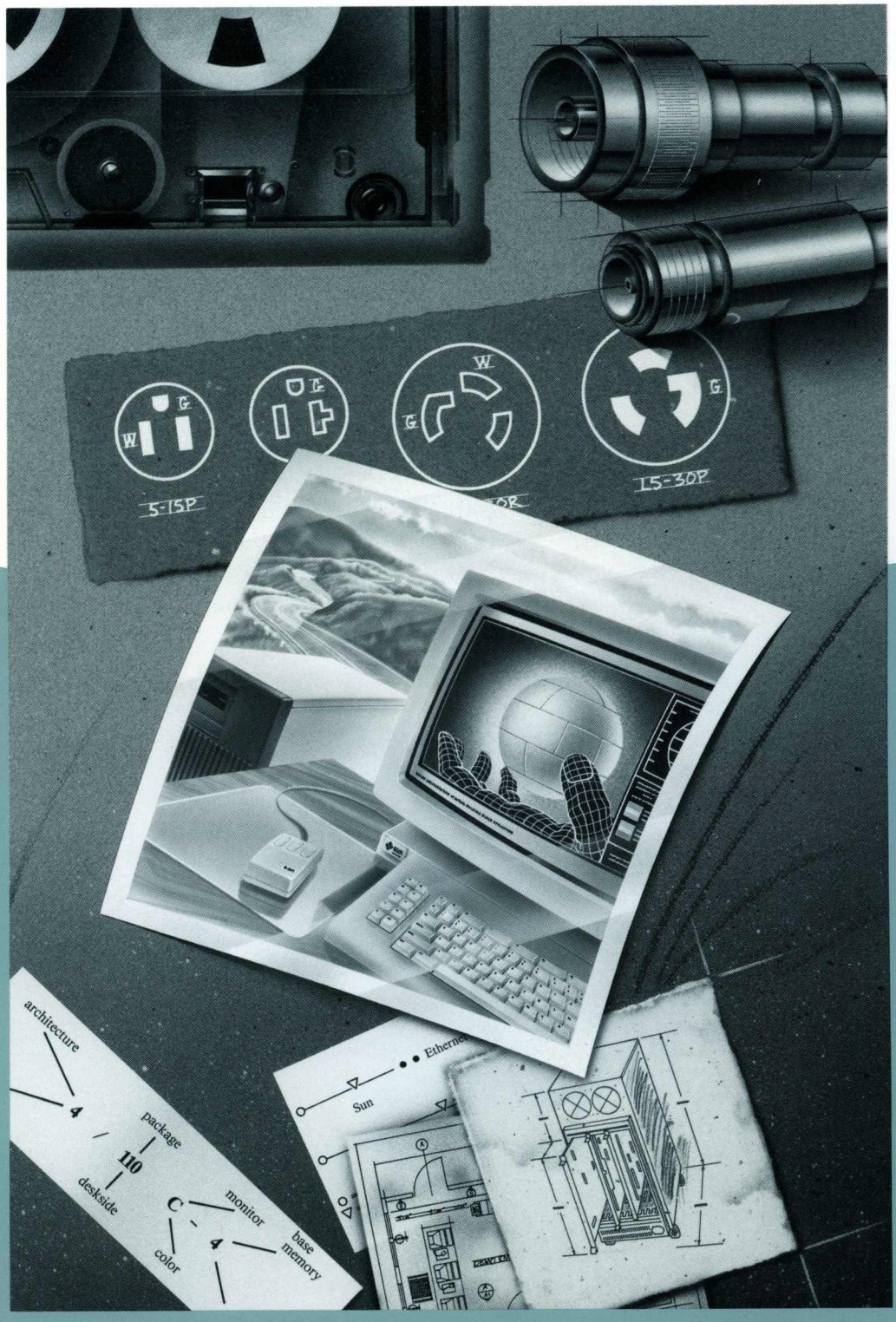
Sun Microsystems, Inc.

Sun-3 Hardware Configuration Guide

November 1989



Sun-3 Hardware Configuration Guide

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Preface

As a manager, engineer, or system architect evaluating a computer, you are often presented with two separate written descriptions of the product: the "brochure" and the "manual." Between these two documents is a large gulf that makes it hard for you to get a moderately detailed picture of a system or a particular aspect of it. To solve this problem and help you understand Sun workstations and servers better, Sun Microsystems® provides ***Configuration Guides*** and ***Technical Reports*** that are shorter and less detailed than manuals, yet have more technical information than brochures.

This book is a ***guide*** only; you will find the technical details you need to install and use your Sun hardware and software in the manuals shipped with those products. This guide discusses hardware issues to help you choose the right hardware configuration from the Sun-3™ product family.

What this Guide Contains

This guide has five chapters and three appendices:

Introduction — tells you about the basic features of the Sun-3 product family.

Standard Configurations — describes standard Sun-3 configurations, keyboards, displays, enclosures and cabinets.

Standard Options — provides detailed information about standard options for all current Sun workstations and servers.

Hardware Features — gives an overview of several hardware features, including the VMEbus, serial ports, SCSI interface and Ethernet information.

Power Requirements — tells you how to calculate current draw and thermal dissipation of your configured system.

Appendix A, ***Environmental Requirements***, lists the Sun-3 environmental specifications and lists any exceptions.

Appendix B, ***Sun SCSI Information***, contains information about Sun SCSI peripherals.

Appendix C, the ***Glossary***, defines some of the technical terms and acronyms used in this guide.

A ***Reader Comment Sheet*** at the end of this guide gives you an opportunity to send us your feedback through the electronic network or U.S. mail. Please use

the comment sheet to list missing information or errors. Thanks for your help.

References

You may find these publications helpful. They are available through your local Sun sales office.

- *Sun Architecture: A Sun Technical Report*
- *The UNIX System: A Sun Technical Report*
- *Sun System Overview (800-1300)*
- *Cardcage Slot Assignment and Backplane Configuration Procedures (813-2004)*
- *Catalyst (catalog of third party software and hardware)*

1

Introduction

1

Introduction

Building an open-network computing environment for your company is a complex process involving many decisions. Where are workstations necessary? How much processing power does each node require? Can you include terminals in the configuration? Does every workstation need its own local peripherals?

The Sun product family of attractively-priced, high-performance workstations and servers may solve many, if not all, of your problems. Sun-3 workstations and servers provide an integrated, high-speed, and high-bandwidth network with links to mainframes, minicomputers, personal computers, and peripherals.

1.1. Sun-3 Product Overview

Sun-3 workstations can increase your productivity with applications in engineering, management, architecture, publishing, and other fields including:

- Architecture and Civil Engineering
- Artificial Intelligence
- Biological and Physical Sciences
- Database Management Systems
- Earth Resource Engineering
- Electrical Engineering
- Manufacturing
- Mathematics and Statistics
- Mechanical Engineering
- Office Automation and Desktop Publishing
- Project Management
- Securities Trading Automation
- Software Engineering

The list is virtually endless. The Sun *Catalyst* catalog lists over 2300 third-party software and hardware products for Sun networking systems.

1.2. Basic Hardware

Sun's commitment to open computing and industry standards gives users the freedom to run applications across a wide spectrum of systems, without a commitment to proprietary hardware, operating systems, or networking architectures. Sun's Open Computing approach lets organizations preserve their existing computer investments, build the most flexible and powerful solutions for their needs, and continue to take advantage of emerging technologies. Open Computing means open hardware, open software, open application interface, and open networking.

Sun-3 workstations, such as the Sun-3/80, have several display options; 17-inch or 19-inch monochrome, and 16-inch or 19-inch color displays. You use a keyboard and a mouse to interact with the Sun workstations.

All Sun workstations and servers have an integrated Ethernet interface for local area networking.

The Sun-3 product family is a group of 32-bit systems based on Motorola MC68020 and MC68030 processors and the high-speed 32-bit VMEbus. The Sun-3 family has six main product lines: the Sun-3/50, the Sun-3/60,the Sun-3/80, the Sun-3/100, the Sun-3/200, and the Sun-3/400 series.

1.3. Operating System

Sun systems run an enhanced version of the UNIX operating system. The UNIX system provides a host of software as a base level package and includes the C language. Originally developed in an environment of computer scientists doing programming research, the UNIX system features many software development tools and utilities for text processing and document preparation.

UNIX supports interprocess communications, networking, and a fast file system. The Sun operating system (SunOS) builds on UNIX to offer a Network File System (NFS), System V compatibility, diskless operation, and an advanced user interface called Openlook. NFS allows you to access files on remote workstations as easily as files on your own machine. Openlook, the Sun user interface, provides overlapping windows and libraries of graphics packages that work with common graphics standards.

