dead, first check the graphics monitor. If the graphics monitor is functional, first replace the frame buffer or move it to a different SBus slot and try it there. If nothing appears on the display, replace the main logic board. See “Removing the Main Logic Board” and “Replacing the Main Logic Board” in Chapter 4.

1. **If all POST tests pass, run the SunDiagnostic Executive with the cache disabled. The SunDiagnostic 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 SPARCstation 1***.**

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

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

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/fasthalt`.**

   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*.

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

```
#  /usr/etc/fasthalt
>  n
ok help diag
     Category:  Diag (diagnostic routines)
test-net           (--)   test network interface
watch-net          (--)   show network activity
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
test-control-regs  (--)   test system control registers
probe-scsi         (--)   show attached SCSI devices
ok
```

Figure 2-2 Halting the System and Displaying On-Board Diagnostic

These on-board tests allow you to test the control registers, the network controller, the diskette drive system, memory, the cache, the system clock, and to watch the network for valid packets. See “Diagnostic Routines” in Chapter 5 of the *Open Boot PROM Toolkit User’s Guide* 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
>
```

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 2-4).

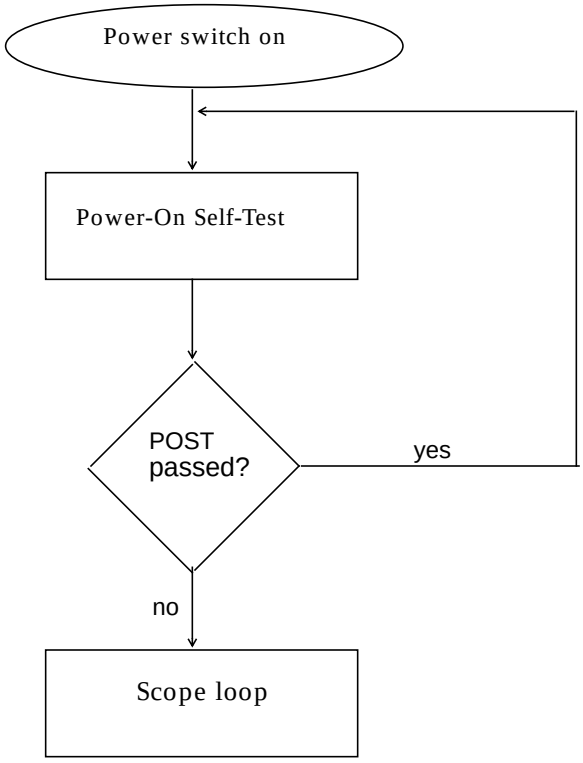


Figure 2-3 Flowchart Illustrating Manufacturing Diagnostics

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:

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

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

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

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

To run Manufacturing Diagnostics:

1. **As `root`, halt the system in an orderly manner.**
   To do this, see the previous procedure and Figure 2-5.
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 "Connecting Wyse WY-50 and VT-100 Terminals" in Chapter 5 of the** *SPARCstation 1 Installation Guide***.**
4. **Enter `reset` to reboot the system.**

Figure 2-5 summarizes the commands you need enter to run Manufacturing Diagnostics.

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

Figure 2-5 Entering Manufacturing Diagnostics

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 2-4.

To leave Manufacturing Diagnostics and boot the SunOS Operating System:

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. **Entern 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 2-6 summarizes the steps you need to take to leave Manufacturing Diagnostics and boot SunOS.

.

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 2-6 Leaving Manufacturing Diagnostics and Rebooting the System

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. If the exerciser is not pre-installed on your system in the /usr/diag/sundiag directory, it can be loaded from tape.

For information on how to use the SunDiag System Exerciser, see the *SunDiag User's Guide*.

Note – SunDiag does not come pre-installed and will not be available on from the disk unless the customer has installed it using `add_services`.

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 Diagnostic Executive to isolate the problem.

SunDiagnostic Executive

The SunDiagnostic Executive is an independent operating system. It runs exhaustive subsystem tests independent of SunOS. Run the Diagnostic Executive if all POST tests pass in order to troubleshoot what 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 manual *SunDiagnostic Executive User's Guide for the SPARCstation 1*.

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 Monitor 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.**

   Figure 2-5 summarizes the steps you need to take to halt the system and enter the Forth Toolkit.

2. **As `root`, enter `/usr/etc/fasthalt`.**

   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 to have the `ok` prompt, the Forth Toolkit 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 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.

For extensive information on tests you can run from the Forth Toolkit see Chapter 5 of the *Open Boot PROM Toolkit User's Guide.*

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

```
ok old-mode
>
```

Preparing to Work

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 remove the System Unit's Cover
- How to attach a wrist strap

Caution – FCC Class B systems (VCCI 2) should only have parts installed in them that are Class B rated. Class A systems (VCCI 1) can use any parts as long as they are functionally interchangeable.

Halting the System

Before you replace FRUs, you must halt the system in an orderly manner.

Caution – 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:

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:**
   - External module (if you have one)
   - System unit
   - Monitor

Caution – Make sure your system is shut off (the green LED should not be lit). 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.

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 the Break key instead of the L1 -A keys to obtain a boot prompt.

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

1. **Press the** L1-A **keys.**

   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.

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

2. **Turn off the power in this order:**
   - External drive unit (if you have one)
   - System unit
   - Monitor

The following example shows how to halt a hung system:

```
(Press the L1-A keys.)
> 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 should not be lit). 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 screwdriver

- Flat blade screwdriver
- Wrist strap
- SIMM extractor (240-1822)
- Chip extractor
- Container for screws
- Anti-static mat for the SIMMs and the main logic board
- Conductive foam to store chips

Disconnecting Desktop Storage Packs

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

To detach the Desktop Storage Pack (DSP) from the system unit:

1. **Press in on the finger clips on the connector connecting the DSP to the system unit and pull the connector off.**

   This action disconnects the SCSI cable from the system unit.

Disconnecting External Storage Modules

If your system unit has External Storage Modules connected to it, detach the External Storage Modules' SCSI connector from the system unit.

To detach the External Storage Module (ESM) from the system unit:

1. **Press in on the finger clips on the connector connecting the ESM to the system unit and pull the connector off.**

   This action disconnects the SCSI cable from the system unit.

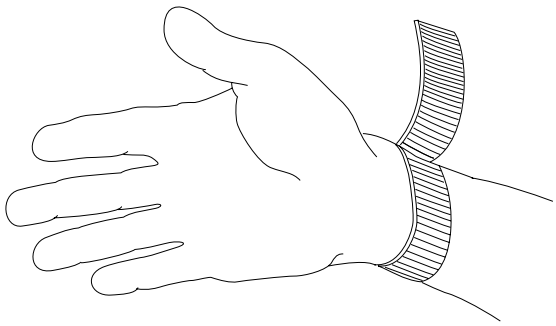
Attaching a Wrist Strap

The wrist strap (P/N 250-1007) is a device that provides grounding between your body and the system unit's chassis for static electricity. Electric current and voltage do not pass through the wrist strap. Attach the wrist strap to your wrist and to the system chassis. Parts that require the use of a wrist strap are packed with one.

Caution – Boards 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.**



2. **Attach the end with the adhesive copper strip to a non-painted area on the bottom of the chassis.**

Removing the System Unit's Cover

Figure 3-1 shows removal of the system unit's cover. Three tabs on the front of the cover fit into three slots in the chassis. These tabs secure the front of the cover to the chassis. A security loop secured to the cover goes through the bottom of the chassis.

To remove the cover 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 cover from the system unit.**

   Do the following in sequence (see Figure 3-1):

   ◦ Remove the two screws holding the cover to the back panel.

- Grasp the sides of the cover from the rear and tilt the cover until the security loop clears the chassis.
- Gently push the cover forward about 1/2 inch (13 mm) so that the plastic tabs clear the chassis.

Caution – The plastic tabs at the bottom of the cover are fragile on earlier units. Be sure the tabs clear the chassis before removing the cover.

- Remove the cover by lifting vertically.

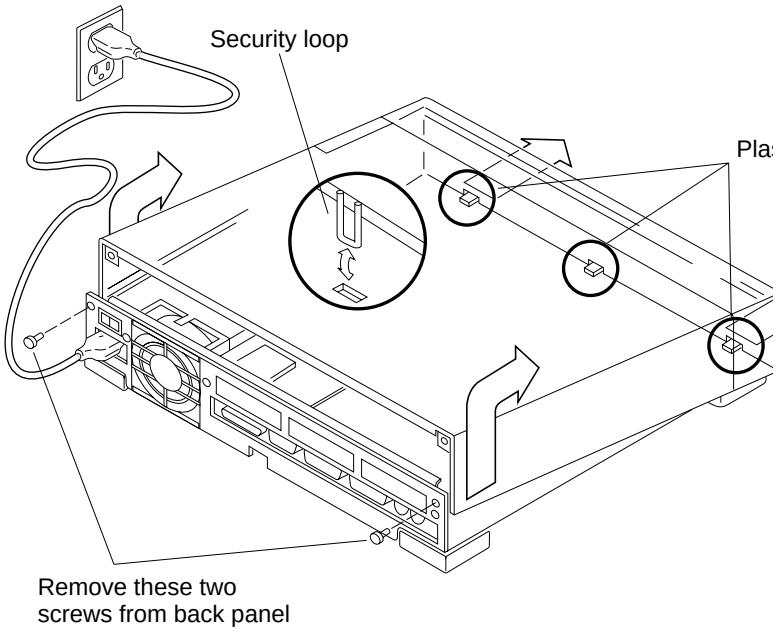


Figure 3-1 Removing the Cover Panel

Warning – Before powering up your system again, be sure to replace the top cover. See “Replacing the System Unit’s Cover” towards the end of Chapter 4. It is not safe to operate the SPARCstation 1 or SPARCstation 1+ without its top cover in place.

Figure 3-2 shows the various components of the system unit. In the left rear area of the chassis is the main logic board. The SBus boards plug into the main logic board. Sixteen additional slots on the main logic board accept the Single Inline Memory Modules (SIMMs).

The left front area of the chassis is reserved for two hard disk drives. Opposite, in the right front area of the chassis is space for a diskette drive. Mounted just behind the diskette drive is the power supply.

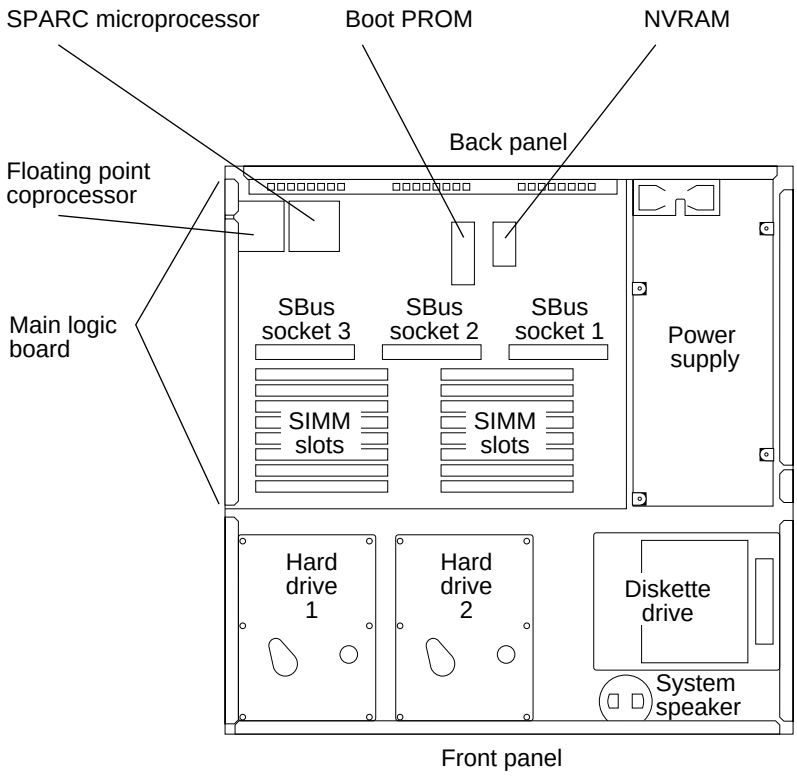


Figure 3-2 System Unit and Subassemblies

FRU Replacement

This chapter explains how to remove defective FRUs and install new ones. Part numbers for the FRUs are given with the instructions later in this chapter and in Appendix B, “Illustrated Parts Breakdown”. Part numbers for the cables are presented on the next page. 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 and speaker clip
- Video monitor
- Keyboard
- Mouse, mouse pad, and cable

In addition, the following cables are field-replaceable:

- Diskette drive data cable (Part Number 530-1452)
- Diskette drive power cable (Part Number 530-1441)
- Hard disk drive data cable (Part Number 530-1451)
- Hard disk drive power cable (Part Number 530-1453)
- Video cable (Part Number 530-1440)
- Audio Input/Output cable (Part Number 530-1594)
- AC power cable for the system unit (see Appendix B for part numbers)
- AC power cable for the video monitor (see Appendix B for part numbers)
- Keyboard cables (Part Numbers 530-1442 and 530-1443)

How to replace FRUs in the Desktop Storage Pack and the External Expansion Module are not covered in this manual. See the *Desktop Storage Pack Field Service Manual* for more information.

Caution: FCC Class B systems (VCCI 2) should only have parts installed in them that are Class B rated. Class A systems (VCCI 1) can use any parts as long as they are functionally interchangeable.

Before You Begin

Before you replace FRUs, make sure you have done the following. Chapter 3 describes these instructions.

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

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). 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 SIMM, make sure that you have the right unit. Figure 4-1 shows a top view of the system unit with the cover removed. Figure 4-2 shows the field-replaceable boards and SIMMs. Part Numbers are presented in the following list.

