System Overview

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

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

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

Major Components

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

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

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

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

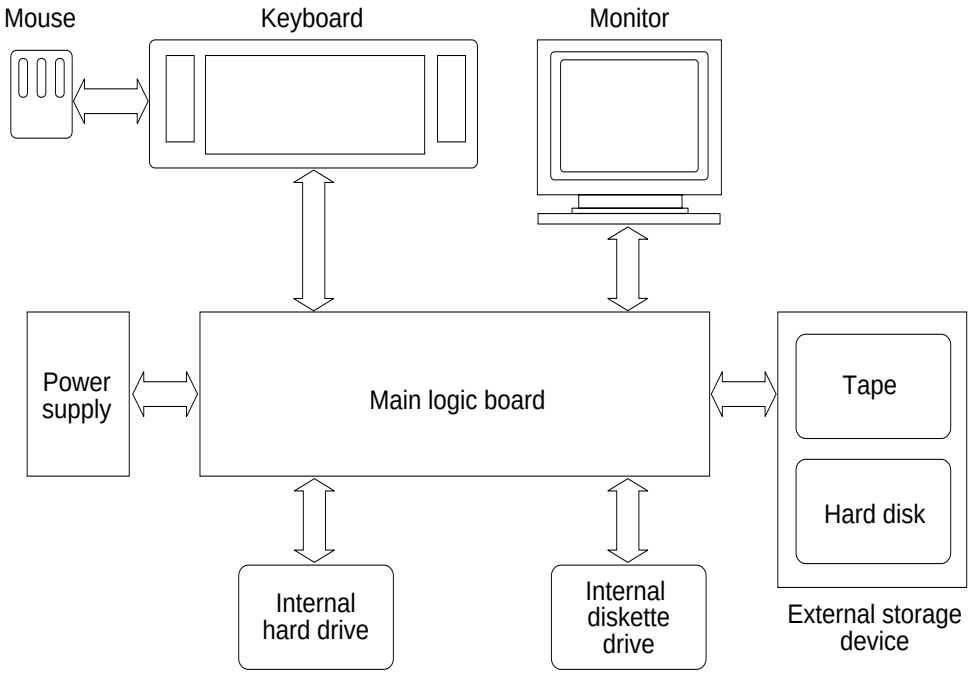

Figure 1-1 SPARCstation IPC With External Storage Device Block Diagram

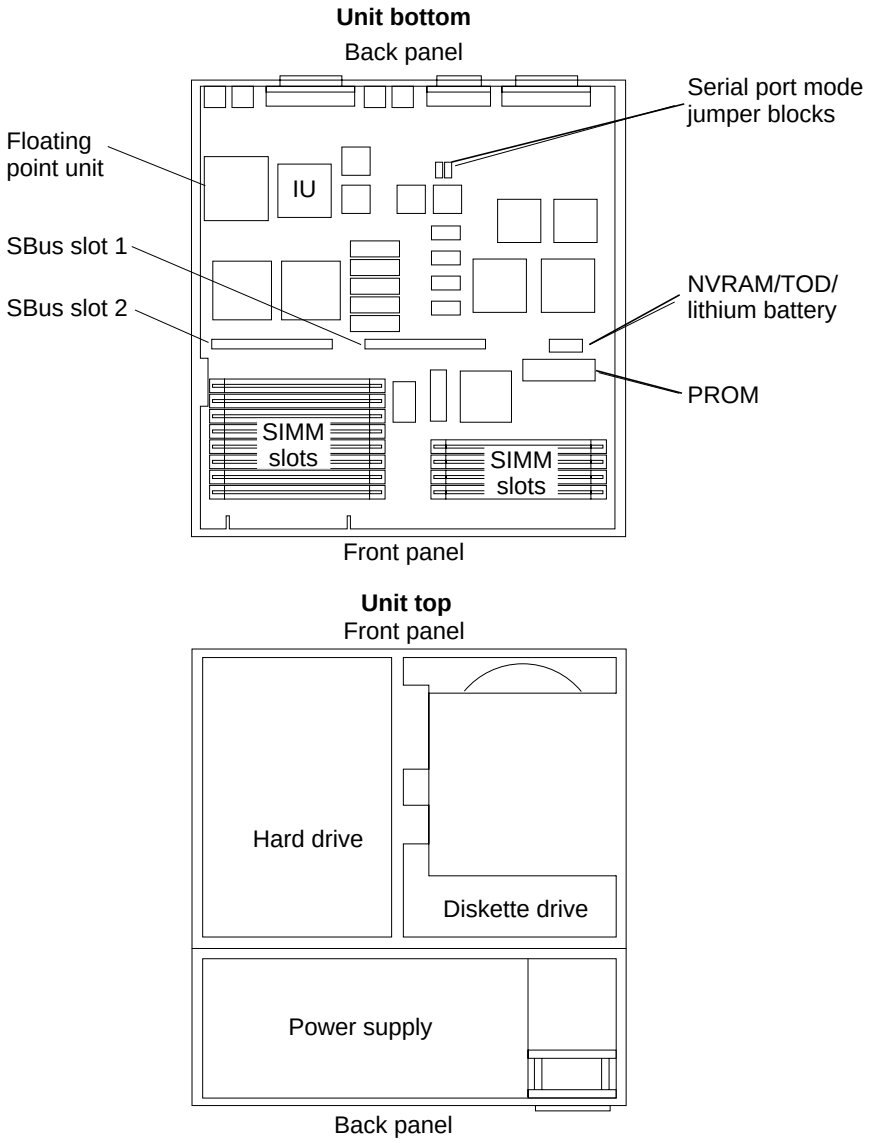

Figure 1-2 Open View of the System

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

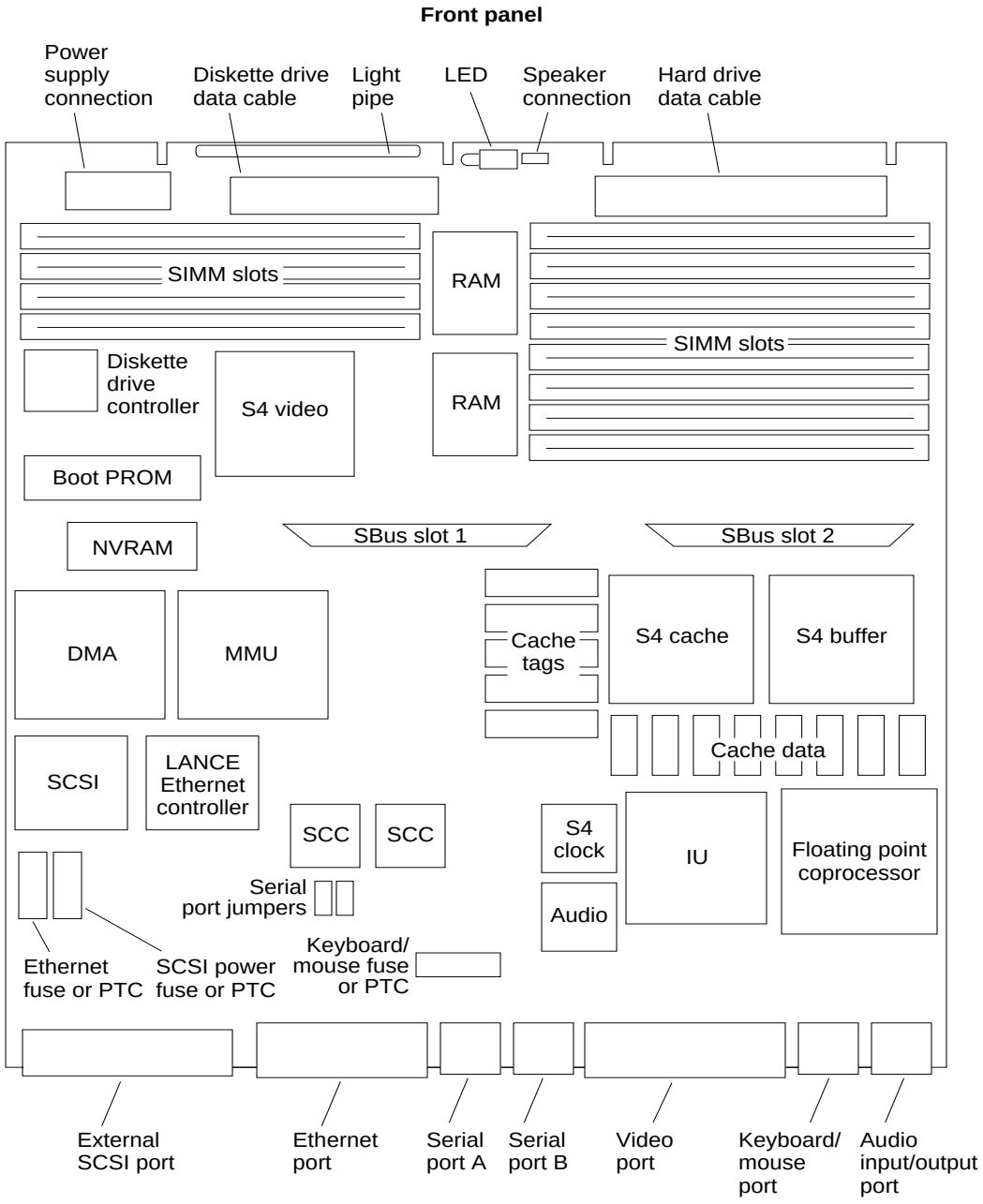

Figure 1-3 The Workstation's Main Logic Board

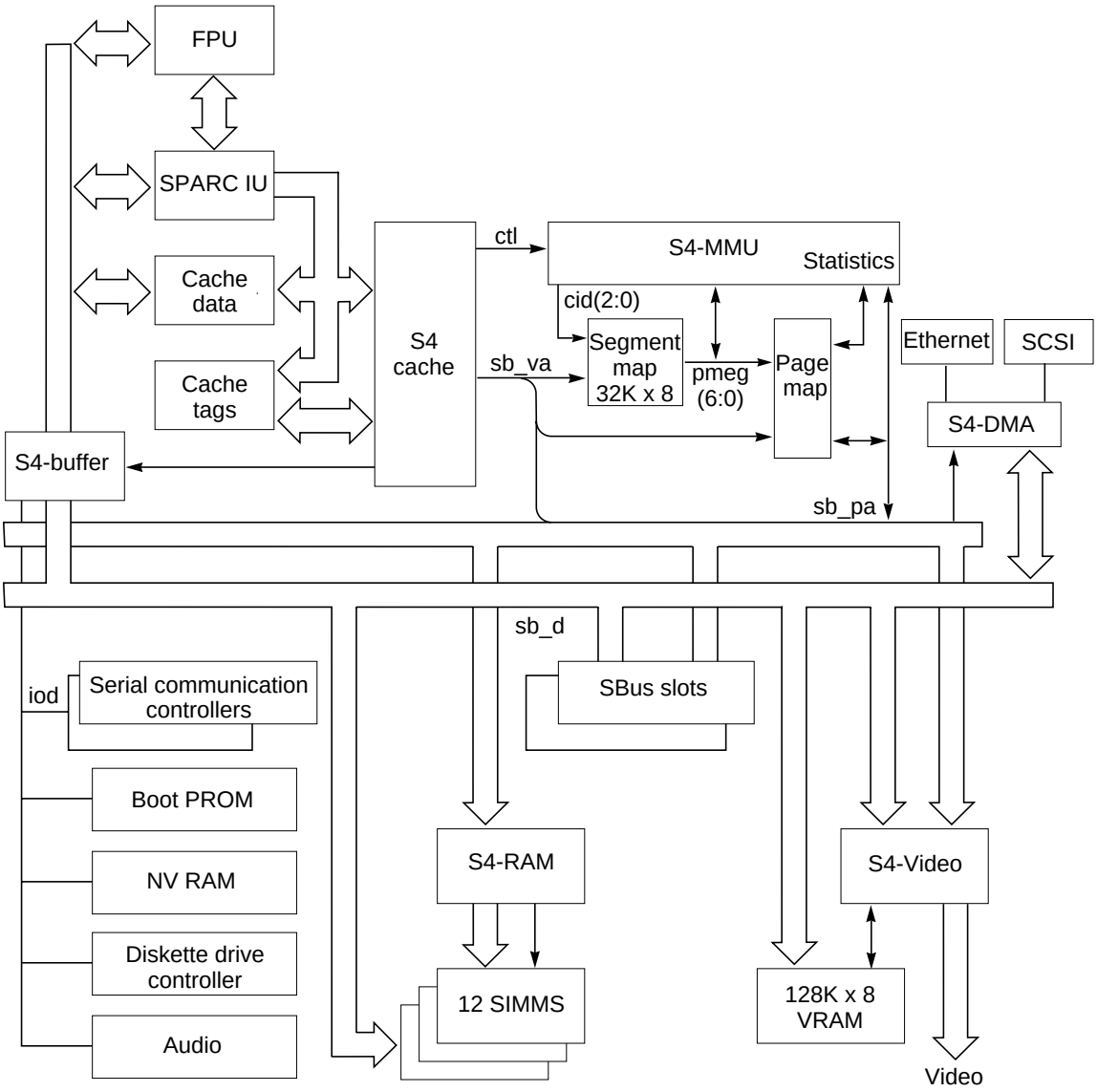

Figure 1-4 A Block Level Diagram of the Main Logic Board

Main Logic Board

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

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

CPU Core

The CPU core consists of the following:

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

These components are discussed in the sections that follow.

Instruction Unit

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

Floating-Point Coprocessor

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

Cache Memory

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

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

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

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

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

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

Eight Bit Devices

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

- Boot PROM

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

  The boot PROM does the following:

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

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

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

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

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

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

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

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

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

Memory Management Unit

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

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

S4 Direct Memory Access (DMA)

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

Dynamic RAM

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

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

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

SBus Slots

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

Input/Output

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

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

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

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

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

Single Inline Memory Modules (SIMMs)

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

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

SBus Cards

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

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

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

Mass Storage Devices

The mass storage devices available include the following:

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

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

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

Power Supply

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

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

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

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

Graphics I/O Devices

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

The available monitors are listed in Table 1-1.

Table 1-1 Video Monitors

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

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

Monochrome Video Port

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