1.4. Features and Packaging

Sun-3 systems offer:

- Full 32-bit architecture
- Integrated bit-map frame buffer
- Low profile keyboard and mouse (optional on servers)
- Two RS-423 serial ports with modem control
- At least 4 MB of main memory.
- Integrated Ethernet interface
- SunOS, NFS, SunPro, SunView, C, SunCore, and SunCGI at no cost for all single-user workstations and servers

Enclosure Styles

The Sun-3 systems are available in four enclosure styles.

- Desktop (the entire system fits on your office desktop)
- Deskside (the system enclosure stands next to your desk)
- Data Center cabinet-mounted — supports more terminals and disk capacity than deskside systems

Displays

Sun workstations come with a variety of displays indicated by the letter at the end of the model number.

- FM - 17-inch monochrome display
- M - 19-inch monochrome display
- C - 19-inch color display
- FC - 16-inch color display
- HM - High resolution monochrome display
- S - Server (no display)

1.5. Configuration Issues

Before deciding on a specific configuration for your Sun systems, consider:

- the role of each system on the network(s)
- the application
- disk storage requirements
- site requirements

Role of the Workstations and Servers

You should carefully examine the role of each system, as a stand-alone machine, fileserver, diskless client, or diskfull client. These terms are defined as:

Stand-alone
Does not require support from any other machine. It must have its own disk and may or may not be attached to an Ethernet network. It may or may not have a local tape drive. **However, a tape drive or Ethernet connection to a tape drive is required for software installation and data archiving.**

Server
Provides resources for other machines on a local network. A suitably configured server supports from 1 to 30 diskless clients, depending on the network configuration and application. Must have disk and tape storage.

Diskless Client
Relies on a server for all of its disk storage. Diskless clients reduce the system price and are quieter than diskfull clients. They also make system administration easier for the client user since administration is centralized.

Diskfull Client
Relies on a server for resources, such as files, but has its own local disk storage. Some of its files are local and others are remote. The remote files can be obtained from any machine running as a network fileserver.

Each workstation option has its advantages. A server with large disk storage and a number of diskless clients is often less expensive than the same number of stand-alone workstations. In many cases, diskless clients achieve comparable performance to diskfull workstations. A server configuration reduces disk requirements by allowing clients to share common libraries and binaries.

In comparing diskfull and diskless clients, remember that a diskfull client may be somewhat faster, but also more expensive. The performance advantage of a local disk lessens when a server shares the cost of a higher performance drive with its clients.

Application Needs

In addition to your networking needs, you also need to evaluate the intended applications of your system(s) or network. Is your system dedicated to one particular application or to many applications? What are the memory and disk requirements for each specific application?

Sun workstations run a wide variety of software products. To expand your software horizons, refer to *Catalyst*, the Sun catalog of third-party software and hardware.

A related application question and implication accompanies each basic configuration question.

Configuration Question	*Application Question*	*Configuration Implication*
How much main memory?	Are the applications compute intensive, I/O intensive, or primarily interactive? How many applications will run at the same time?	Additional main memory improves interactive response time, but has less effect on computation times, except in programs that use large arrays. I/O intensive applications benefit the most from local disk drives.
How much disk space?	Are the application programs large? Do they use large virtual address spaces? How large are the data files?	Large virtual address space requires large disk swap space in addition to the data storage requirements of the applications.
More memory or local disk?	Are the applications paging intensive or I/O intensive?	Additional main memory reduces paging traffic to the server or disk, but has less effect on data I/O throughput.
Hardware floating-point?	Do the applications perform heavy floating-point computation?	Hardware floating-point accelerators will dramatically improve performance.

Disk Storage

You should also consider disk storage.

- How much disk storage is needed for your application(s)?
- How should backups be done and how often?
- If a local disk is needed, how much disk storage is needed?
- If a local tape is needed, how much tape storage is needed?

Site Requirements

Specific site requirements that require some planning are:

- Physical space
- Power needs
- Environmental factors

See Chapter 5, *Power Requirements* and Appendix A for more details.

Table 1-1 *Sun-3 Series CPU/Memory Overview*

	3/50	3/60	3/80	3/150 3/160	3/260 3/280	3/470 3/480
Processor						
CPU	MC68020	MC68020	MC68030	MC68020	MC68020	MC68030
CPU clock (MHz)	15	20	20	16.67	25	33
FPC	MC68881	MC68881	MC68882	MC68881	MC68881	MC68882
MMU	Sun-3	Sun-3	n/a	Sun-3	Sun-3	n/a
Virtual Memory	256 MB	256 MB	4 Gbytes per process	256 MB	256 MB	4 Gbytes per process
Hardware Contexts	8	8	n/a	8	8	n/a
CPU Performance	1.5 MIPS	3 MIPS	3 MIPS	2 MIPS	4 MIPS	7 MIPS
Memory						
Standard	4 MB	4 MB	4 MB	4 MB	8, 16 or 32 MB	8, 16 or 32 MB
Maximum	4 MB	24 MB	16 MB	16 MB	64 MB	128 MB
Error Detection	bp	bp	bp	bp	ECC	ECC
Cycle Time	270 ns	200 ns	100 ns	270 ns	80 ns	30 ns *

NOTES

* cycle time for cache access

Table 1-2 *Sun-3 Standards*

Sun-3 Standards	
Microprocessor	MC68020, MC68030
Bus	32-bit VMEbus
Floating Point	IEEE standard 754
Local Area Network	Ethernet
Tape Interface	Pertec/PE (1600 BPI) or GCR (6250 BPI), SCSI/QIC 24 (60 MB ¼-inch tape), SCSI/QIC-150 (150 MB ¼-inch tape cartridge), QIC 11.
Disk Interface	SCSI 3½-inch (104 MB), SCSI 5¼-inch (327 MB), SCSI/ESDI 5 ¼-inch (141 MB and 327 MB), SMD 8-inch (688 MB), SMD 9-inch (892 MB)
Operating System	4.2/4.3 BSD UNIX, UNIX System V Release 3
Local Area Network Protocols	TCP/IP; Network File System (NFS)
Languages	ANSI FORTRAN-77, Pascal, C, CommonLisp, Modula 2, Ada
Graphics	ACM Core, ANSI/ISO PHIGS, ANSI/ISO GKS, ANSI/ISO CGM, GKS, CGI, PostScript™

1.6. Cardcage Slot Assignments

For cardcage slot assignment information refer to Cardcage Slot Assignment and Backplane Configuration Procedures - 813-2004-XX. Cardcage information for newly released products may not be in this document. If this is the case then refer to the specific Cardcage assignment documentation for each newly released product.

1.7. Ordering Procedures

Ordering procedures have changed since previous releases of this document. Refer to the "Quick Reference How-to-Order" cards, to order new products.

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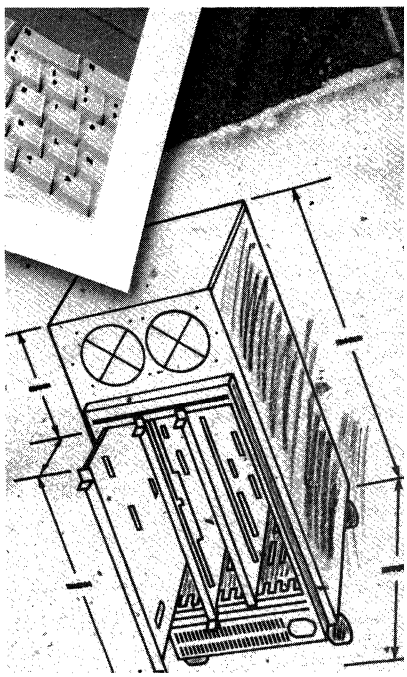
Standard Configurations



2

Standard Configurations

This chapter provides detailed specifications for all current Sun workstations and servers, including dimensions, power requirements, and cabinets styles.

2.1. Sun-3/50

Designed to be an inexpensive node in a computer network, the Sun-3/50 functions like a higher-priced workstation in an economical desktop package. Because of the single-board "no bus" design, no internal add-on memory or storage controller boards are possible.