Color Frame Buffer Board	(P / N 501-1415
ECL Frame Buffer Board (Available in SPARCstation 1 systems only.)	(P / N 501-1419)
GX Graphics Accelerator Board	(P / N 501-1481)
Analog Monochrome Frame Buffer Board	(P / N 501-1455)
Ethernet Board	(P / N 501-1450)
Main Logic Board (SPARCstation 1)	(P / N 501-1629)
Main Logic Board (SPARCstation 1+)	(P / N 501-1632)
1 megabyte SIMM	(P / N 501-1408)
4 megabyte SIMM	(P / N 501-1682)

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 the components themselves or any metal parts. Wear a grounding strap when handling the boards.

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.

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.

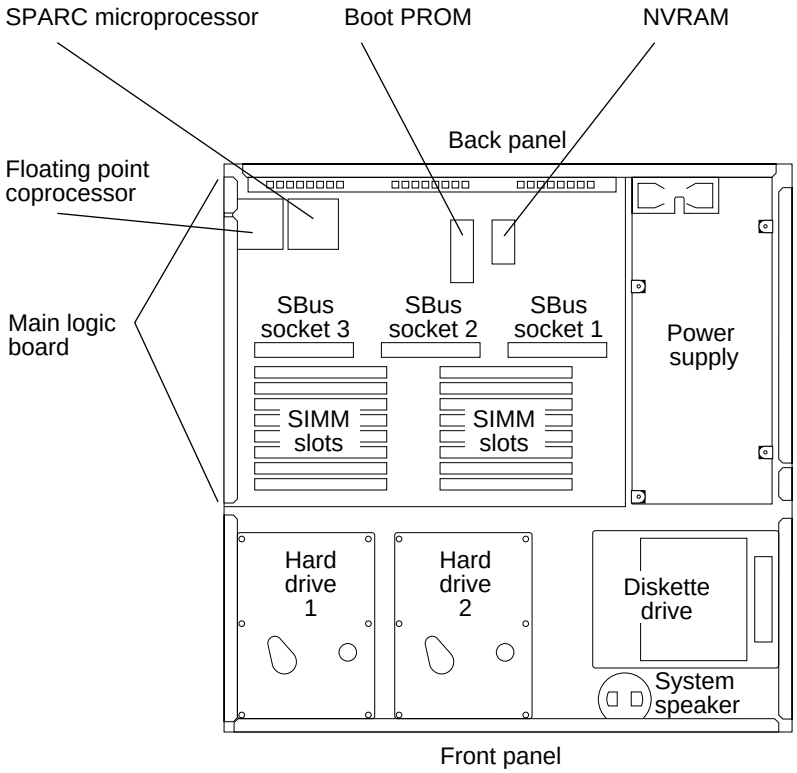
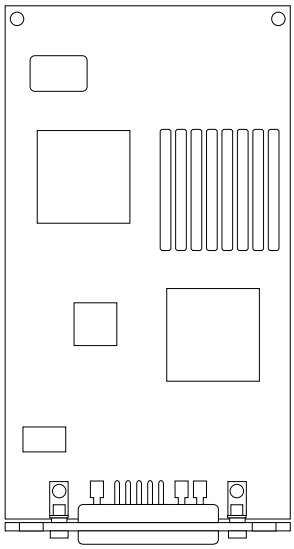
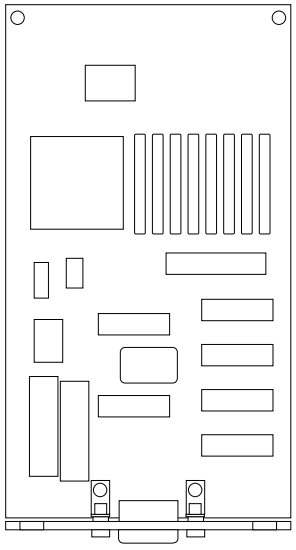


Figure 4-1 Boards and SIMMS

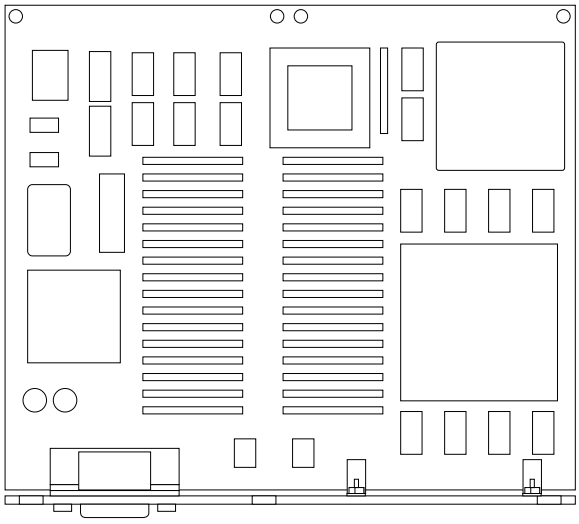
Figure 4-2 Boards and SIMMs (continued on next page)



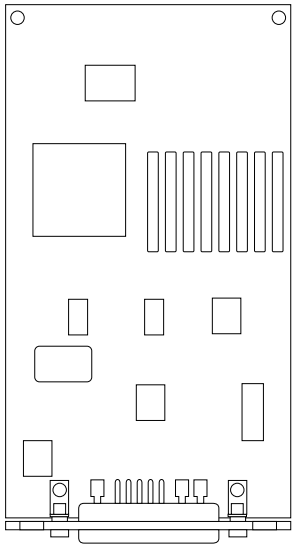
Color frame buffer board



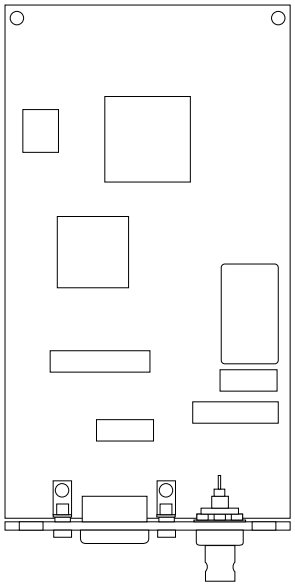
*ECL monochrome frame buffer board
(*Used in SPARCstation 1 only)



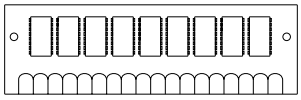
GX graphics accelerator board



Analog monochrome frame buffer board



Ethernet board



1MB SIMM

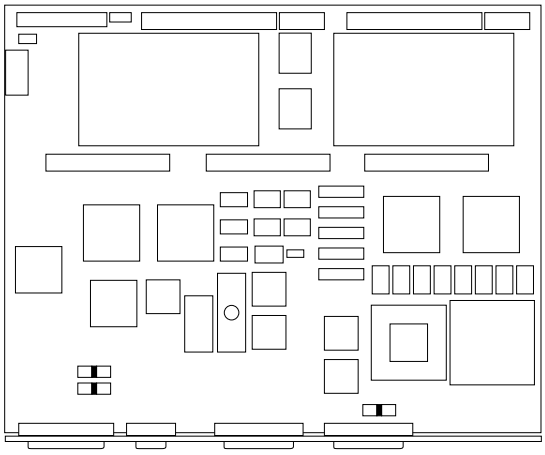


Figure 4-3 Boards and SIMMs (continued)

Single Inline Memory Modules (SIMMs)

The system comes equipped with 4, 8, 12, or 16 megabytes of Random Access Memory (RAM; 8 megabytes is standard.) Physically, RAM chips are grouped together in Single Inline Memory Modules (SIMMs). Each 1 megabyte SIMM (Part Number 501-1408) plugs into one of the 16 SIMM slots located on the system unit's main logic board. Additional SIMMs may be added to the system unit as needed, up to a maximum of 16 SIMMs.

Memory must be added in 4 SIMM increments. You can add memory using either all 4 megabyte SIMMs or all 1 megabyte SIMMs. You cannot mix 4 megabyte SIMMs and 1 megabyte SIMMs within a group of 4 slots.

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.

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.

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.

Determining Faulty SIMM Locations

The SunOS, Sundiag System Exerciser, SunDiagnostic Executive, and POST diagnostics can report memory errors encountered during program execution. Memory error messages are usually displayed to the system monitor with a physical memory address of the memory error.

Depending on the diagnostic program you are running, or the SunOS release loaded, a SIMM or location number ("U" number) may be displayed. If the location number is present in the error message, remove the defective SIMM at that location and install 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 Figure 4-3 to locate the SIMM group where the defective SIMM is installed. For example, if an error is detected at physical memory address 12fe958, the defective SIMM is in slot group 3. If the failing byte at that address is also known, figure 4-4 indicates the location ("U" number) of the failing SIMM (see figure 4-4 for SIMM location numbers). The SIMM can then be removed and replaced with a new one.

SIMM slot group	Physical memory address ranges		SIMM location	
	with 1MB SIMMs	with 4MB SIMMs	Byte	SIMM #
1	000000 through 3fffff	000000 through ffffff	3 2 1 0	U0585 U0586 U0587 U0588
2	2000000 through 23fffff	2000000 through 2ffffff	3 2 1 0	U0677 U0683 U0676 U0678
3	1000000 through 13fffff	1000000 through 2ffffff	3 2 1 0	U0589 U0590 U0591 U0584
4	3000000 through 33fffff	3000000 through 3ffffff	3 2 1 0	U0679 U0680 U0681 U0682

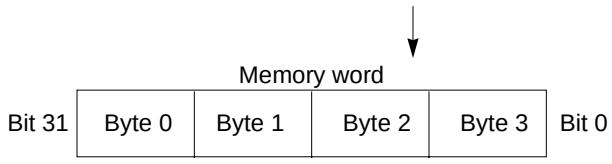
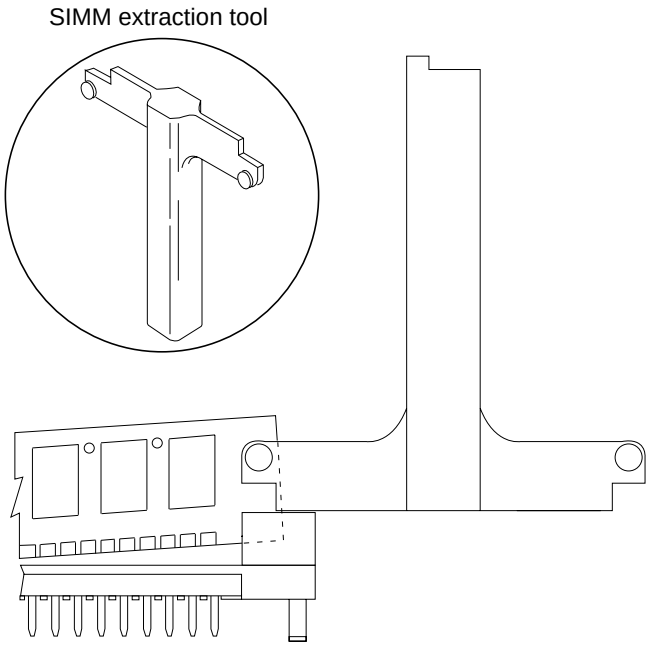


Figure 4-4 Determining Faulty SIMMs Locations

To remove a 1 megabyte SIMM, follow these steps:

1. **See and follow Chapter 3 instructions on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Insert the crossbar section of the SIMM extraction tool (Part Number 240-1822) into the hole at one end of the SIMM. The logo should face the module and the round embossment should fit into the hole. Rotate the tool away from the socket. Repeat the procedure on the opposite end.**



To install a 1 or 4 megabyte SIMM, follow these steps:

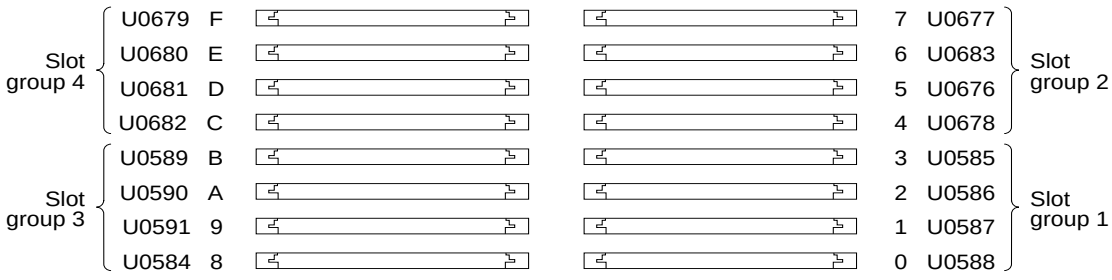
You must install additional SIMMs in unoccupied slots so that the slots are filled by groups: 0–3 (slot group 1), 4–7 (slot group 2), 8–B (slot group 3), and C–F (slot group 4). See Figure 4-4. The order in which the groups are filled does not matter, but slot group 1 (0-3) must always be filled. Failure to fill these slots will prevent the system from operating.

For example, suppose slot groups 1 and 2 are already filled. Slot groups 3 and 4 do not have SIMMs installed. You want to add four SIMMs. You may install the additional SIMMs either in slot group 3 or in slot group 4.

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 anti-static 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 Chapter 3 instructions on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. SIMM Slots **Place an anti-static mat (P/N 330-1145), shiny side down, next to the system unit.**

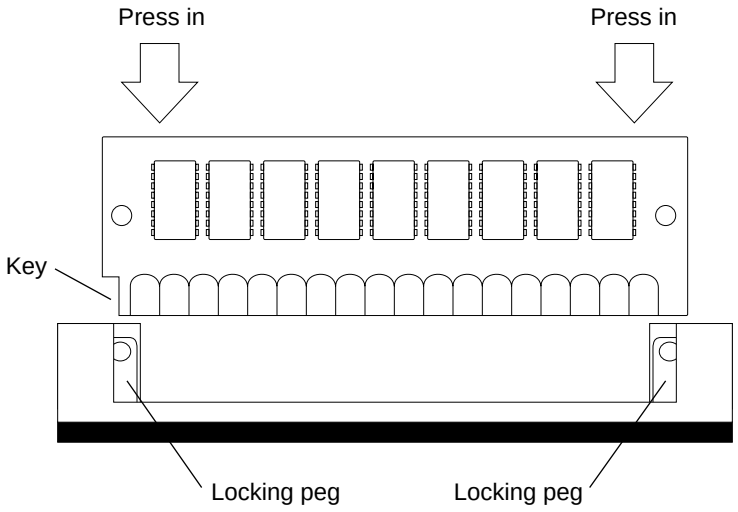
5. **Make sure the wrist strap is securely attached to your wrist and the bottom of the system unit chassis.**

   See Chapter 3 for instructions describing how to attach a wrist strap.