The Sun-3/50 **desktop** series offers these features:

- 15 MHz MC68020 CPU
- 1.5 MIPS system performance
- 4 MB of main memory
- High resolution 19-inch landscape monitor with 1152 x 900 pixel resolution and 66 Hz, non-interlaced refresh
- Desktop packaging with single-board design
- Built-in SCSI host adapter allowing external add-on mass storage
- Built-in Ethernet

Because of its single board design, the Sun-3/50 offers relatively few options. The Sun-3/50 is offered with only a 19-inch Monochrome monitor (M). The Sun-3/50 has a SCSI (Small Computer Systems Interface) host adapter on the CPU board to connect local mass storage. The Sun-3/50 can also have an optional MC68881 floating point coprocessor to improve floating-point calculations performance.

The Sun-3/50 has a built-in Thin Ethernet transceiver with a BNC-type T connector that links other nodes with a 50 ohm, ¼-inch diameter, RG58 coaxial cable. You can connect to a standard Ethernet by using "fat" coaxial cable and external transceivers with a "barrel" connector that has a BNC female connector on one end and a Type N female connector on the other end.

The Sun-3/50 originally shipped with an attached 19-inch monochrome monitor. The Sun-3/50 now uses the "Flat-Top" package and supports a 141, or 327 MB disk with or without a 60 MB ¼-inch cartridge tape drive. These peripherals are housed in a desktop mass storage subsystem (MSS). If the MSS does not contain

a tape drive, it can be configured with two 5¼-inch disk drives. You can add a second expansion mass storage subsystem with one or two 5¼-inch disk drives for a maximum of 1.3 GB.

NOTE *Disk capacity is given in formatted megabytes.*

Package Dimensions and Weights	
Traditional Desktop Package	
Height	11.3 cm (4.45 inches)
Width	61.6 cm (24.25 inches)
Depth	46.5 cm (18.32 inches)
Net Weight	15.7 kg (35 lbs.)
Shipping Weight	18 kg (40 lbs.)

Table 2-1 *Maximum Power Consumption by Voltage Range For Sun-3/50*

Sun Product *	*Line Current By VAC Range*		*100/200 VAC*			*120/240 VAC*			*220 VAC*		
	100-120	200-240	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr
3/50 (100 WDC)†	6‡	3	143	220	488	143	220	488	143	220	488
3/50 (116 WDC)	6	3	166	255	566	166	255	566	166	255	566

NOTE * *Maximum surge for any Sun product is 75 Amp peak for 20 ms after each unit is off for 30 minutes.*

† Units produced after 12/15/88 have a 116 WDC power supply.

‡ 3/1.5 for the base unit. 6/3 reflects 3/1.5A available at output connector for monitor.

2.2. Sun-3/60

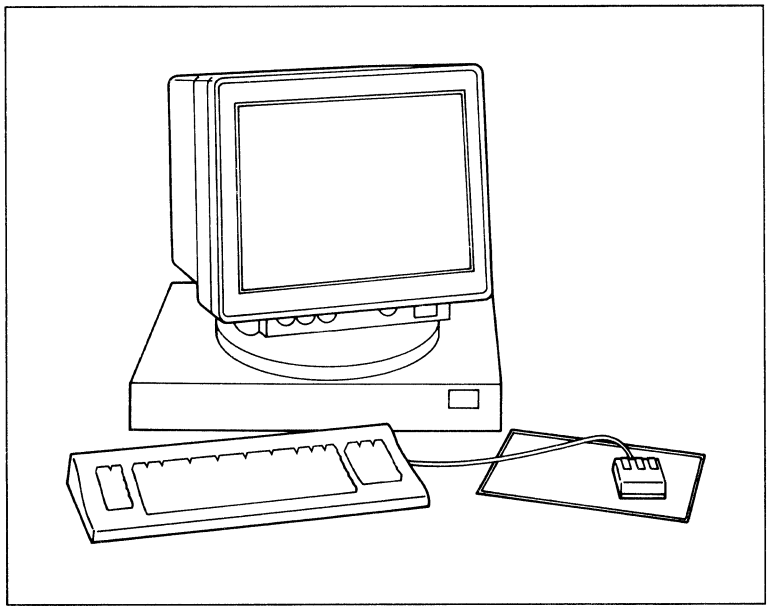


Figure 2-1 *Desktop Model - Sun-3/60*

The Sun-3/60 workstation provides a solution for low-cost applications. By using state-of-the-art technology, such as 1-Mbit SIMMS and high-speed video RAMS, the Sun-3/60 offers a powerful workstation on a single board. The Sun-3/60 has expansion capability for memory expansion and for a dedicated frame buffer.

The Sun 3/60 is completely compatible with the existing Sun-3 family.

The Sun-3/60 series offers:

- 20 MHz MC68020 CPU
- 20 MHz MC68881 floating-point coprocessor
- 3.0 MIPS system performance
- Main memory expandable from 4 to 24 MB
- Optional 19-inch landscape monitor in monochrome, high-resolution monochrome, color,and grayscale
- Optional 16-inch color monitor
- Desktop packaging with single-board design
- Built-in SCSI host adapter allowing external add-on mass storage
- Built-in Ethernet

Sun3/60 series Configurations

The Sun-3/60 is a line of low-cost, single-board desktop workstations and servers based on the new Sun-3/60 CPU board. These products are fully software-compatible with other members of the Sun-3 Family.

The Sun-3/60 uses the Sun "Flat-Top" package and is offered with three different monitors, (M, C, FC) as well as in a server configuration. An on-board SCSI host adapter for local mass storage, two serial ports and controllers, as well as connectors for standard Ethernet and Thin Ethernet with a built-in transceiver are included.

The Sun-3/60 series is available in two different accelerated color configurations:

- Sun-3/60FGX -- A 16-inch accelerated color system.
- Sun-3/60GX -- A 19-inch accelerated color system.

The Sun-3/60 mass storage is housed in a desktop mass storage subsystem like the one for the Sun-3/50. You can also use a disk-only box without tape by doing backups and installing SunOS over a network.

The key configuration differences between the Sun-3/60 and other Sun-3 products are:

- SIMM memory packaging: On other Sun-3 products (with the exception of the Sun-3/50 and Sun-3/80), memory was expanded with full-size VME boards, with 4 to 32 Mb on each. The Sun-3/60's main memory is upgradable with SIMMs (Single Inline Memory Modules). SIMM memory upgrades are easy to install. Options 104C, 108C, 112C, 116C, and 120C (4, 8, 12, 16, and 20 Mb upgrades, respectively) are complete memory upgrades kits. These kits include complete instructions and tools for customer installation. The tools are shipped with a wrist strap to avoid accidental static discharge causing damage to integrated circuits and include an insertion/extraction tool.
- Color frame buffer and the P4 connector: On other Sun-3 products (with the exception of the Sun-3/80 and Sun-3/400 CPU), color frame buffers were put on full-size VME boards. On the Sun-3/60, the P4 connector is used to attach the monochrome frame buffer for monochrome machines or the color frame buffer and color graphics accelerator daughter board for color machines. This board is approximately 4 inches x 6 inches and sits on top of the main CPU board.

Package Dimensions and Weights	
Traditional Desktop Package	
Height	11.3 cm (4.45 inches)
Width	61.6 cm (24.25 inches)
Depth	46.5 cm (18.32 inches)
Net Weight	15.7 kg (35 lbs.)
Shipping Weight	18 kg (40 lbs.)

Table 2-2 *Maximum Power Consumption by Voltage Range For Sun-3/60*

Sun Product *	***Line Current By VAC Range***		***100/200 VAC***			***120/240 VAC***			***220 VAC***		
	100-120	200-240	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr
3/60 (100 WDC)†	6‡	3	143	220	488	143	220	488	143	220	488
3/60 (116 WDC)	6	3	166	255	566	166	255	566	166	255	566

NOTE ** Maximum surge for any Sun product is 75 Amp peak for 20 ms after each unit is off for 30 minutes.*

† Units produced after 12/15/88 have a 116 WDC power supply.

‡ 3/1.5 for the base unit. 6/3 relects 3/1.5A available at output connector for monitor.

2.3. Sun-3/80

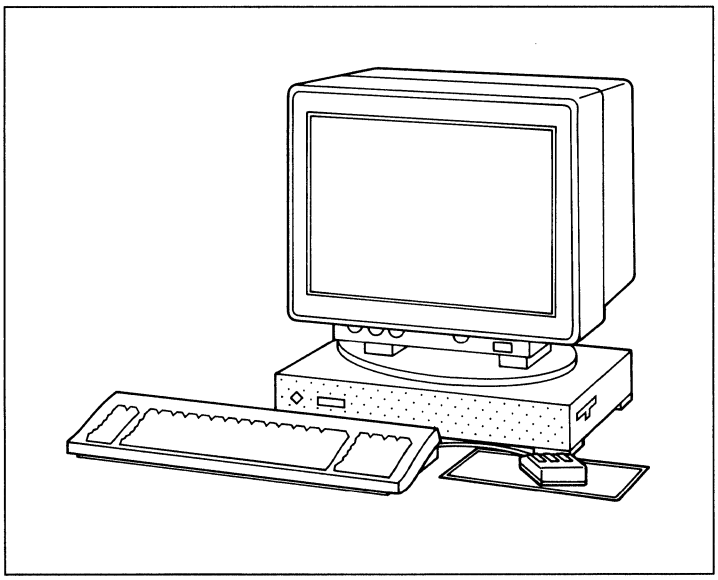


Figure 2-2 *Desktop Model - Sun-3/80*

The Sun-3/80 represents the newest generation of Motorola 68030-based Sun-3 workstations. New features provide a smaller footprint, internal mass storage, graphics acceleration and true color imaging. The Sun-3/80 is capable of running just about every third-party software package in the Sun-3 Catalyst program today. The Sun-3/80 is a natural evolution for the Sun-3/50 and Sun-3/60.

The Sun 3/80 series offers:

- 20 MHz MC68030 CPU
- 3 MIPS, 160 KFLOPS DP Linpack (std) system performance
- 20 MHz MC68882 floating-point coprocessor
- Integrated mass storage options (up to 208 MB), with read-ahead cache for improved I/O performance.
- Main memory expandable from 4 to 16 MB
- Compact desktop packaging
- Internal synchronous SCSI bus
- True Color Model for desktop imaging capabilities (16.7 million simultaneously displayable colors)
- Optional internal IBM-format 3.5-inch, 1.44 MB floppy disk

Sun-3/80 Configurations

The Sun-3/80 has been introduced in a variety of configurations to suit different budgets and applications:

- The Sun-3/80FM -- Low entry price monochrome system with 17 inch monochrome monitor, 4 MB main memory and expandability.
- The Sun-3/80FC -- Low entry price 8-bit color system with 16 inch Trinitron display, 4 MB main memory and compact packaging.
- The Sun-3/80GX -- Leading edge accelerated 2D/3D color graphics workstation, 8 MB main memory, and exceptionally balanced performance.
- The Sun-3/80TC -- 24 bit true color workstation for desktop imaging.

Sun-3/80 Options

Table 2-3 *Sun-3/80 Options*

Sun-3/80 Options	
Option #	***Option Name***
X104G	4 MB add-on memory
X550G	104 MB internal disk
X551G	104 MB desktop disk pack
X554G	3.5 inch IBM-Format floppy
X660G	150 MB desktop backup pack
X526G	327 MB external disk
X527G	327 MB external disk expansion
X529G	2 x 327 MB external disk expansion
X530G	2 x 327 MB external disks
X539G	327 MB external disk and 150 MB ¼ tape drive

Package Dimensions and Weights	
System Chassis	
Height	7.1 cm (2.8 in.)
Width	40.9 cm (16.0 in.)
Depth	40.9 cm (16.0 in.)
Net Weight	9.9 kg (22 lbs.)
Shipping Weight	12.6 kg (28 lbs.)
Desktop Storage Pack	
Height	7.1 cm (2.8 in.)
Width	24.4 cm (9.6 in.)
Depth	26.4 cm (10.4 in.)
Net Weight	3.1 kg (7 lbs.) + disk
Shipping Weight	4.5 kg (10 lbs.) + disk

Table 2-4 *Maximum Power Consumption by Voltage Range For Sun-3/80*

Sun Product *	*Line Current By VAC Range*		*100/200 VAC*			*120/240 VAC*			*220 VAC*		
	100-120	200-240	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr
3/80	2	1	122	188	416	122	188	416	122	188	416

NOTE * *Maximum surge for any Sun product is 75 Amp peak for 20 ms after each unit is off for 30 minutes.*

2.4. Sun-3/100 Series

The Sun-3/100 series offers:

- 16.67 MHz MC68020 CPU
- 2 MIPS system performance
- 16.67 MHz MC68881 floating-point coprocessor
- VMEbus architecture
- Main memory expandable from 4 to 16 MB
- 19-inch monochrome or color monitor (optional for servers) with 1152 x 900 pixel resolution and 66 Hz, non-interlaced refresh
- Deskside, or Data Center cabinet packaging

Sun-3/100 Series Configurations

The Sun-3/100 series is available in two different configurations to suit different budgets and applications:

- Sun-3/150 -- The Sun-3/150 combines performance of the 16.67 MHz, MC68020 microprocessor with the expandability of the Sun 6-slot VMEbus pedestal package. Available as deskside workstation or fileserver.
- Sun-3/160 -- The Sun-3/160 offers the power of an MC68020-based workstation with the flexibility of VME-based architecture. Available as a workstation or fileserver in a 12-slot deskside package.

Package Dimensions and Weights	
6-slot Deskside Package	
Height	61.6 cm (24.25 inches)
Width	17.7 cm (7 inches)
Depth	46.5 cm (18.32 inches)
Net Weight	45.4 kg (101 lbs.)
Shipping Weight	47.7 kg (106 lbs.)
12-slot Deskside Package	
Height	71.1 cm (28 inches)
Width	32.5 cm (12.8 inches)
Depth	59.7 cm (23.5 inches)
Net Weight	76.4 kg (170 lbs.)
Shipping Weight	86.8 kg (193 lbs.)

Table 2-5 *Maximum Power Consumption by Voltage Range For Sun-3/100 Series*

*Sun Product **	*Line Current By VAC Range*		*100/200 VAC*			*120/240 VAC*			*220 VAC*		
	100-120	200-240	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr
3/150	12†	6†	821	1264	2803	821	1264	2803	821	1264	2803
3/160	12	6	780	1200	2661	936	1440	3193	857	1319	2925

NOTE ** Maximum surge for any Sun product is 75 Amp peak for 20 ms after each unit is off for 30 minutes.*

† Includes 3/1.5A available for monitor at output connector.

2.5. Sun-3/200 Series

The Sun-3/200 series includes the Sun-3/260 and Sun-3/280 workstations and servers.

The Sun-3/200 series offers:

- 25 MHz MC68020 CPU
- 20 MHz MC68881 Floating Point Coprocessor
- 64 Kbyte virtual address, write-back cache
- High bandwidth 64-bit processor-to-memory bus
- 4 MIPS system performance
- 125 Kflops floating-point performance (expandable to over 1 mflop with optional FPA)
- 8 MB ECC main memory standard (64 MB maximum)
- 19-inch display (optional for servers) with 1600 x 1280 pixel resolution for monochrome monitors and 1152 x 900 pixel resolution for color monitors
- Deskside or Data Center cabinet packaging

Sun-3/200 Configurations

The Sun-3/200 series is available in variety of configurations:

- Sun-3/260 -- A deskside pedestal with 12-slot VMEbus Cardcage. Optional accelerators are the GP2, FPA, TAAC-1 and Sun IPC. Available as a Deskside server or workstation.
- Sun-3/280 -- Data Center cabinet-mounted server. 12-slot VMEbus cardcage. Mass storage expandable to 14.3 Gbytes. The Data Center cabinet is optional and must be ordered separately.

Package Dimensions and Weights	
Deskside Package	
Height	71.1 cm (28 inches)
Width	32.5 cm (12.8 inches)
Depth	59.7 cm (23.5 inches)
Net Weight	76.4 kg (170 lbs.)
Shipping Weight	86.8 kg (193 lbs.)
Data Center Cabinet	
Height	196.8 cm (77.5 inches)
Width	62.2 cm (24.5 inches)
Depth	91.4 cm (36 inches)
Net Weight	95.3 kg (212 lbs.)

Table 2-6 *Maximum Power Consumption by Voltage Range For Sun-3/200 Series*

Sun Product *	***Line Current By VAC Range***		***100/200 VAC***			***120/240 VAC***			***220 VAC***		
	100-120	200-240	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr
3/260,3/280†	12	6	857	1199	2925	987	1382	3368	943	1319	3217
3/2603/280‡	12	6	987	987	3368	987	987	3368	987	987	3368

NOTE ** Maximum surge for any Sun product is 75 Amp peak for 20 ms after each unit is off for 30 minutes.*

† For products shipped before 10/1/89

‡ For products shipped after 9/30/89

2.6. Sun-3/400 Series

The Sun 3/400 series of workstations and servers is Sun's newest member of the Sun-3 family. The Sun-3/400 series uses Motorola's 33MHz version of the MC68030 to deliver 7-MIPS of integer performance. The Sun-3/400 is binary compatible with other members of the Sun-3 family, so users can run existing Sun-3 applications without recompiling their software.