6. **Open the anti-static envelope and take out the SIMMs.**

7. **Place the SIMMs on the anti-static mat.**

8. **Holding a SIMM at its edges, insert it into the plastic guides. The SIMM should rest loosely in the slot.**



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

10. **Replace the system unit's top cover. See "Replacing the System Unit's Cover" 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 Boards

The system can be equipped with a variety of optional printed circuit boards. The following list shows some of the SBus boards that plug into the SBus slots on the system's main logic board. Figure 4-5 shows which slots to use.

- GX Graphics Accelerator Board (P / N 501-1481)

  This board controls the video output from the system unit, and accelerates the generation of graphic images. The GX Graphics Accelerator board occupies two SBus slots on the main logic board.
- Color Frame Buffer Board (P / N 501-1415)

  This card controls the video output from the system unit to a color monitor.
- Analog Monochrome Frame Buffer Board (P / N 501-1455)

  This board controls the video output from the system unit to a 17-inch monochrome monitor.
- ECL Monochrome Frame Buffer Board (P / N 501-1419) (Used in SPARCstation 1 systems only)

  This board controls the video output from the system unit to standard (1152 x 900 pixels) and high-resolution (1600 x 1280 pixels) 19-inch (483 mm) monochrome monitors.
- Ethernet Board (P / N 501-1450)

  This board provides you with an extra Ethernet port. The Ethernet board is used in applications in which your SPARCstation 1 or SPARCstation 1+ acts as a gateway between two physically distinct Ethernet networks.

  This card has two connectors to either standard (thick) Ethernet and thin Ethernet.

Since you must install or replace each SBus board in the correct slot, use Figure 4-1 to learn where the slots are located and how they are numbered.

Figure 4-5 shows which boards plug into which slots.

Table 4-1 Table for Plugging Boards into SBus Slots

Board	Install in SBus Slots (s)
GX Graphics Accelerator	3+2 or 2+1
Color Monochrome Frame Buffer	3, 2, or 1
Analog Monochrome Frame Buffer	3, 2, or 1
ECL Frame Buffer (SPARCstation 1 only)	3, 2, or 1
Ethernet	2 or 1

Note: The GX Graphics Accelerator board and frame buffer should be plugged into slot 3 whenever slot 3 is available. If slot 3 is being used, you can plug the GX Graphics Accelerator board into slots 2 and 1, and any of the frame buffer boards into either slots 2 or 1.

To remove an SBus board in the system unit:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Locate the SBus board you want to remove.**
4. **See Figure 4-5 for a list of SBus boards and what slots they may be installed in. Figure 4-1 illustrates the SBus slots.**
5. **Remove the external connectors attached to the SBus boards.**
6. **Grab the handle of the SBus board. Pull up on the SBus board where it is plugged into the SBus slot. On early units without an SBus handle, position your thumb and forefinger on the front corners of the SBus board. Pull up on the SBus board where it is plugged into the SBus slot.**

   This action releases the SBus board from the SBus slot.

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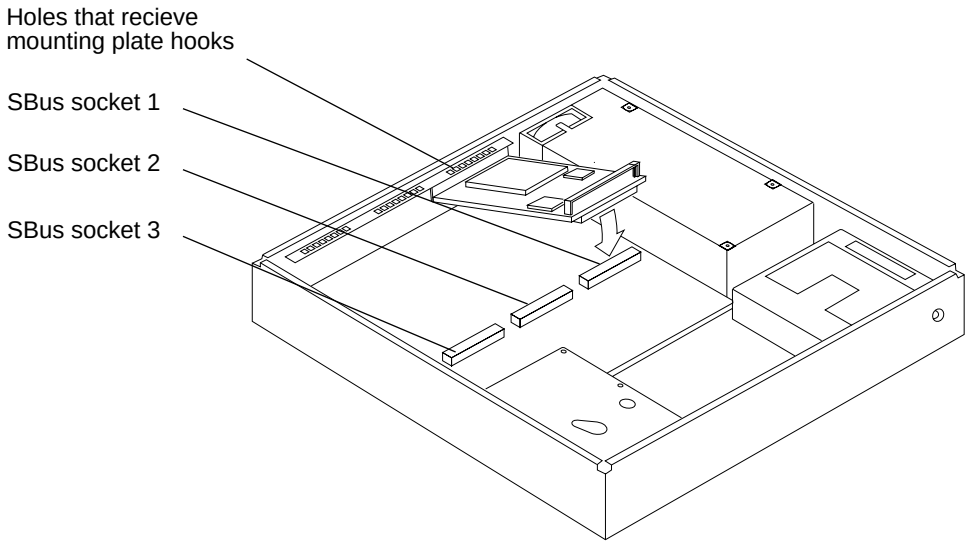
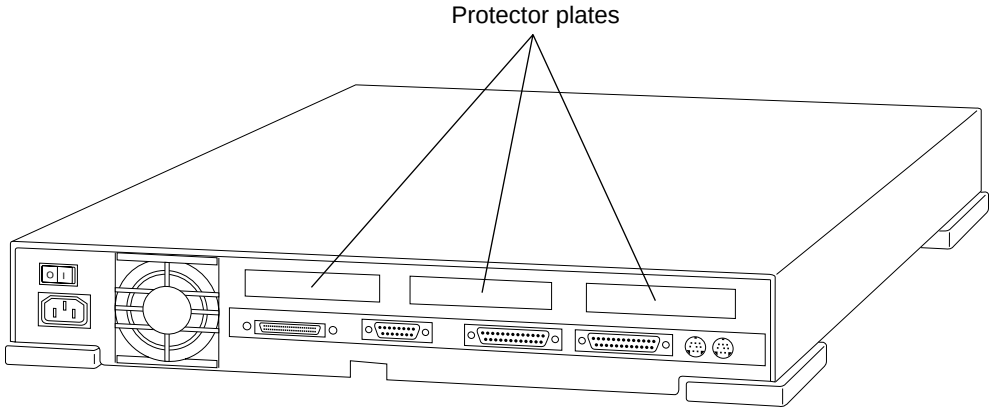


To install an SBus board in the system unit:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Remove the sheetmetal filler panels(s) for the desired slot(s) from the inner surface of the back panel of the system unit. If you are replacing an SBus board, it will not be necessary to remove the filler panel unless you are installing it into a different slot.**

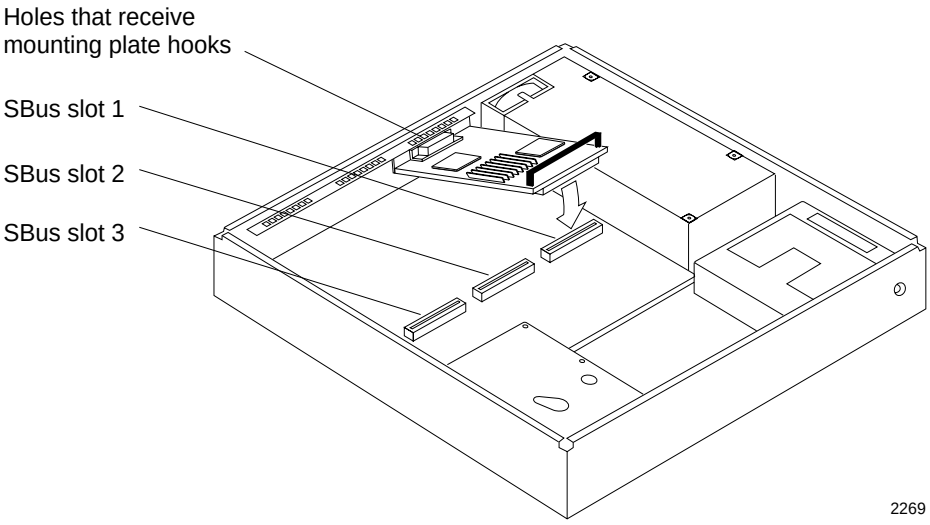


4. Slide the SBus board at an angle into the back panel of the system unit (see the following figure).

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

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

1. Push the SBus board against the back panel. Align the plug with the socket of the SBus slot and gently press the plug into the socket.



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

Replace the system unit's top cover. To do this, see "Replacing the System Unit's Cover" near the end of this chapter.

2. **Replace the external cables to the SBus boards.**

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

Power Supply

The power supply (Part Number 300-1038) is a self-contained metal assembly located just behind the diskette drive (see Figure 4-1). The recess in the bottom of the chassis is for the fan that is built into the power supply.

The power supply is held in place by two guides in the bottom of the chassis, two tabs that mate with two slots in the bottom of the power supply, and a Philips head screw. The Phillips head screw is inserted through the rear bezel of the system unit.

A 12-pin power cable connects the power supply to the main logic board just behind the power cable connector for the diskette drive.

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.

To remove the power supply follow these steps:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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.**
3. **Disconnect the power cord from the system unit and from the wall outlet.**
4. **Remove the Phillips head screw from the back panel (see Figure 4-6).**
5. **Disconnect the cable from the white 12-pin connector on the main logic board.**
6. **Grasp the power supply. Slide it forward toward the front of the chassis and lift it out of the chassis.**

To install a new power supply follow these steps:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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.**
3. **Align the power supply correctly as shown in Figure 4-6 with the tabs and guides in the bottom of the chassis.**
4. **Properly position the power supply by pushing it firmly toward the rear of the chassis until it locks into the tabs.**
5. **Connect the 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 (see Figure 4-6).**
6. **Secure the power supply to the chassis by installing the screw through the rear panel of the chassis (see Figure 4-6).**
7. **Replace the system unit's top cover. See "Replacing the System Unit's Cover" near the end of this chapter.**
8. **Connect the system power cord to the back of the unit and to the AC power outlet.**
9. **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.**
10. **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.

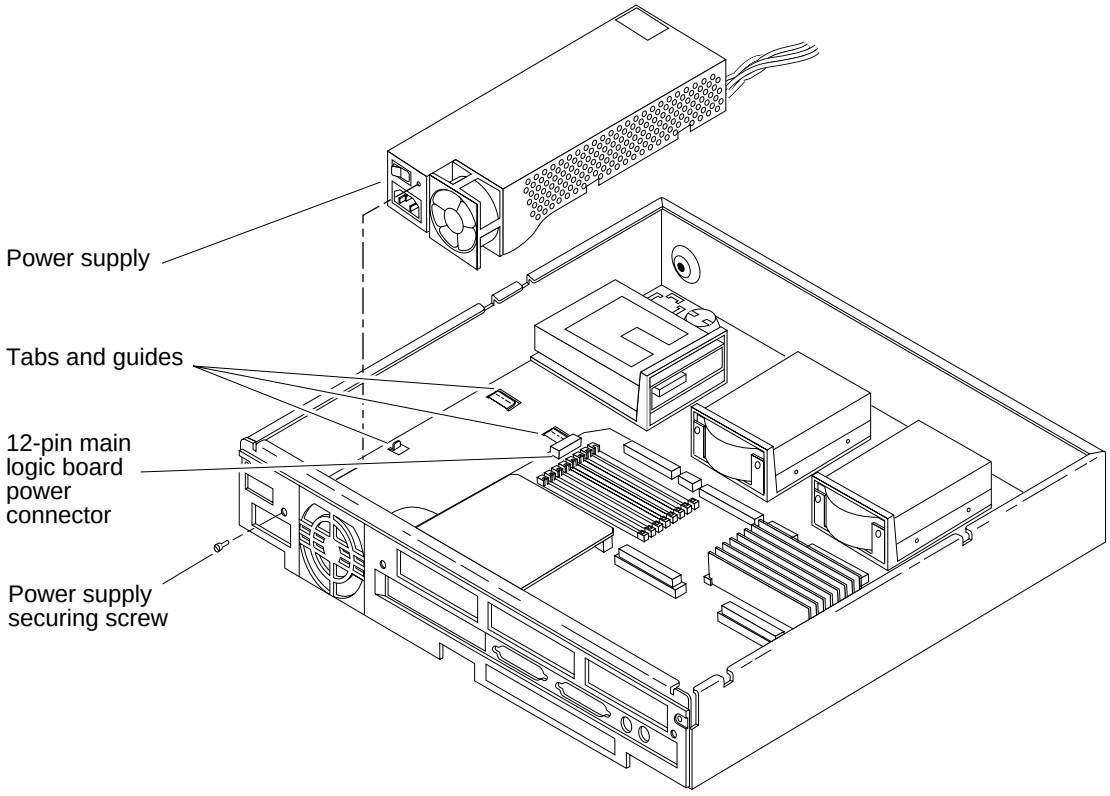


Figure 4-5 Removing and Replacing the Power Supply

Hard Disk Drive

Two 3 1/2-inch half-height hard disk drives (Part Number 370-1200) can be installed in the system chassis. A 50-pin SCSI data cable and a 4-pin power cable connect to the rear of each drive. Each drive and its plastic mounting bracket are secured to the chassis by four mounting tabs and two locking tabs

that fit into slots in the bottom of the chassis. Early hard disk drives have metal brackets. The hard disk drives with metal brackets are secured to the chassis by two tabs and a mounting screw.

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.