The Sun-3/400 series offer the following features:

- 33 MHz MC68030 CPU with on chip MMU
- 7 MIPS integer performance
- 33 MHz MC68882 floating-point coprocessor
- Optional FPA+ for up to 1.2 Mflops single precision and 0.6 Mflops double precision Linpack performance (standard on GXP models)
- 64 Kbyte physical address write back cache for no wait state operation
- I/O cache for improved I/O performance
- VMEbus architecture
- P4 bus connector for graphics frame buffers and accelerator daughterboards
- Main memory expandable from 8 to 128 MB
- Ethernet port
- 2 serial ports
- 12-slot office pedestal and data center packaging

Sun-3/400 Configurations

The Sun-3/470 is available in three graphics configurations:

- The Sun-3/470GX accelerates 8-bit 2D and 3D graphics with support for flat shading and fast window response. The Sun3-470GX is equipped with a 19-inch Trinitron color display.
- Sun-3/470GXP -- The Sun-3/470GXP offers accelerated 24-bit 3D solids modeling capabilities with hardware firmware support for Z buffering, Gouraud shading, Depth Cueing and Lighting models. The Sun-3/470GXP is also configured with a 19-inch color Trinitron display.
- Sun-3/470M -- The Sun-3/470M is a general purpose monochrome workstation with a 19-inch monochrome display.

The Sun-3/470S and Sun-3/480S are servers configured in a 12-slot Office Pedestal and a 76-inch data center cabinet.

Figure 2-3 *Deskside Model - Sun-3/470*

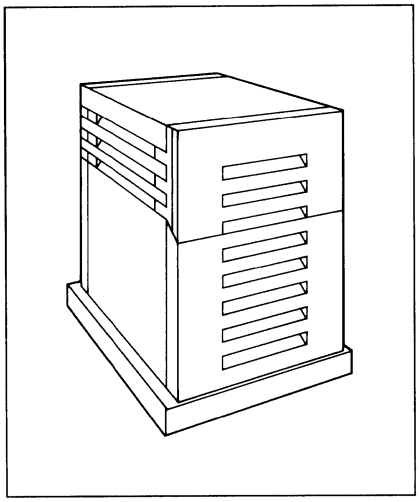
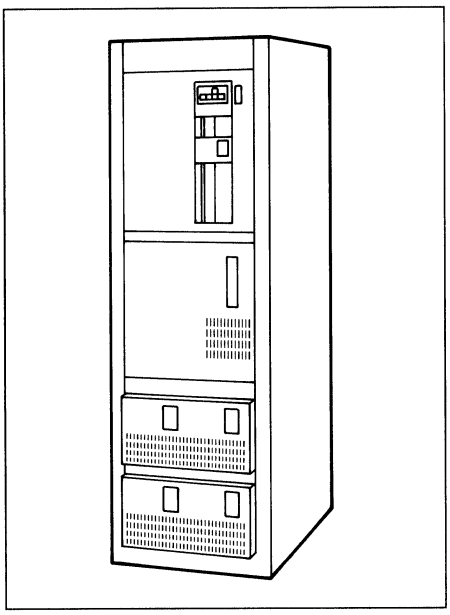


Figure 2-4 *Data Center Cabinet - Sun-3/480*



Sun-3/470 Deskside and Server Options

Sun-3/470 Options	
Option #	***Option Name***
108A	8 MB ECC memory board
116B	16 MB ECC memory board
132A	32 MB ECC memory board
155A	FPA+
450A	2nd Ethernet
482A	ALM-2
221A	TAAC accelerator
221A-01	¼-inch TAAC S/W
221A-02	½-inch TAAC S/W
222A	SunVideo -- Video I/O board and software
526K	327 MB Embedded SCSI disk
599K	SCSI Host adapter
650K	60 MB ¼-inch internal tape drive
660K	150 MB ¼-inch internal tape drive
731K	688 MB SMD with EXP pedestal
732K	2 x 688 MB SMD with EXP pedestal
733K	3 x 688 MB SMD with EXP pedestal
734K	4 x 688 MB SMD with EXP pedestal
X410A	Standalone SMD-4 disk controller for 688 MB disk
TAP	Ethernet Transceiver (vampire)
INLINE	Ethernet Transceiver (N-Series)
THIN	Thin Ethernet

Package Dimensions and Weights	
12-slot Office Pedestal 3/470	
Height	65.3 cm (25.7 inches)
Width	48.0 cm (18.9 inches)
Depth	72.6 cm (28.6 inches)
Net Weight (max)	99.9 kg. (220 lbs.)
Shipping Weight (max)	118.0 kg. (260 lbs.)

Sun-3/480 Data Center Server Options

Sun-3/480 Data Center options	
Option #	***Option Name***
108A	8 MB ECC memory board
116B	16 MB ECC memory board
132A	32 MB ECC memory board
155A	FPA+
450A	2nd Ethernet
482A	ALM-2
650B	60 MB tape drive
675A	½-inch 6250bpi tape drive
X401A	Standalone SMD-4 disk controller with 2 meter cables
X402A	Standalone SMD-4 disk controller with 6 meter cables
641A	892 MB disk subsystem with SMD-4
642A	2 x 892 MB disk subsystem with SMD-4
643A	3 x 892 MB disk subsystem with SMD-4
644A	4 x 892 MB disk subsystem with SMD-4
X645A	892 MB expansion disk without mounting tray
X646A	892 MB expansion disk without mounting tray
647A	2 x 892 MB disk with 2 x SMD-4 controllers
960A	Data center cabinet
TAP	Ethernet Transceiver (vampire)
INLINE	Ethernet Transceiver (N-Series)
THIN	Thin Ethernet

Package Dimensions and Weights	
Data Center Cabinet 3/480	
Height	196.8 cm (77.5 inches)
Width	62.2 cm (24.5 inches)
Depth	91.4 cm (36.0 inches)
Net Weight	95.3 kg (212 lbs.)

Table 2-7 *Maximum Power Consumption by Voltage Range For Sun-3/470 & 480*

Sun Product *	***Line Current By VAC Range***		***100/200 VAC***			***120/240 VAC***			***220 VAC***		
	100-120	200-240	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr
3/470	12	6	1380	1380	4709	1380	1380	4709	1380	1380	4709
3/480 †	12	6	857	1199	2925	987	1382	3368	943	1319	3217
3/480 ‡	12	6	987	987	3368	987	987	3368	987	987	3368

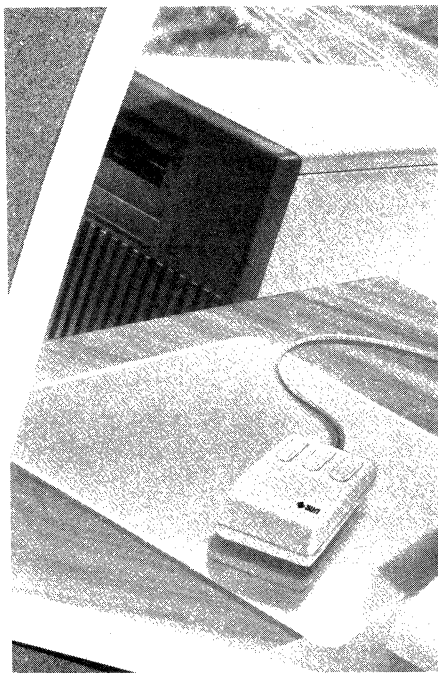
NOTES * Maximum surge for any Sun product is 75 Amp peak for 20 ms after each unit is off for 30 minutes.

† For systems shipped before 10/1/89

‡ For systems shipped after 9/30/89

3

Standard Options



3

Standard Options

This chapter provides detailed information about standard options available for all current Sun workstations and servers. Information about options includes dimensions, power requirements, and special requirements.

3.1. Keyboard

One keyboard is available:

- 107-key, low profile (Type-4)

Table 3-1 *Sun 107-key, Keyboard*

107-key, low profile keyboard	
Height	5.4 cm (2.1 inches)
Width	45.5 cm (17.87 inches)
Depth	18.6 cm (7.32 inches)
Shipping weight	24.49 kg (5.5 lbs.)

3.2. Mouse

An optical, 3 button mouse is provided with all systems.