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.

To remove a hard disk drive:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Disconnect the hard disk drive power and data cables from the main logic board.**

   Go to the next step if the bracket is plastic. Go to step 6 if the bracket is metal.

4. **Grasp the hard disk drive mounting bracket handle (see Figure 4-10). Pull it up slightly to release the locking tabs on the bottom of the mounting bracket.**

5. **Slide the hard disk drive toward the rear of the chassis. Lift the hard disk drive out of the chassis.**

   This completes the hard disk drive removal process for disk drives with the plastic bracket.

6. **Remove the data cable from the hard disk drive. Next, remove the chassis-mounting screw from the mounting bracket at the rear of the drive with a screwdriver (see Figure 4-11).**

7. **Grasp the hard disk drive (see Figure 4-11). Pull it up slightly to release the tabs on the bottom of the mounting bracket.**

8. **Slide the hard disk drive toward the rear of the chassis. Lift the hard disk drive out of the chassis.**

9. **Replace the data cable to the hard disk drive.**

   The data cable can be connected in any orientation. The connector is not keyed.

Before replacing a hard disk drive, you must verify that the SCSI drive address ID is installed correctly (see Figures 4-7, 4-8 and 4-9).

The SCSI device ID of drive 1 must be 3. The SCSI device ID of drive 2 must be 1 (see Figure 4-9). The factory setting for all hard drives is SCSI device ID 3 (A0 and A1 jumpered).

Drive Number	SCSI Device ID	Jumper In
1	3	A0 and A1
2	1	A0

Figure 4-6 Table of Hard Disk ID Jumper Settings

To prepare a hard disk drive with a *metal bracket* for replacement:

1. **Remove the mounting bracket from the drive so that you can reach the entire area of the drive controller board and access the jumpers. Remove four screws (two on either side) from the metal bracket and slide the bracket off the drive (see Figure 4-11 for the location of the screws). You now have access to the drive controller board. Go on to the next step of you are replacing drive 2. Go to step 3 if you are replacing drive 1.**
2. **Remove the jumber from A1 (see Figures 4-7 and 4-8) if it is present on the replacement drive. This action changes the SCSI Device ID of drive 2 from 3 to 1.**
3. **Inspect the SCSI Address Jumpers on the replacement drive to be sure that A0 and A1 are present. Install the mounting bracket on the new drive. Fasten the bracket to the drive by inserting and tightening the four screws through the sides of the bracket into the sides of the drive.**

To prepare a hard disk drive with a *plastic bracket* for replacement:

1. **Remove the mounting bracket from the drive so that you can reach the entire area of the drive controller board and access the jumpers. Turn the drive over and remove the four screws securing the plastic bracket to the bottom of the drive. You now have access to the drive controller board. Go to the next step if you are replacing drive 2. Go to step 3 if you are replacing drive 1.**
2. **Remove the jumper from A1 (see Figures 4-8 and 4-9) if it is present on the replacement drive. This action changes the SCSI Device ID of drive 2 from 3 to 1.**
3. **Inspect the SCSI Address Jumpers on the replacement drive to be sure that A0 and A1 are present. Install the mounting bracket on the new drive. Fasten the bracket to the bottom of the hard drive by inserting and tightening the four screws through the bracket.**

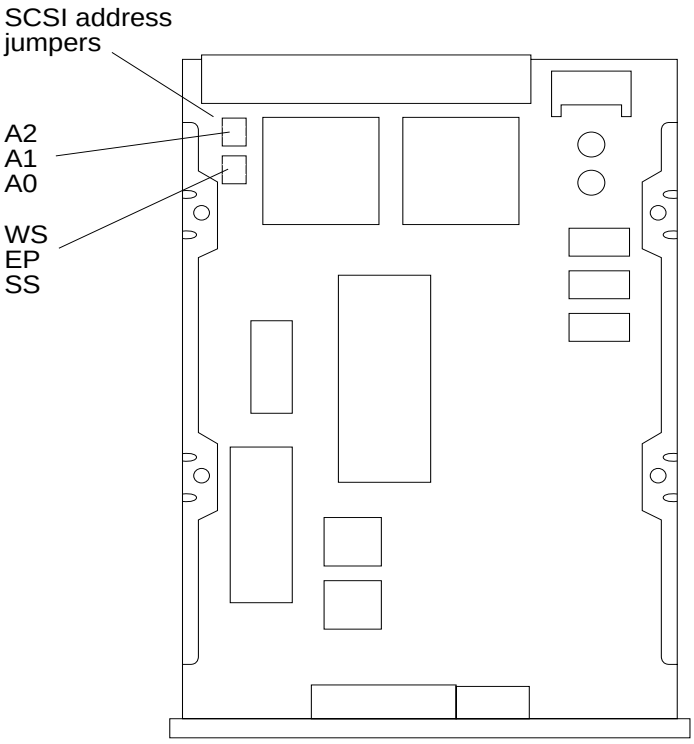


Figure 4-7 Hard Disk Drive Controller Board With the Bracket Removed

Note: If the drive is 200 megabytes, the order of the jumpers from the top down will be:
A0
A1
A2

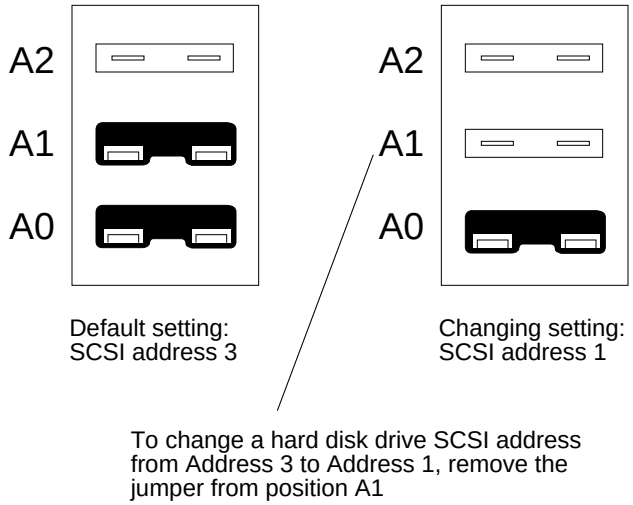


Figure 4-8 Changing a SCSI Address Jumper

To replace a hard disk drive:

1. **Make sure you have followed the previous procedure on preparing the hard disk drive for replacement.**

2. **Connect the data and power cables to the drive.**

   The power connector is keyed so it will fit only one way. The data cable can be connected in any orientation. The connector is not keyed.

   Go to the next step if the hard disk drive bracket is plastic. Go to step 4 if the hard disk drive bracket is metal.

3. **Lower the drive into the chassis and align the four mounting tabs on the bottom of the drive mounting bracket with the slots in the bottom of the chassis (see Figure 4-10). The drive unit's data and power sockets should be facing the rear of the chassis. Slide the drive forward toward the front of the chassis until the two rear locking tabs click into their slots.**

   Go to step 6.

4. **Lower the drive into the chassis and make sure the tabs seat into the chassis slots (see Figure 4-11). The drive unit's data and power sockets should be facing the rear of the chassis. Slide the hard disk drive and mounting bracket toward the front of the chassis.**

5. **Remove the data cable from the hard disk drive. Insert the chassis-mounting screw into the mounting bracket at the rear of the drive. Tighten the screw with a screwdriver so that the drive and bracket are securely fastened to the chassis. Reconnect the data cable to the hard disk drive.**

   The data cable can be connected in any orientation. The connector is not keyed.

6. **Connect the data and power cables to the main logic board (see Figure 4-12).**

   The data cable plugs into the data connector on the main logic board. The data cable will fit in any orientation. The connector is not keyed.

   The power cable plugs into the power connector on the main logic board. The power connector is keyed so that it will fit only one way.

7. **Replace the system unit's top cover. See "Replacing the System Unit's Cover" near the end of this chapter.**