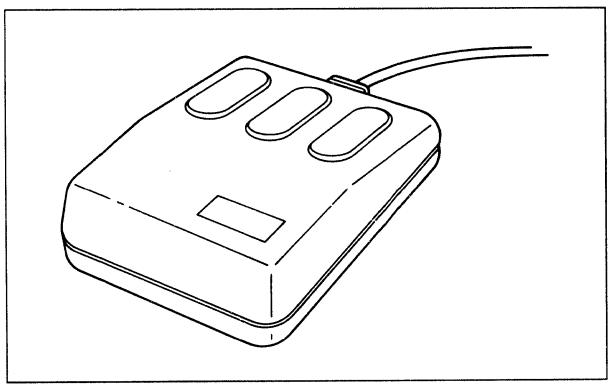


Figure 3-1 *3 button, optical mouse*

3.3. Sundials

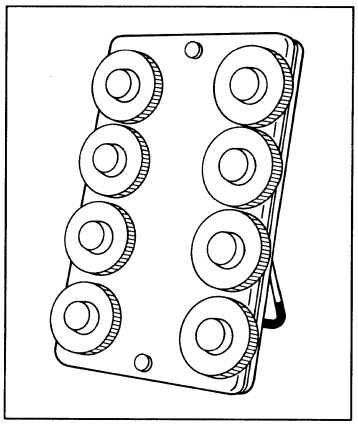


Figure 3-2 *Sundials*

Table 3-2 *Sundials - Dimensions*

Sundials, Dimensions	
Height	21.94 cm (8.64 inches)
Width	12.7 cm (5.0 inches)
Depth	4.06 cm (1.60 inches)

Table 3-3 *Sundials - AC Power Requirements*

Sundials - AC Power Requirements				
Line Voltage VAC ± 10%	***Line Frequency Hz ± 3 Hz***	***Volt-Amps***	***Watts***	***BTU/hr***
100,120,200,220,240	50/60	33.6	7.5	26

3.4. The Sun Displays

Table 3-4 *Dimensions and Weights of Sun Displays*

Dimensions and Weights of Sun Displays.	
19-inch Color (C)	
Height	44.2 cm (17.4 inches)
Width	46.7 cm (18.4 inches)
Depth	52.3 cm (20.6 inches)
Net Weight	34.1 kg (75 lbs.) 8-bit
Shipping Weight	37.1 kg (81.5 lbs.) 8-bit
19-inch Trinitron Color (C)	
Height	48.3 cm (19.0 inches)
Width	47.0 cm (18.5 inches)
Depth	53.3 cm (21.0 inches)
Net Weight	39.0 kg (86 lbs.)
Shipping Weight	43.6 kg (96 lbs.)
16-inch Trinitron Color (FC)	
Height	40.0 cm (15.8 inches)
Width	39.4 cm (15.5 inches)
Depth	43.8 cm (17.3 inches)
Net Weight	31.8 kg (70 lbs.)
Shipping Weight	34.1 kg (75 lbs.)
17-inch Monochrome (FM)	
Height	40.0 cm (15.8 inches)
Width	39.4 cm (15.5 inches)
Depth	43.8 cm (17.3 inches)
Net Weight	31.8 kg (70 lbs.)
Shipping Weight	34.1 kg (75 lbs.)
19-inch Monochrome (M)	
Height	44.5 cm (17.5 inches)
Width	46.0 cm (18.1 inches)
Depth	45.2 cm (15.9 inches)
Net Weight	23.6 kg (52 lbs.)
Shipping Weight	27.7 kg (61 lbs.)
19-inch Hi-res Monochrome (HM)	
Height	44.5 cm (17.5 inches)
Width	46.0 cm (18.1 inches)
Depth	45.2 cm (15.9 inches)
Net Weight	23.6 kg (52 lbs.)
Shipping Weight	27.7 kg (61 lbs.)

Table 3-5 *Power Standards for Sun Displays*

Power Standards for Sun Displays.			
	VA	Watts	BTUs/hr
19-inch Color (C)			
Surge	230	140	478
Typical*	292	205	700
Maximum	385	250	53
Fuse	Internal†		
19-inch Trinitron Color (C)			
Surge	230	140	478
Typical*	292	205	700
Maximum	385	250	853
Fuse	4 amps, 115V T3.15, 240 V		
16-inch Trinitron Color (FC)			
Surge	174	127	433
Typical*	174	127	433
Maximum	205	150	512
Fuse	4 amps, 115V T3.15 240 V		
17-inch Monochrome (FM)			
Typical‡	-	60 W	-
Maximum	-	85 W	-
Fuse	Internal†		
19-inch Monochrome (M)			
Surge	105	83	283
Typical‡	96	66	225
Maximum	146	95	324
Fuse	Internal†		
19-inch Hi-res Mononchrome (HM)			
Surge	102	97	331
Typical‡	102	97	331
Maximum	186	121	413
Fuse	1.5 amps, 115 V 1.5 amps, 240 V		

Notes ‡ This is the typical draw for a white screen. This amount is less for reverse video.

* This is the typical current draw for a white screen. This amount is less depending on the display's content and color mixing or gray shading

† Units with universal power supplies have internal fuses that are not customer replaceable.

3.5. Enclosures

This section describes dimensions and power information for Sun enclosures, racks and rack-mounted options. Please note that you can purchase the rack-mounted options **without** the rack.

Table 3-6 *Overview of Sun Enclosures*

Dimensions of Sun Enclosures	
Traditional Desktop (Sun-3/50, 3/60)	
Height	11.3 cm (4.45 inches)
Width with base	61.6 cm (24.25 inches)
Depth	46.5 cm (18.32 inches)
Low-Profile Desktop (Sun-3/80)	
Height	7.1 cm (2.8 inches)
Width	40.9 cm (16.0 inches)
Depth	40.9 cm (16.0 inches)
Pedestal 6-slot (Sun-3/150)	
Height	61.6 cm (24.25 inches)
Width with base	38.1 cm (15 inches)
Width w/o base	17.7 cm (7 inches)
Depth	46.5 cm (18.32 inches)
12-slot Deskside Pedestal (x/x60)	
Height	71.1 cm (28 inches)
Width	32.5 cm (12.8 inches)
Depth	59.7 cm (23.5 inches)
12-slot Office Pedestal (x/x70)	
Height	65.3 cm (25.7 inches)
Width	48.0 cm (18.9 inches)
Depth	72.6 cm (28.6 inches)
Data Center Enclosure * (x/x80)	
Height	196.8 cm (77.5 inches)
Width	62.2 cm (24.5 inches)
Depth	91.4 cm (36.0 inches)
Weight	95.3 kg (212 lbs.)

NOTES * When planning for space requirements for the Data Center cabinet, you should add 30 inches for rear clearance and 30 inches for front clearance.

3.6. Data Center Enclosure

The Data Center Enclosure has a power sequencer with three outlet sections: unswitched, switched 1, and switched 2. The Data Center Rack has a remote power-on key switch. Refer to the following diagrams for allowed connections.

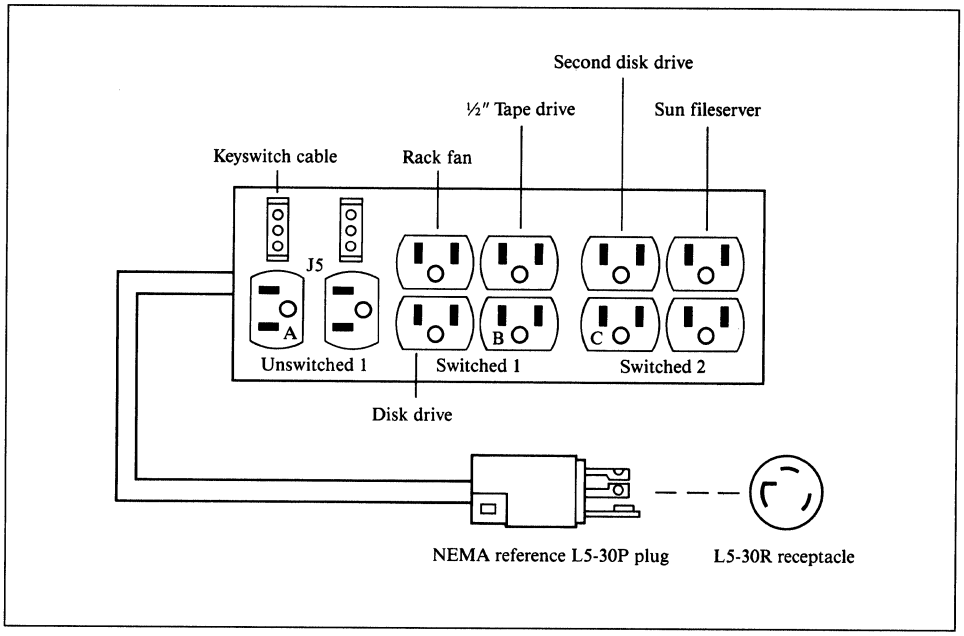


Figure 3-3 *Connections to the 100-120V Domestic Power Controller*

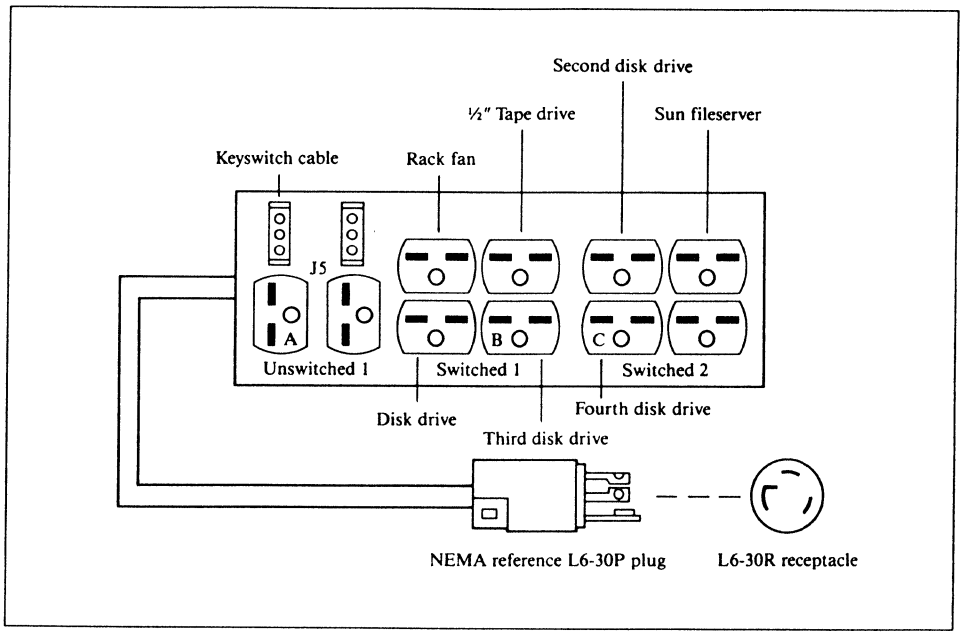


Figure 3-4 *Connections to the 200-240V Domestic Power Controller*

Figure 3-5 *Connections to the 220-240V European Power Controller*

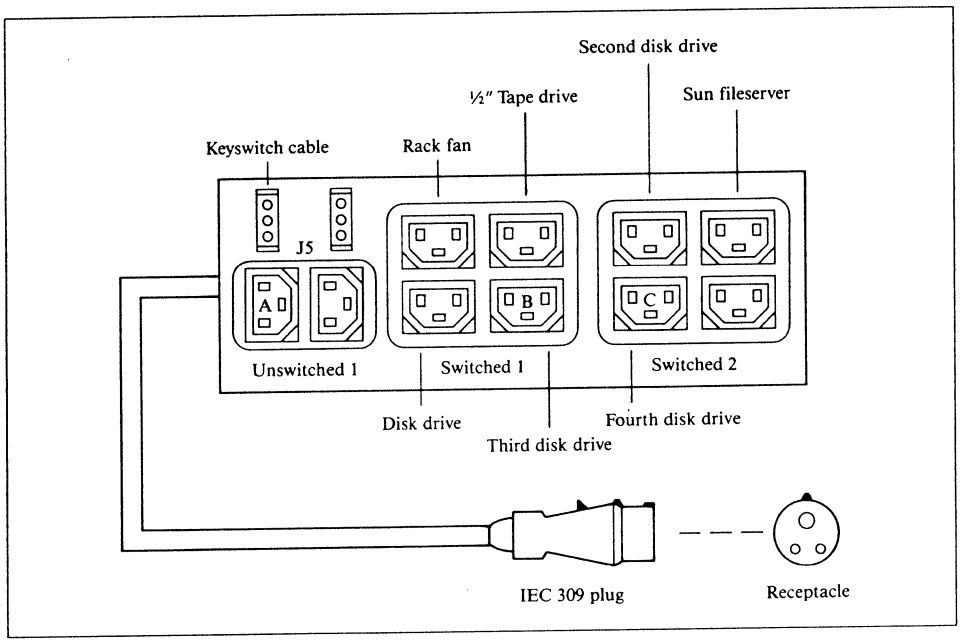


Table 3-7 *Data Center Cabinet Power Requirements*

Data Center Enclosure	
Power rating	
Worst-case 120 VAC	2880 watts (24 amps @ 120 VAC)
200 VAC	4800 watts (24 amps @ 200 VAC)
208 VAC	4992 watts (24 amps @ 208 VAC)
220 VAC	5280 watts (24 amps @ 220 VAC)
240 VAC	5760 watts (24 amps @ 240 VAC)
Typical	user-calculated
Thermal dissipation	user-calculated
Circuit breakers	
230 & 120	VAC range,16 amps,3 each

Perform the following to calculate the Volt-Amps, Watts, and BTUs/hr of the Data Center Cabinet.

1. Calculate the logic enclosure values by following the directions in Chapter 5, Power Requirements.
2. Add up the values for all the peripherals installed in the Data Center Cabinet. See section 5.1 for other considerations.
3. Add values from Steps 1 and 2 to values for the cabinet's blower assembly.

   Bottom-mounted blower (older versions):

   Volt-Amps - 64

Watts - 42

BTU/hr - 143

Top-mounted fan (current version):

Volt-Amps - 17

Watts - 11

BTU/hr - 38

3.7. Board Options

This section briefly describes the board options available with the Sun-3/100, Sun-3/200 and Sun-3/400 series listed in the order they are usually found in the cardcage. See Sun document 813-2004 for current slot assignments.

NOTE *Not all options are available for all models. Please consult the Price List for specific information.*

Memory Expansion Board

These 4 MB,8 MB and 32 MB memory expansion boards expand the CPU board memory. You can have up to three memory expansion boards in the Sun-3/100 deskside systems and up to four memory expansion boards in the Sun-3/200 and 3/400 systems.

The following table shows the amount of on-board memory available with different Sun-3 workstations.

Table 3-8 *Maximum System Memory*

Model No.	*Maximum System Memory*			
	MB/Memory on CPU	*MB/Exp. Memory Bd*	*No. of Bds*	*Total MB Memory*
3/50	4	No	0	4
3/60	4–24	No	0	24
3/80	4-16 MB	No	0	16
3/150/160	4	4	3	16
3/260/280	No	8,16,32	4	128
3/470/480	No	8,16,32	4	128

Floating Point Accelerator

The Floating Point Accelerator (FPA) speeds up high-speed floating-point calculations. The CPU, memory expansion and Floating Point Accelerator (FPA) boards must go into slots one to six in order to share a common memory (*P2*) bus, available in the 1-6 slot arrangement. See Chapter 2, *Standard Configurations*, for more information on the memory bus. Note that the Sun-3/400 series uses the new FPA+ daughterboard which plugs into the CPU board.

VME(2)-to-VME(3) Adapter

The VME-to-VME Adapter is available in two different configurations: Option 160A and Option 160B. The "A" option connects rows A and C of both P2 connectors together while the "B" option does not. Rows A and C are used to implement private bus applications. The "A" option should only be used in slots 7, 8, or 9 of a 3/x60 & 3/x80 12-slot backplane if no private bus is required. If a private bus application is required and no Sun graphics accelerator (multiple board version) is required, Sun provides slots 10 through 12 (12-slot backplane) or slots 5 and 6 (6-slot backplane) for this need. For the 3/x70 12-slot backplane, the "A" option should only go in slots 8 or 9. See section 4.1 for additional backplane information.

MCP

The SunLink Multiprotocol Communications Processor (MCP) supports the SNA 3270, IR, DDN, bisync RJE, and X.25 SunLink software products to allow higher line speeds. You can have up to four MCP boards per system.

NOTE *The MCP and SunIPC boards are unbundled options. Contact the local Sun Sales Office for current availability because of SunOS release version support issues.*

ALM-2

The Asynchronous Line Multiplexer (ALM-2)* board connects multiple terminals or other serial devices to Sun network fileservers or workstations. The ALM-2 occupies only one slot and can be installed in any slot provided the cables do not interfere with the other boards. You can have four ALM-2 boards in most Sun systems.