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

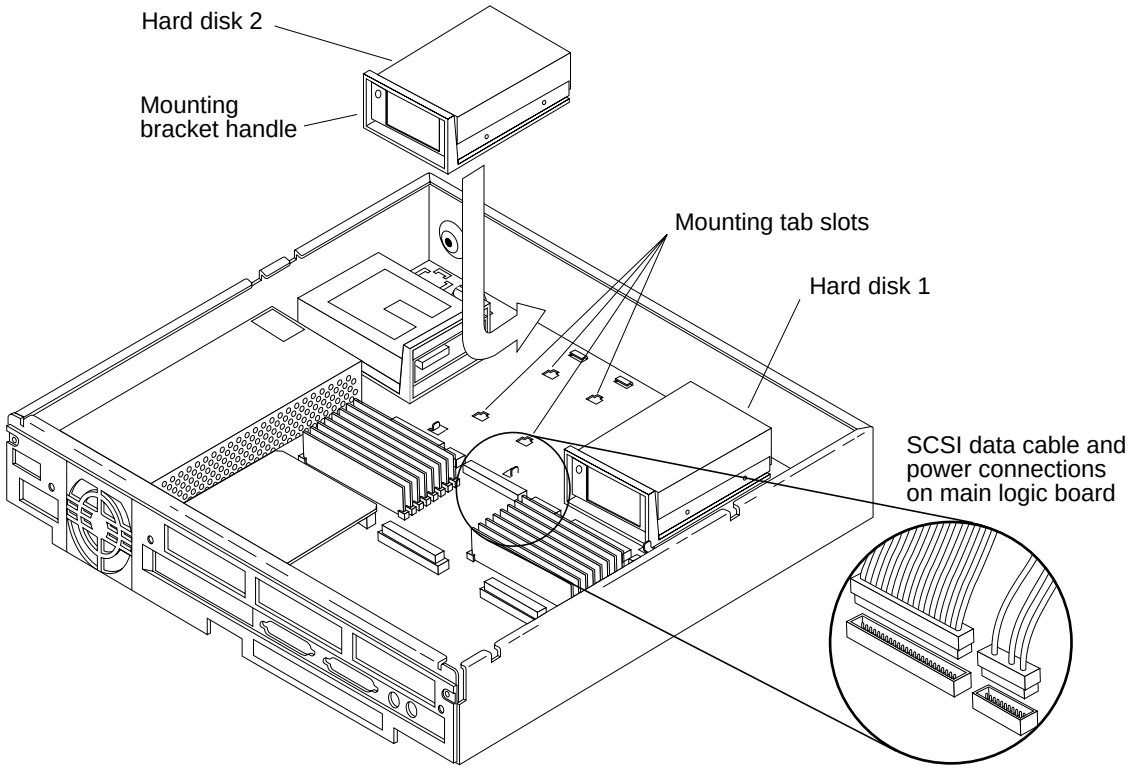


Figure 4-9 Removing and Replacing the Hard Disk Drive With the Plastic Bracket

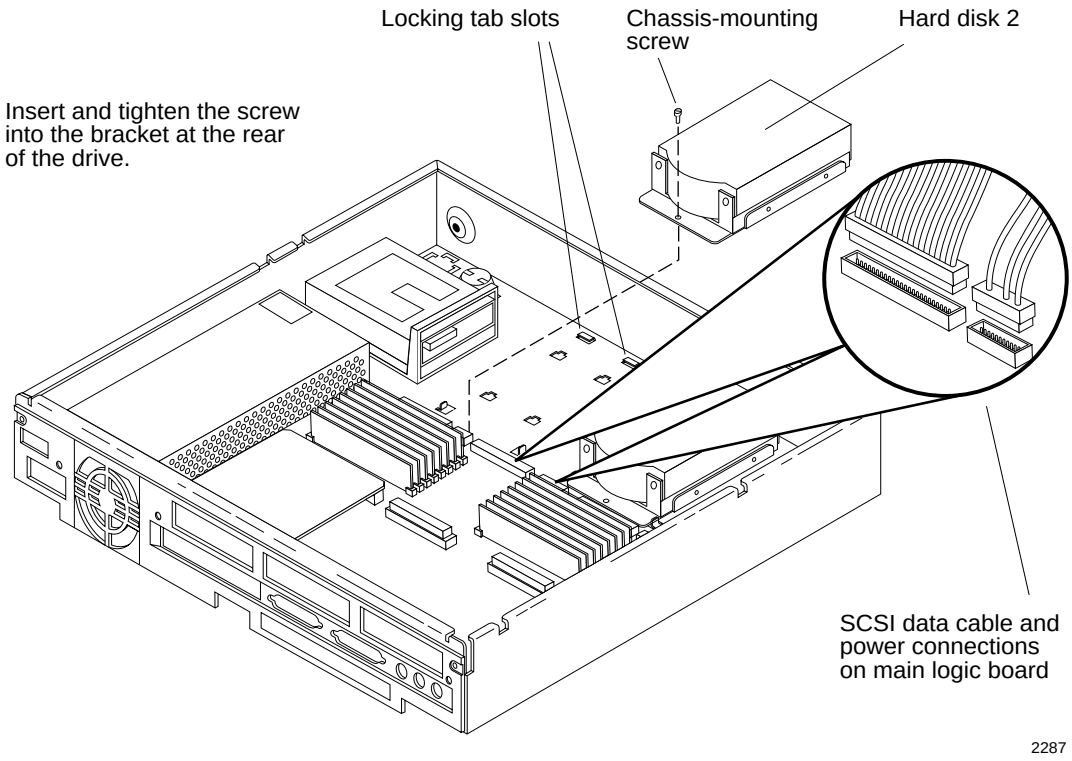


Figure 4-10 Removing and Replacing the Hard Disk Drive With the Metal Bracket

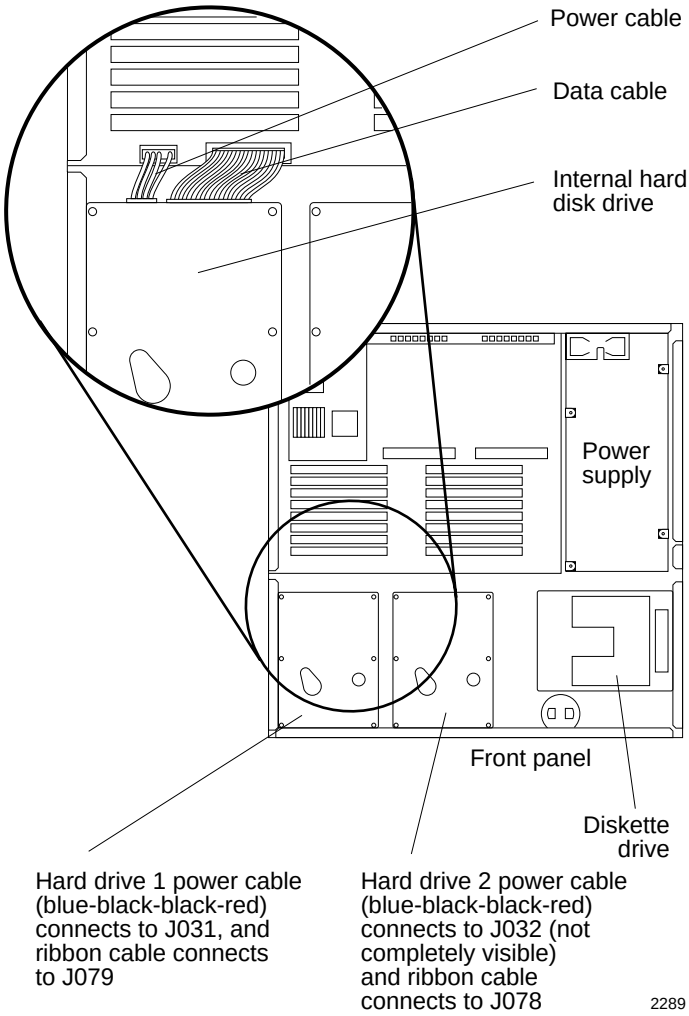


Figure 4-11 Connecting Power and Data Cables to the Hard Disk Drive

Diskette Drive

The diskette drive (Part Number 370-1207) is located at the front right side of the chassis next to the hard disk drives (see Figures 4-1 and 4-12). A 34-pin data cable and a 4-pin power cable connect to the rear of the drive. The drive

and its plastic mounting bracket are secured to the chassis by four mounting tabs and two locking tabs that fit into slots in the bottom of the chassis. Early diskette drives have a metal bracket. The diskette drive with a metal bracket is secured to the chassis by two tabs and a mounting screw.

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 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.

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.

To remove the diskette drive:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
2. **Disconnect the diskette drive's power and data cables from the main logic board.**

   Go to the next step if the bracket is plastic. Go to step 6 if the bracket is metal.
3. **Grasp the diskette drive mounting bracket handle (see Figure 4-13). Pull it up slightly to release the locking tabs on the bottom of the mounting bracket.**
4. **Slide the diskette drive toward the center of the chassis. Lift the diskette drive out of the chassis.**

   This completes the diskette drive removal process.

5. **Remove the data cable from the diskette drive. Next, remove the chassis-mounting screw from the mounting bracket at the rear of the drive with a screwdriver.**

6. **Grasp the diskette drive (see Figure 4-14). Pull it up slightly to release the tabs on the bottom of the mounting bracket.**

7. **Slide the diskette drive toward the center of the chassis. Lift the diskette drive out of the chassis.**

8. **Replace the data cable to the diskette drive.**

   The data cable can be connected in any orientation. The connector is not keyed.

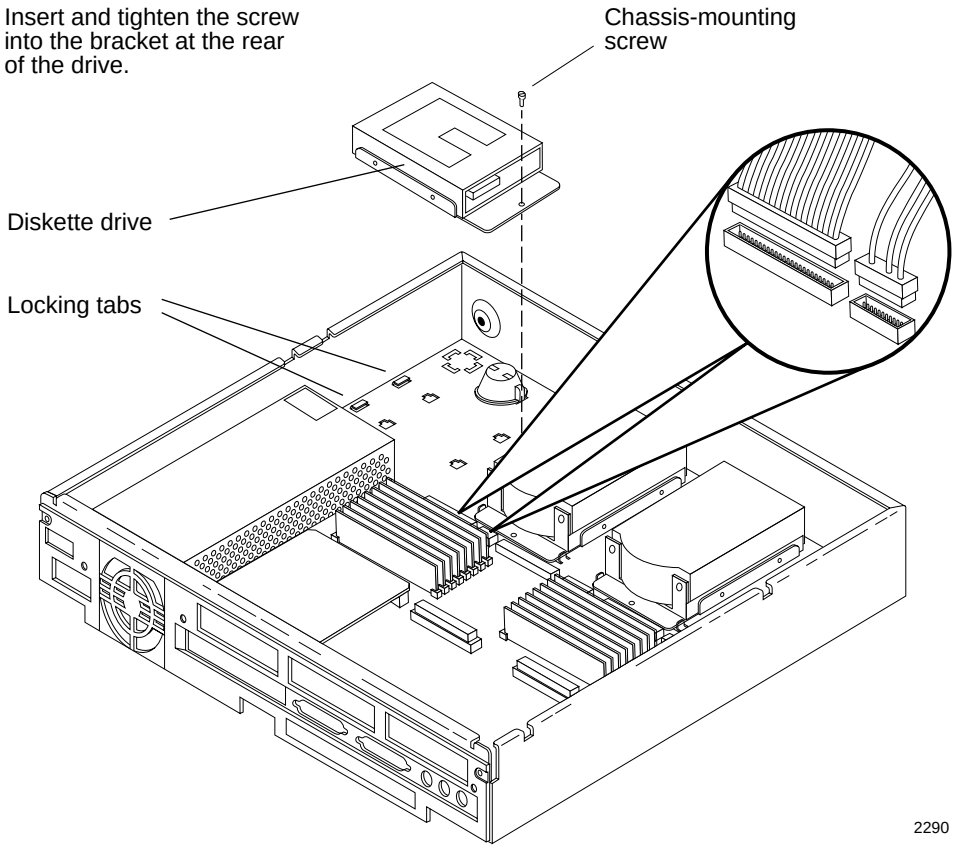


Figure 4-12 Removing and Replacing the Diskette Drive With the Plastic Bracket

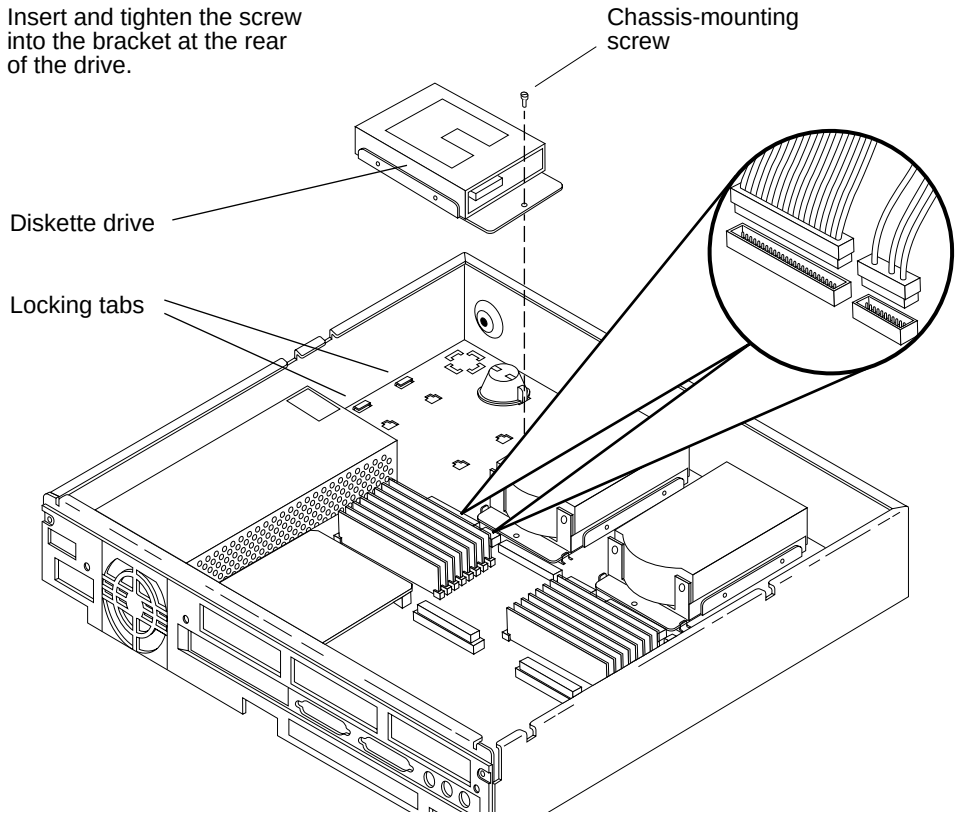


Figure 4-13 Removing and Replacing the Diskette Drive With a Metal Bracket

To prepare a diskette drive with a *metal bracket* for replacement:

1. **Remove the mounting bracket from the drive. Remove four screws (two on each side) from the metal bracket and slide the bracket off the drive (see Figure 4-14 for the location of the screws).**
2. **Install the mounting bracket on the replacement drive. Fasten the bracket to the drive by inserting and tightening the four screws through the sides of the bracket into the sides of the drive.**

To prepare a diskette drive with a *plastic bracket* for replacement:

1. **Remove the mounting bracket from the drive. Turn the drive over and remove the four screws securing the plastic bracket to the bottom of the drive.**
2. **Install the mounting bracket on the replacement drive. Fasten the bracket to the bottom of the hard drive by inserting and tightening the four screws through the bracket.**

To replace the diskette drive:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Connect the data and power cables to the drive.**

   The power connector is keyed so it will fit only one way. The data cable can be connected in any orientation. The connector is not keyed.

   Go to the next step if the diskette drive bracket is plastic. Go to step 6 if the diskette drive bracket is metal.

4. **Align the four mounting tabs on the bottom of the drive mounting bracket with the slots in the bottom of the chassis (see Figure 4-13).**
5. **Slide the drive forward towards the outside of the chassis until the two locking tabs click into their slots.**

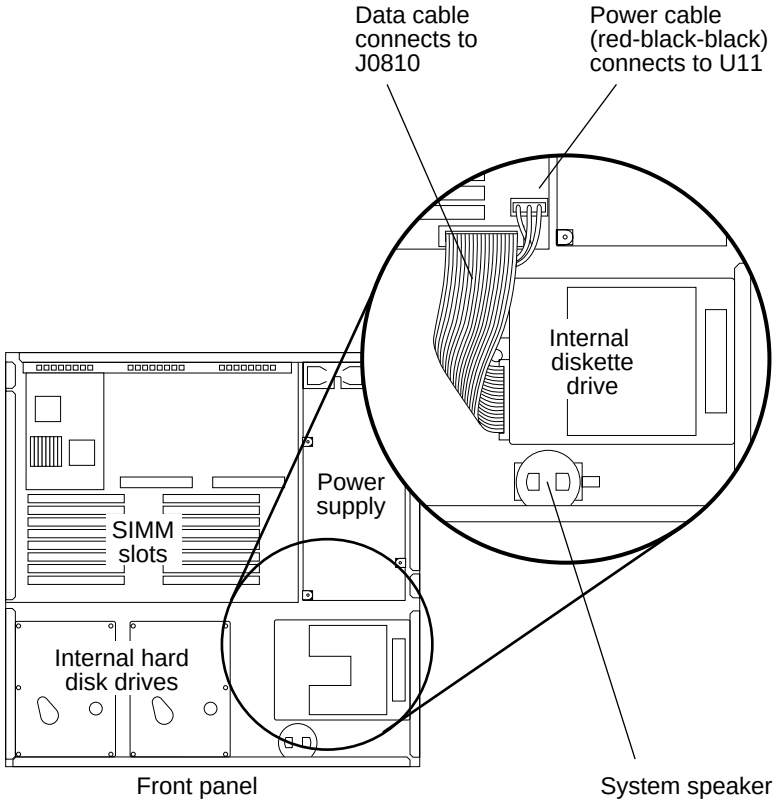
   Go to step 9.

6. **Slide the diskette drive and mounting bracket toward the side of the chassis.**
7. **Make sure the tabs seat into the chassis slots (see Figure 4-14).**
8. **Remove the data cable from the diskette drive. Insert the chassis-mounting screw into the mounting bracket at the rear of the drive. Tighten the screw with a screwdriver so that the drive and bracket are securely fastened to the chassis. Reconnect the data cable to the diskette drive.**
9. **Connect the data and power cables to the main logic board (see Figure 4-15).**

   The data cable plugs into the data connector on the main logic board. The data cable will fit in any orientation. The connector is not keyed.

   The power cable plugs into the power connector on the main logic board. The power connector is keyed so that it will fit only one way.
10. **Replace the system unit's top cover. See "Replacing the System Unit's Cover" near the end of in this chapter.**
11. **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.**

Figure 4-14 Connecting Power and Data Cables to the Diskette Drive



Main Logic Board

The main logic board contains the CPU, the floating point coprocessor, the boot PROM, the NVRAM, SIMMs, SBus boards, two RS232 ports, an Ethernet port, a SCSI port, and connectors for audio in/out, and keyboard/mouse as well as many other ICs and 3 fuses (see Figure 4-16). See Chapter 1 for an overview of the main logic board. Part Numbers for the main logic boards are presented in the following list:

- SPARCstation 1 main logic board(P/N 501-1382)
- SPARCstation 1+ main logic board(P/N 501-1632)

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

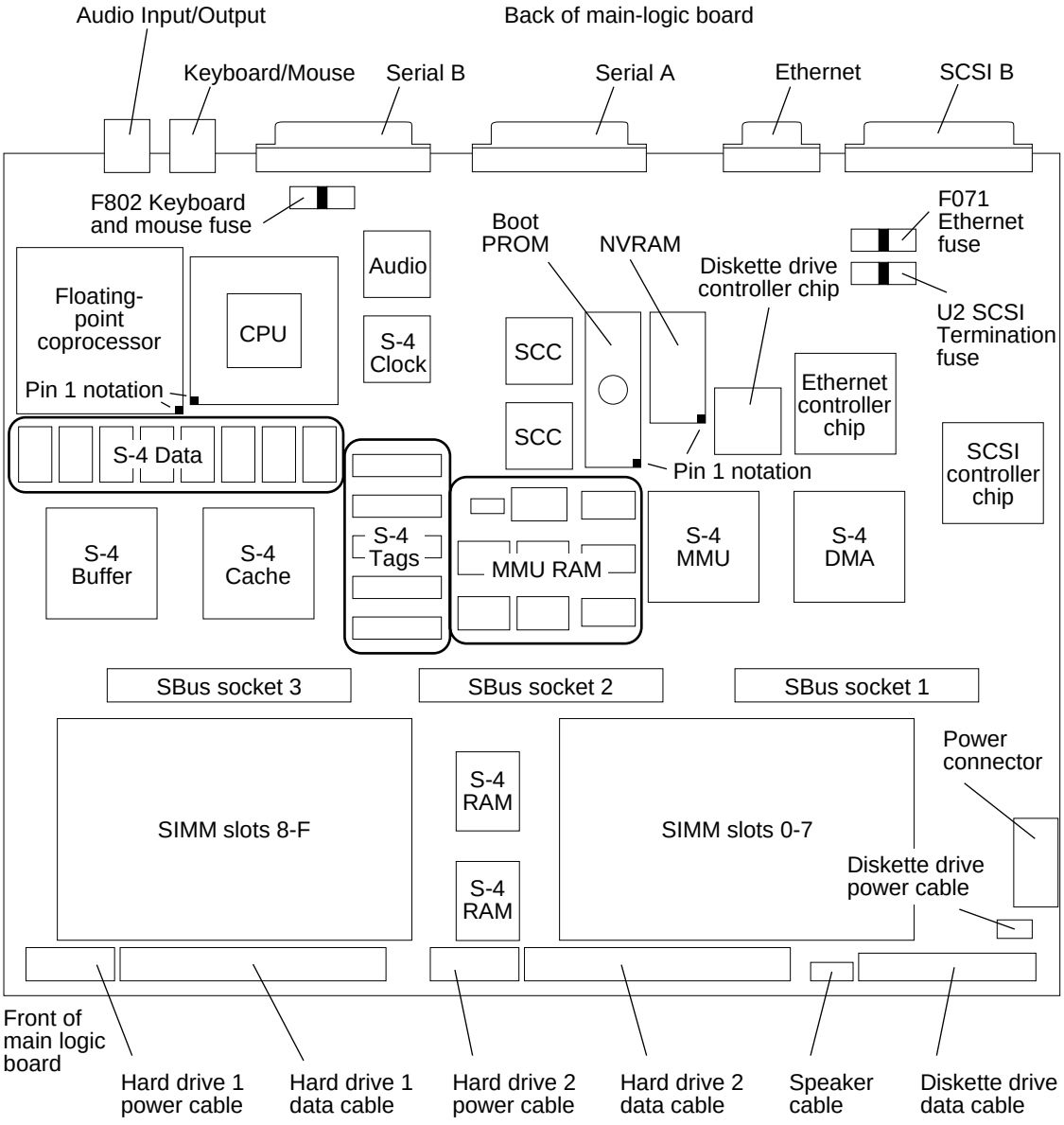
Main Logic Board Jumper

There are no jumpers to set on the main logic board. The one jumper on the main logic board, which is a test jumper, is not user-configurable.

Main Logic Board Voltage Test Points

There are no voltage test points on the main logic board. If you need to measure voltages, use the +5/GND pins on the boot PROM and the NVRAM chip. The safest place to measure voltages is at the power connector on the main logic board. The limits for the voltages are +4.75V-5.25V.

Figure 4-15 Main Logic Board Layout



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.

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.

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. The part number for each of the 2 ampere fuses is 150-1174.

The keyboard and mouse fuse (F802), located near the serial port B 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 speaker does not beep.
- The LED on the front panel is not lit.
- The LED on the bottom of the mouse is not lit.

The Ethernet fuse (F071), located near the external SCSI connector, protects the Ethernet transceiver from overvoltages. If you plug in the Ethernet card into the main logic board and the Ethernet transceiver LED does not light, the Ethernet fuse may need to be changed. 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 (U2), 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.

To check the fuses, follow these steps:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Remove the SBus boards from SBus slots 1 and 3. Figure 4-1 illustrates the location of the SBus slots. See "SBus Boards" 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 4-15 illustrates the fuse locations on the main logic board.**
5. **If the fuse is bad, remove the fuse from the board with a small flat-blade screwdriver. These fuses are not soldered in.**
6. **Insert a new fuse using a small flat-blade screwdriver.**
7. **Replace the SBus boards. See "SBus Boards" earlier in this chapter.**
8. **Replace the system unit's top cover. See "Replacing the System Unit's Cover" 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 how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Attach a terminal to the system unit. For complete details, see "Connecting Wyse WY-50 and VT-100 Terminals" in Chapter 5 of the** *SPARCstation 1 Installation Guide* **and** *SPARCstation 1+ Installation Guide***.**

   This will enable 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 boards from the system. To do this see "SBus Boards" in this chapter.**

6. **Unplug the hard disk drives and the diskette drive from their data and power cables. See Figures 4-12 and 4-15 in this chapter for the location of the data and power cables.**

7. **Make sure all SIMMs are correctly seated (see Figure 4-1 for the location of the SIMM slots), all cables attached, and all chips on the main logic board correctly seated in their sockets.**

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

Caution: Measuring voltages without connecting the DC cable to the main logic board will result in inaccurate readings. Without load, the power supply will not regulate.

The wire colors before serial number 04000 (the last five digits on bar code on the power supply) are the following:

Red	+5V
Yellow	+12V
Blue	-12V
Brown	Por
Black	Return

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

The wire colors after serial number 04000 (the last five digits on the bar code on the power supply) are the following:

Red	+5V
Blue	+12V
Brown	-12V
Gray	Por
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.

9. **Replace the system unit's cover. To do this see "Replacing the System Unit's Cover" towards the end of this chapter.**

10. **Turn on the system and the terminal. The system will start to boot. To interrupt the boot sequence, press the Break key 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* (Part Number 800-4251-10.)

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

11. **At the > prompt, enter n.**

    This enters the Forth Toolkit and displays its ok prompt.

12. **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        the system is rebooted and POST is run
```

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

13. **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 boot PROM. See “Boot PROM” later in this chapter.
    - If you replace the boot PROM and re-run the POST and the PROM tests fails again, a component between the CPU and the boot PROM on the main logic board is defective. Reinstall the original boot PROM. See “Boot PROM” later in this chapter. Remove and 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 4-3). 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.
14. **At the > or ok prompt, turn off the system’s power switch.**
15. **Remove the system unit’s cover. See “Removing the System Unit’s Cover”" in Chapter 3.**
16. **Replace the SBus boards. See “SBus Boards” in this chapter.**
17. **Reconnect the power and data cables to the hard disk drives and the diskette drive. See Figures 4-11 and 4-14 in this chapter for the location of the data and power cables.**
18. **Replace the system unit’s cover. See “Replacing the System Unit’s Cover” 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 20.

19. **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 1 Installation Guide* **or** *SPARCstation 1+ Installation Guide***.**

    This completes the procedure.

20. **Turn the system and the terminal on and run the SunDiagnostic Executive with the cache disabled** *only* **if all POST tests passed. The SunDiagnostic Executive is an independent operating system. It runs exhaustive subsystem tests independent of the SunOS. See the** *SunDiagnostic Executive User's Guide for the SPARCstation 1* **(Part Number 800-3414-10).**

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

22. **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 1 Installation Guide* **or the** *SPARCstation 1+ Installation Guide***, depending on which system you are using.**

Removing the Main Logic Board

This section explains how to remove the main logic board from the system unit. Part Numbers for the main logic boards are presented in the following list:

SPARCstation 1 main logic board (P/N 501-1382)

SPARCstation 1+ main logic board (P/N 501-1632)

Note: Be sure to replace the main logic board with the same part number. Don't use the SPARCstation 1+ main logic board in the SPARCstation 1 or the SPARCstation 1 main logic board in the SPARCstation 1+.

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 how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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**
4. **Disconnect all of the cables from the connectors on the rear of the system unit.**
5. **Place an anti-static mat next to the system unit.**
6. **Remove the SBus boards. See "SBus Boards" earlier in this chapter.**
7. **Disconnect the 12-pin power supply cable from the connector in the right front corner of the main logic board (see Figure 4-17).**
8. **Disconnect the LED speaker assembly cable from the from the connector in the right front corner of the main logic board (see Figure 4-17).**
9. **Disconnect the 34-line diskette data and power cables from the connectors on the main logic board (see Figure 4-17) and fold them out of the way.**
10. **Disconnect the hard disk drive data and power cables from the data and power connectors on the main logic board (see Figure 4-17). Fold them out of the way.**
11. **With an IC extractor, remove the NVRAM chip (see Figure 4-16 for the location of the NVRAM chip) from its socket slowly and evenly. The part number of the NVRAM chip is 525-1032.**
12. **Store the NVRAM chip in conductive foam to prevent damage from electrostatic discharge. Save the NVRAM chip for re-use.**
13. **Remove the two Philips head screws that secure the board to the back panel (see Figure 4-17).**
14. **Slide the main logic board toward the front of the chassis to release it from the five standoffs in the bottom of the chassis.**

15. **Grasp the board by the connectors with both hands and carefully lift it out of the chassis. Avoid handling any of the delicate electronic components or touching any of the main logic board's traces.**

16. **Place the main logic board on an anti-static 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: When you replace the main logic board, remove the NVRAM chip from the defective board and insert it in the new board at the same location. Be sure to match the pin 1 indicator on the NVRAM with the indicator on the socket.

---

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**

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. **Insert the connectors on the rear of the replacement board into the back panel as shown in Figure 4-17.**

4. **Align the board so that the five tapered mounting holes align with the standoffs in the bottom of the chassis. After the board is properly aligned, slide it back toward the rear bezel until the standoffs lock into the mounting holes.**

5. **Replace the two Phillips screws that secure the board to the back panel.**

6. **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 4-16 shows the location of the NVRAM chip.**

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 and power cables to the connectors on the main logic board (see Figure 4-17).**

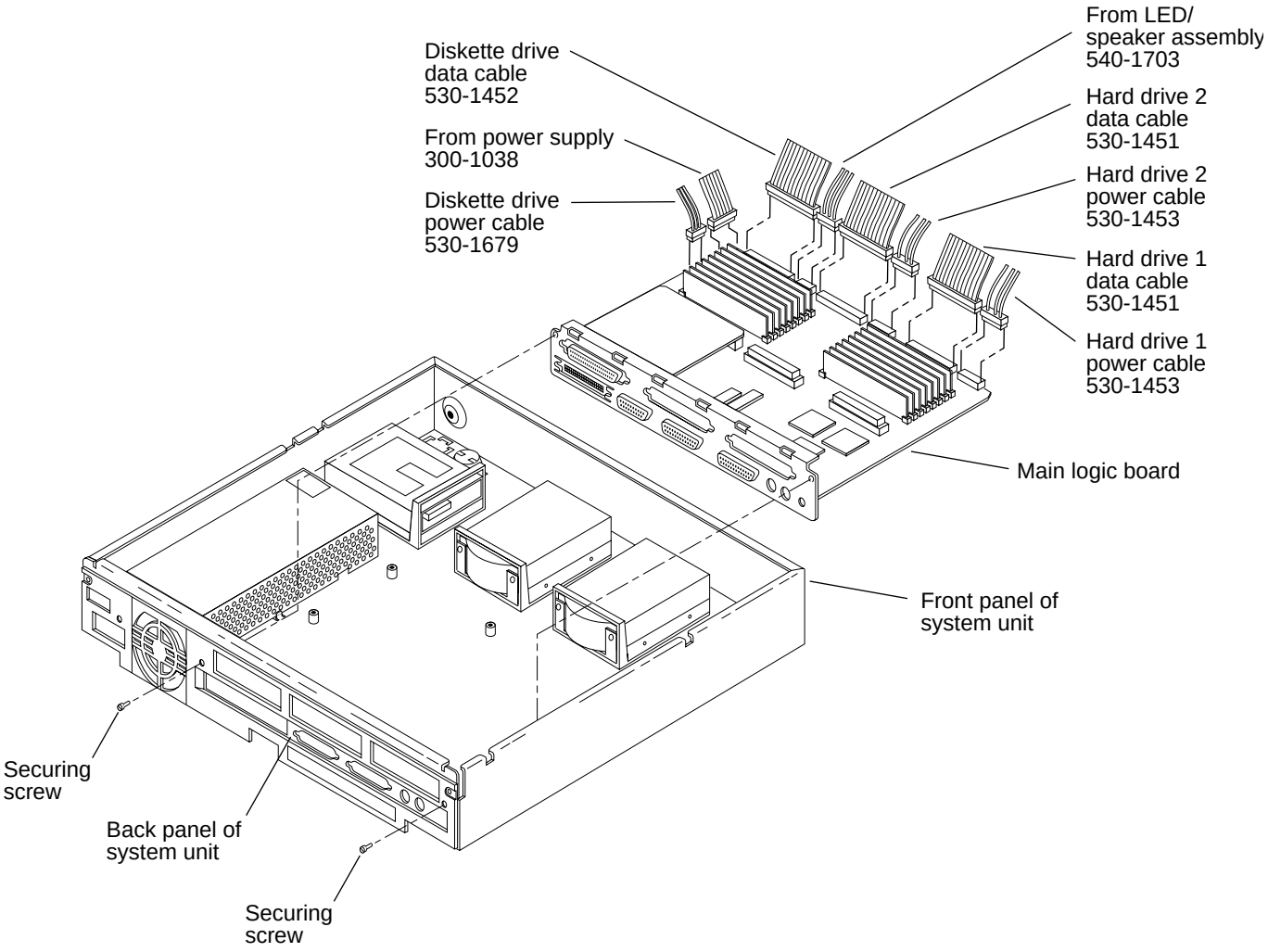
   The connectors are keyed so they will fit only one way.

9. **Connect the hard disk drive data and power cables to the data and power connectors on the main logic board (see Figure 4-17).**

   The connectors are keyed so that they will only fit one way.

10. **Re-install the SBus boards as directed in “SBus Boards” earlier in this chapter.**
11. **Connect all of the cables to the ports at the rear of the system unit.**
12. **Replace the system unit’s top cover. See “Replacing the System Unit’s Cover” later in this chapter.**
13. **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.**

Figure 4-16 Removing and Replacing the Main Logic Board


From LED/
speaker assembly
540-1703
Diskette drive
data cable
530-1452
Hard drive 2
data cable
530-1451
From power supply
300-1038
Hard drive 2
power cable
530-1453
Diskette drive
power cable
530-1679
Hard drive 1
data cable
530-1451
Hard drive 1
power cable
530-1453
Main logic board
Front panel of
system unit
Securing
screw
Back panel of
system unit
Securing
screw

Boot PROM

This section explains how to remove and replace the boot PROM on the main logic board.

To remove and replace the boot PROM, follow these steps:

1. **Before removing and replacing the boot PROM, you should have verified that the boot PROM needs to be replaced. See "Before Replacing the Main Logic Board" earlier in this chapter before continuing. The procedure described in that section explains how to run POST and the SunDiagnostic Executive.**
2. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Remove the SBus board from slot 2 (see Figure 4-16 for the location of the SBus slots). See "Removing SBus Boards" in this chapter.**
5. **Locate the boot PROM (see Figure 4-16). Remove the boot PROM. To do this use an IC extractor and remove the PROM from its socket slowly and evenly.**
6. **Insert the new boot PROM (P/N 525-1043) in the socket. To do this, match the pin 1 indicator on the boot PROM with the indicator on the socket. Holding the boot PROM at the edges, carefully align the pins and insert the boot PROM in the socket.**
7. **Replace the system unit's cover. To do this, see "Replacing the System Unit's Cover" towards the end of this chapter.**
8. **Re-run the POST test again to determine if the new boot PROM solved the problem. See "Before Replacing the Main Logic Board" earlier in this chapter.**

Speaker

The speaker is mounted at the front of the system on the right hand side (see

Figure 4-1). There are two parts to the speaker: the LED/speaker assembly (540-1703) and the speaker clip (330-1165). See Appendix B “Illustrated Parts Breakdown” for an illustration of the speaker parts.

Note: Do not touch or press on the speaker cone. The cone or sound quality may be damaged.

To test if the speaker assembly needs to be replaced:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit’s cover.**
2. **Make sure that the system unit’s power is turned on. The power cord should be attached to the system unit and to the wall outlet.**
3. **Locate the speaker assembly (see Figure 4-1).**
4. **With a VOM, measure the voltage on the LED pin of the speaker connector. If the voltage measured is 0V, the LED will not light. Replace the main logic board. See “Removing the Main Logic Board” and “Replacing the Main Logic Board” earlier in this chapter. If at least +5V is measured on the LED pin of the connector and the LED does not light, the LED is bad. Replace the speaker assembly as directed in the following procedures.**

5. **To test if sound is heard when sound is being sent to the speaker, first replace the system unit's cover. To do this see "Replacing the System Unit's Cover" later in this chapter.**

6. **Bring up the system and boot the SunOS Operating System. To do this, see "Booting Your System" in Chapter 1 of the** *Sun System & Network Manager's Guide***.**

7. **To generate sound enter either of the following:**

```
% cat /usr/demo/sound/sample.au > /dev/audio  (for SunOS 4.0.3c)
% cat /usr/demo/SOUND/sounds/sample.au > /dev/audio (For SunOS 4.1)
                                                  The system plays back
                                                  a spoken message

                          or

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

8. **If either of the sound tests fail, replace the speaker assembly as directed in the following procedures. If either of the sound tests pass, do not replace the speaker. Replace the speaker or the main logic board only if the LED does not light (see step 3).**

To remove the speaker, follow these steps:

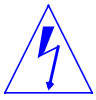
1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
2. **Make sure that the system unit's power is turned off by checking to make sure that the green LED at the front of 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. **Locate the speaker assembly and its 4-pin connector at the front right corner of the main logic board.**
4. **Unplug the 4-pin connector from the main logic board.**
5. **Push the spring-loaded clip on the speaker clip. Slide it forward and lift out the speaker assembly and the attached speaker clip.**
6. **Pull the LED out of its mounting clip.**

To replace the speaker, follow these steps:

1. **See and follow the instructions in Chapter 3 on how to halt your system, tools needed, removing expansion units, attaching a wrist strap, and removing the system unit's cover.**
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. **Push the LED into the mounting clip.**
4. **Slide the speaker assembly and the attached speaker clip into its catch and push it down.**
5. **Plug the 4-pin connector onto the main logic board. The connector is keyed so it will fit only one way.**
6. **Replace the system unit's top cover. See "Replacing the System Unit's Cover" later in this chapter.**
7. **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.**

Battery

There is a lithium battery within the NVRAM chip. The NVRAM chip is located to the right of the boot PROM (see Figure 4-16). You must remove the NVRAM chip from the main logic board you are replacing and install it in the new main logic board. For more information see “Replacing the Main Logic Board”.



Warning - There is a lithium battery molded into the NVRAM Mostek real-time clock, No. MK48T02BU or No. MK48T02B-XX, where X may be any number from 1-9. It is located on the main logic board of the system unit next to the boot PROM. The battery may explode if mistreated. Do not disassemble it or attempt to recharge it.

Replacing the System Unit’s Cover

To replace the system unit’s cover:

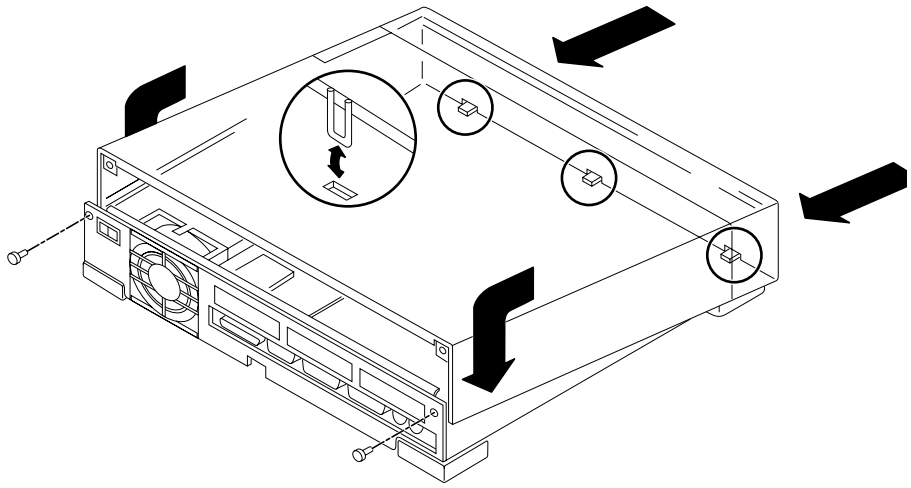
1. **Hold the cover at an angle of approximately 30 degrees in relation to the system unit chassis with the front end down and the back end up. Gently guide the plastic tabs on the front of the cover into the tab slots on the front of the chassis (see Figure 4-18). Continue to hold the cover with your hands.**

Caution - Holding the cover at angles greater than 30 degrees can prevent insertion of the tabs into the tab slots. Once the tabs are in the slots, raising the cover to angles greater than 30 degrees can break the tabs.

2. **Slowly lower the cover onto the chassis, and be sure the protector loop clears the diskette drive (if equipped) and seats into the protector loop slot on the bottom of the chassis.**
3. **Insert the two screws which hold the top cover to the back panel. If the screws strip out after use, replacement screws will be needed. The size of the screws are M4 0.7x10mm. Tighten the two screws with a screwdriver.**

Warning - Do not power up the system unit without replacing the cover and securing it. Failure to take this precaution may result in personal injury and system damage. Do not block vents on the sides or rear of this unit; permanent damage may occur.

Figure 4-17 Replacing the System Unit's Cover



Connecting the Desktop Storage Pack

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

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

Connecting the External Storage Module

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

1. **Connect the SCSI connector on the SCSI adapter cable to the SCSI port on the system unit's back panel.**
2. **See the** *Sun External Storage Module Installation Manual* **for additional installation instructions.**

Video Monitors

There are several different types of monitors and cabling. The color monitors have BNC connectors labeled R, G, B, H / HV, and Sync (H / HV and Sync are interchangeable) that mate with similarly labelled connectors on the video cable adapter. Cables for monochrome and grayscale monitors have a one multi-pin connector that mates with a corresponding jack at the back of the monitor. See "Installing Your Monitor" in Chapter 2 of the *SPARCstation 1 Installation Guide*, for more specific information on monitors and monitor cables in the SPARCstation 1 system. See Appendix C and Chapter 2 in the *SPARCstation 1+ Installation Guide* for more specific information on monitors and monitor cables for the SPARCstation 1+ system.

Part numbers for the various monitors are listed in Figure 4-19.

Caution - Some monitors are classified as FCC Class B (VCCI-2). If you are replacing a monitor, check the label on the rear of the monitor. If it is FCC- B, replace the monitor with one that has the same rating. If the monitor is FCC-A (VCCI-1), you can replace it with EITHER an FCC-A (VCCI-1) or FCC-B (VCCI-2) monitor.

Table 4-2 Video Monitors

Monitor Type	Voltage	Part Number
16-inch color monitor (407mm)	115V	365-1020
17-inch monochrome monitor (432mm)	115V	365-1055
19-inch color monitor (483mm)	115V	365-1056
19-inch standard analog monitor (483mm)	115V	365-1071
19-inch high-resolution (1600 x 1280) monochrome monitor (483mm)	115V	365-1047
17-inch greyscale OCLI (432mm)	90-240V	365-1062
19-inch color monitor(483mm)	115V	365-1038
19-inch monochrome OCLI monitor (483mm)	115V	365-1044
16-inch color monitor (407mm)	240V	365-1022
19-inch color monitor (483mm)	240V	365-1054
19-inch standard(1152 x 900) monochrome monitor (483mm)	240V	365-1043
19-inch high-resolution (1600 x1280) monochrome monitor (483mm)	240V	365-1050
19-inch high-resolution (1600 x 1280) OCLI monitor (483mm)	240V	365-1049
19-inch monochrome OCLI monitor (483mm)	240V	365-1045
19-inch color monitor (483mm)	240V	365-1039

Mouse

The optical mouse connects to one of two jacks in the back of the keyboard. The part number for the optical mouse and mouse pad is 370-1161. 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 (Part Numbers 530-1442 or 530-1443) on either the left or right side of the keyboard, then to the port on the back of the system unit. The part number of the keyboard is 320-1005.

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 one 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. This pause prevents 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 your 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.

Figure 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
87.5-132 Vac	2.1 A rms	119 watts	179	406 BTU	47-63Hz
180-264 Vac	1.2 A rms	119 watts	179	406 BTU	47-63Hz

Environmental Requirements

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

Table A-1 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	0m to 12,192m (0 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-2 Table of Physical Specifications

Component	Height	Width	Depth	Net Weight
System Unit	2.8 in (7.1cm)	16 in (40.9 cm)	16 in (40.9 cm)	25 lbs (11 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 mono	13 in (33 cm)	15 in (38 cm)	13 in (33 cm)	25 lbs (11 kg)
Monitor, 19 in color	17.4 in (44.2 cm)	18.4 in (46.7cm)	20.6 in (52.3cm)	75 lbs (34.1 kg)
Monitor, 19 in analog	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 and presents global views of the system.

System Interconnection

Figure B-1 illustrates system interconnection. Figure B-2 gives part numbers of the system components.

Figure B-1 System Interconnection

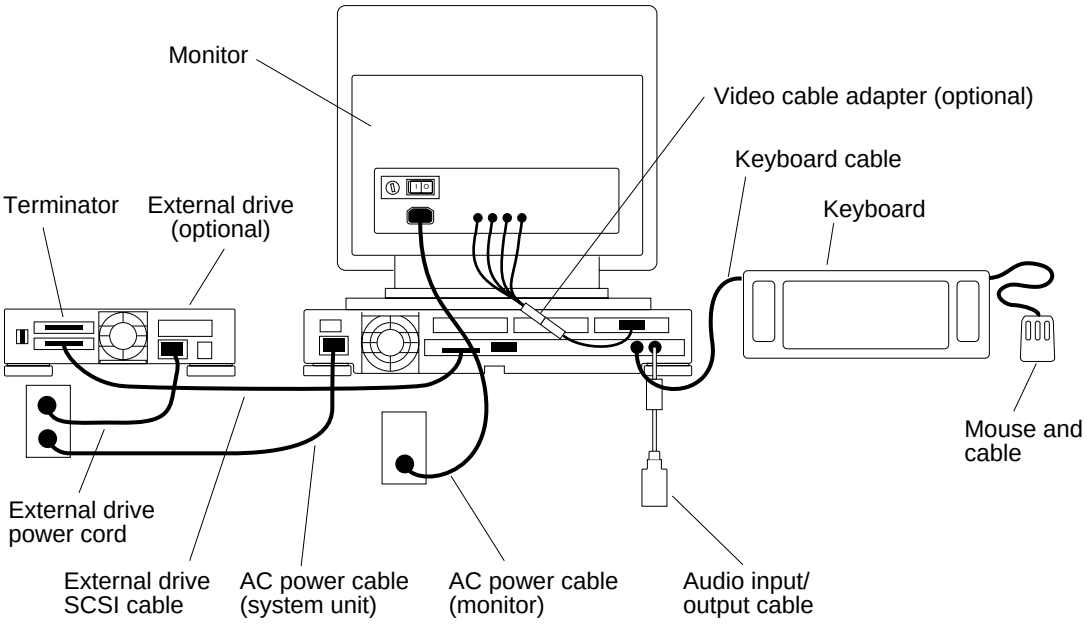


Table B-1 System Components and Their Part Numbers

Component	Part Number
Color Video Cable Adapter	530-1446
Keyboard cable	530-1442 or 530-1443
Keyboard	320-1005
Video cable	530-1440
Greyscale Video Cable Adapter	530-1511
AC power cable (monitor)	180-1146 (115V) or 180-1125 (240V)
Mouse, mousepad, and cable	370-1161
Monitors	See “Video Monitors” in Chapter 4
AC power cable (system unit)	180-1179, 180-1177, 180-1178, 180-1176, 180-1097
Audio input/output cable	530-1594
NVRAM	525-1032
LED Speaker Assembly	540-1703
Speaker Clip	330-1165
Boot PROM	525-1043

Exploded Views

Figures B-3 through B-6 illustrate global views of the system.

Figure B-2 Exploded View of the System Unit, Sheet 1

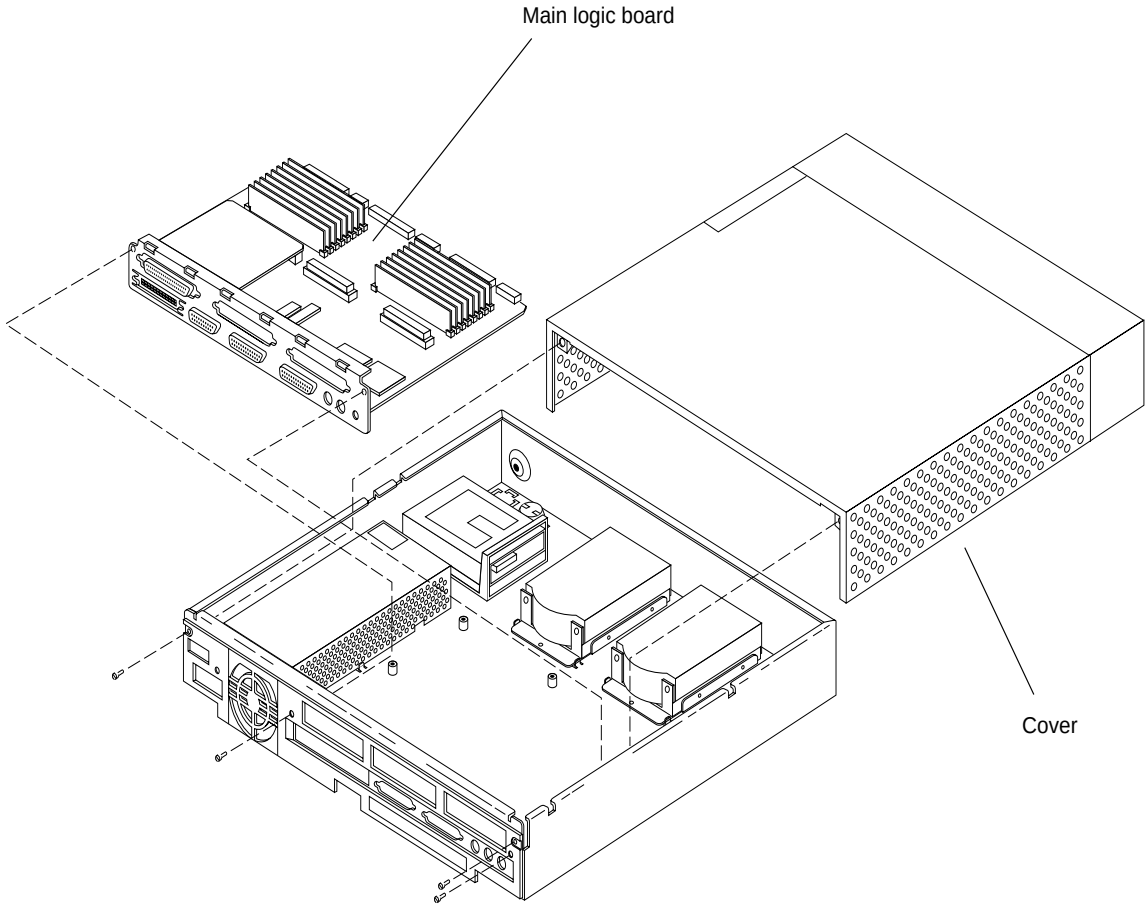


Figure B-3 Exploded View of the System Unit , Sheet 2

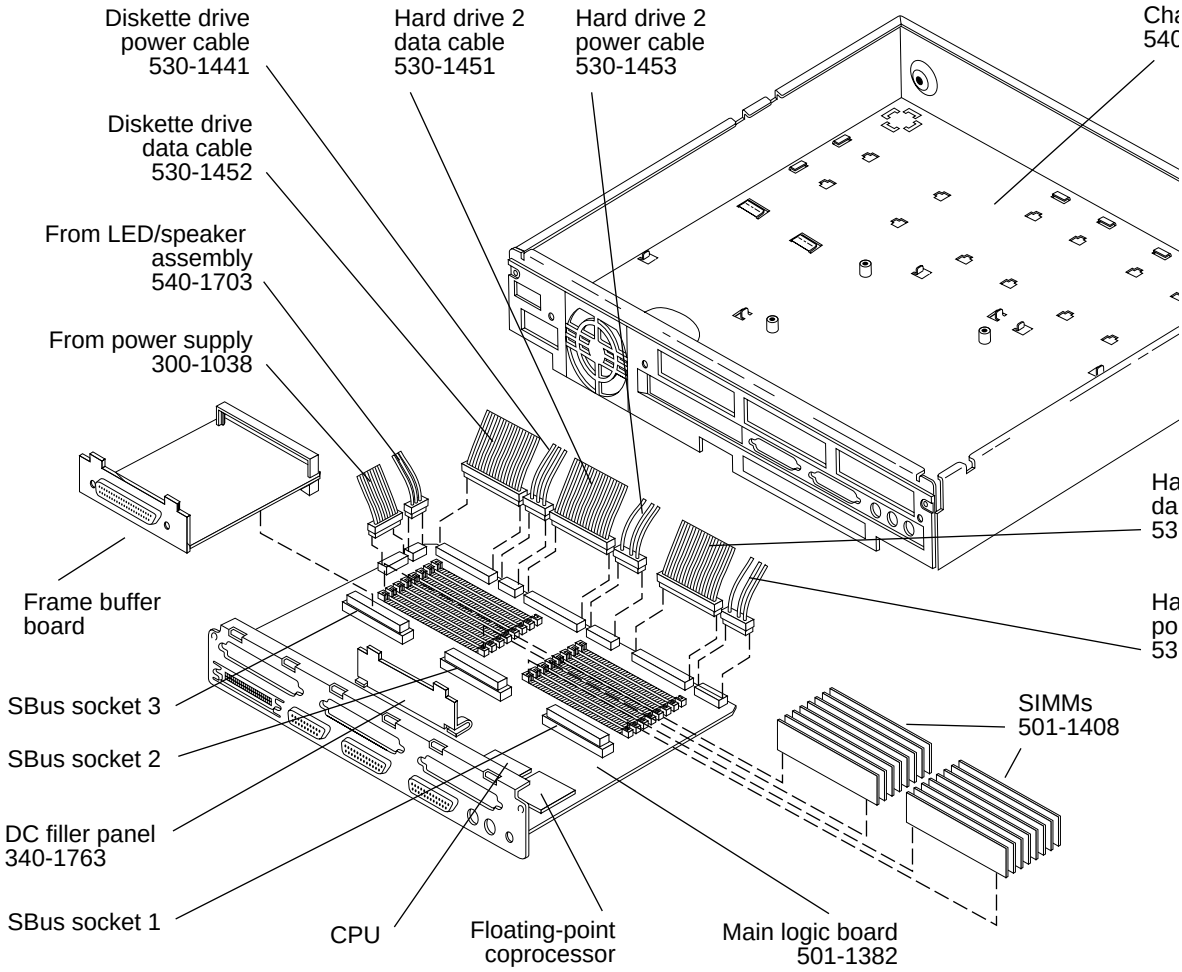
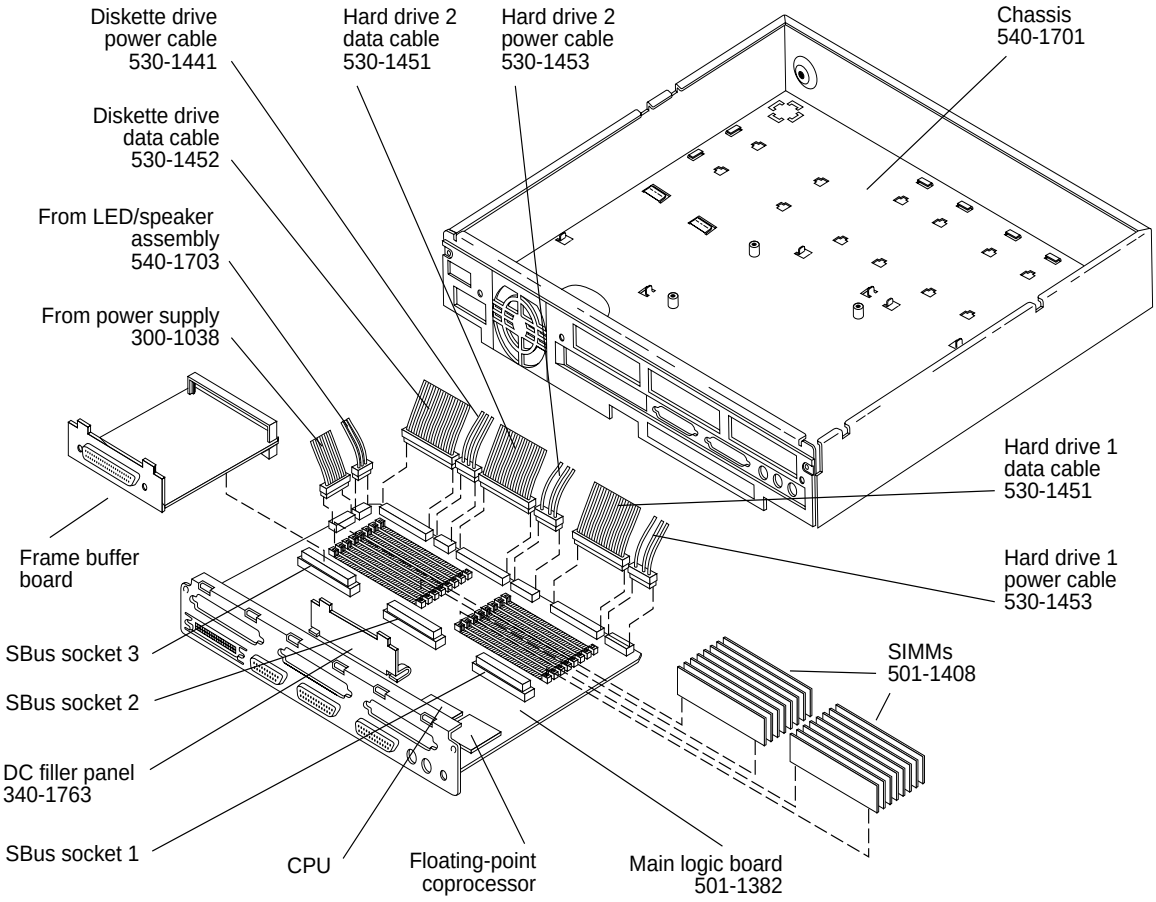


Figure B-4 Exploded View of the System Unit Showing Metal Drive Brackets, Sheet 3

Figure B-5 Exploded View of the System Unit, Sheet 4



Glossary

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

Processing Unit.

Desktop Backup Pack

An external unit containing a tape drive that can be connected to a SPARCstation 1.

Desktop Disk Pack

An external unit containing a disk drive that can be connected to a SPARCstation 1.

Desktop Storage Pack (DSP)

An external data storage unit that contains a disk drive (Desktop Disk Pack), a tape drive (Desktop Backup Pack), or a compact disc drive (Desktop SunCD Pack) and that can be connected to a SPARCstation 1 or SPARCstation 1+.

Desktop Sun CD Pack

An external storage unit that contains a compact disc (CD) drive.

DMA

Direct Memory Access.

DRAM

Dynamic Random Access Memory.

DSP

Desktop Storage Pack. An external data storage unit that contains a disk drive (Desktop Disk Pack), a tape drive (Desktop Backup Pack), or a compact disc drive (Desktop SunCD Pack) and that can be connected to a SPARCstation 1 or SPARCstation 1+.

EEM

External Expansion Module.

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

external unit that contains a disk drive and can be connected to a SPARCstation 1 or SPARCstation 1+.

External Storage Module

An external unit containing disk and tape drives that can be connected to a SPARCstation 1 or SPARCstation 1+.

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

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.

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

ower-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.

RAM

Random Access Memory.

ROM

Read Only Memory.

SBus board

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

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.

SunDiagnostic Executive

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

SunDiag System Exerciser

The SunDiag System Exerciser, which runs under the SunOS Operating System, 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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