Color Video Board

For the Sun-3/60, 3/80 and 3/400, the optional color frame buffer board connects directly onto the CPU board via the P4 connector.**

You can upgrade your Sun-3/100/200/400 system to color by adding a VME color board and a color display.

SCSI Controller

The SCSI (Small Computer Systems Interface) is an industry standard bus. The SCSI host adapter connects 5¼-inch disks (141 and 327 MB) and ¼-inch tape drive (60 and 150 MB) to the workstation.

The SCSI host adapter board plugs into a VME(2)-to-VME(3) adapter board and goes into slot seven in the 3/x60 deskside 12-slot logic enclosure. In the 6-slot cabinet and the rack-mountable 12-slot package, the board may go into any slot if the VME(2)-to-VME(3) adapter board has no P2 connections. For the 3/x70 package the SCSI Controller can go in slots to the right of the CPU.

*Cabinet-mounted ALM-1s shipped in 1985 or early 1986 have a PS connector and interface with other boards, and must be isolated in slots 10, 11, and 12. GP+/GB and GP2/CG5 options are not allowed with these ALM-1s. Deskside ALM-1s shipped in 1985 or early 1986 must be installed in slots 11 and 12.

** For all other Sun products, the color board plugs into a cardcage slot.

Second Ethernet Controller

You can add a second Ethernet controller to your system to make your workstation a router or gateway.

SunIPC

The SunIPC (Sun Integrated Personal Computer) board gives you the full-functionality of an MS-DOS system without losing any of the performance or versatility of Sun's UNIX-based system. The SunIPC is so flexible you can configure a SunIPC for your own workstation or share a SunIPC on a server over a network.

An optional Intel 80287 math coprocessor is available for increased performance. The board executes applications written for MS-DOS 3.1 or later and includes Microsoft's GWBASIC compiler. Either color or monochrome applications can run in SunWindows display while UNIX applications run in other windows. An optional external 1.2 MB floppy disk drive is available for PC software.

Tape Controller

The ½-inch tape controller connects a ½-inch tape drive to the workstation. You can have up to two tape controllers.

SMD Controller

SMD (Storage Module Device) is an industry standard interface for high-performance drives. The SMD controller family connects SMD disk drives (688 or 892 MB) to the workstation. The Sun SMD-4 controller is used with the 688 and 892 MB drives.

NOTE *Sun sells up to four SMD-4 controllers per system. Each controller can handle four drives. You are responsible for technical issues such as power supply capacity, slot assignment, and safety if these options are not used inside an approved Sun package.*

3.8. Graphics Options

GX Graphics Subsystem

The GX graphics subsystem is designed to accelerate a wide variety of 8-bit color applications. The GX offers fast 2D/3D vector performance, windows performance, antialiased vectors, and text scrolling capability. It is also designed to be scalable with CPU power, i.e., as MIPS increases, the rated performance of the GX subsystem increases - this guarantees investment protection to the user. The GX communicates with the CPU through the P4 bus, and extends into an additional slot in the deskside workstations.

GXP Graphics Subsystem

The GXP graphics subsystem consists of a two-board set (GP2+CG9) that provides hardware support for Gouraud-shading, Z-buffering, and Picking. It also provides firmware support for PHIGS+ features such as depth-cueing and lighting. The GXP workstations are targeted at MCAE, Animation, and Scientific applications where accelerated 24-bit color is important.

GP2, GP+, GB Graphics Options

The Graphics Processor 2 (GP2) and color board set, or CG5, Graphics Processor (GP+) and Graphics Buffer (GB) improve graphics performance for applications on the screen with transformation, scaling, and rendering of 2- and 3-dimensional objects. The GP+/GB option set is used on systems with either the CG5 color board or the Sun-3 CG3 color board which can be used with 19-inch color or grayscale monitors.

The GP2 and GP+ move graphics functions normally done in software into efficient, tuned hardware pipelines. For instance, they accelerate vector drawing (either two- or three-dimensional) integer, or floating-point coordinates. The GB is a hardware "z-buffer" for the GP+ that speeds three-dimensional hidden-surface removal. The GP2 has an on-board "z-buffer".

Two GP+/GB configurations are possible.

- Installing the GP+ only (if the GB is not used with the GP+, the GP+ may be installed in slots 8 or 9).
- Installing both the GP+ and GB.

The GP+ and GB combinations or the GP2 and CG5 combination must be installed in slots 10 and 11 in a 12-slot logic enclosure or slots 5 & 6 in the 6-slot logic enclosure, that are connected by a private P2 bus.

TAAC-1

The TAAC-1 is a two-board set C-programmable processor. Data may be stored and manipulated within an 8 MB on-board memory which can also be treated as a 24-bit frame buffer with an 8-bit alpha channel (1024 x 2048 total size). This may be viewed within the Sun window system or displayed on an external monitor.

3.9. Mass-Storage Options

Sun offers a wide range of mass storage peripherals with its workstations and fileservers. For high-performance disks, Sun uses the Storage Module Device (SMD) standard interface. For price-sensitive needs, Sun uses the Small Computer Systems Interface (SCSI) bus.

Sun's mass-storage subsystems are fully-integrated and tested and meet all pertinent safety requirements. They are available in a variety of sizes and packaging configurations to meet your needs.

- low-cost storage
- backup to disk
- deskside high-performance storage
- data center storage

External Storage Module

See Appendix B for additional Desktop Storage Pack and External Storage Module cabling issues and configuration information.

Table 3-9 *External Storage Module*

External Storage Module Power Requirements				
Operating Voltage Range	*Operating Frequency Range*	*VA*	*Watts*	*BTUs/hr*
90-132 VAC	47-63 Hz	273	164	563
180-264 VAC	47-63 Hz	273	164	563

Table 3-10 *External Storage Module and External Expansion Module Dimensions*

ESM/EEM Dimensions	
Height	23 cm (9 inches)
Width	19 cm (7.5 inches)
Depth	52 cm (20.5 inches)
Weight	18 kg (40 lbs.)

Desktop Storage Pack

See Appendix B for additional Desktop Storage Pack cabling issues and configuration information.

Table 3-11 *Desktop Storage Pack Power standards*

Desktop Storage Pack Power Requirements				
Operating Voltage Range	*Operating Frequency Range*	*VA*	*Watts*	*BTUs/hr*
90-132 VAC	47-63 Hz	81	49	166
180-264 VAC	47-63 Hz	81	49	166

NOTE *Power requirements are the same for the External Expansion Module.*

Mass Storage Subsystem (MSS)

For disk storage needs, Sun offers 141 and 327 MB disk drives. Designed for the Sun-3/50/60/150 workstations, these devices fit either horizontally or vertically on or under a desk in Sun's Mass Storage Subsystem (MSS). For more disk space, you can daisy chain a second mass storage option in a separate enclosure.

You can also install up to two 327 MB disks and a 60 MB tape drive inside the logic pedestal of the Sun-3/160/260, and up to four storage devices in the Sun-3/400.

Table 3-12 *Mass Storage Subsystem (MSS) Requirements*

	Power Requirements		
	VA	*Watts*	*BTUs/hr*
Maximum (Disk/disk & tape)	374	243	829
Disk & tape			
Surge	140	105	358
Typical	114	80	273
Disk only			
Surge	130	98	334
Typical	96	64	218
Two disk drives			
Surge	208	145	495
Typical	123	81	276
Fuse			
120/240 VAC		3.15 amps at 250 V slow-blow	

Table 3-13 *MSS Dimensions*

	MSS
Height	16.5 cm (6.5 inches)
Width	37.5 cm (14.7 inches)
Depth	37.5 cm (14.7 inches)
Weight	17 kg (37 pounds)

Backup

Sun offers three backup options.

- The dual-speed/dual-density 1600/6250 bpi tape drive backs up fileservers cost-effectively. This dual-speed drive provides 150 MB of data storage on a single tape reel.
- The 1600 bpi tape drive offers an alternative ½-inch reel-to-reel backup that provides 40 MB of formatted data storage.
- For local workstation backup, Sun offers two ¼-inch cartridge tape devices with 60 or 150 MB of storage that resides in either the low-cost MSS, the external storage module, the desktop storage pack, or inside the logic pedestal.

1600 bpi Tape

Table 3-14 *½-inch 1600 bpi Tape Drive Power Requirements*

1600 bpi Tape Drive Power Requirements	*VA*	*Watts*	*BTUs/hr*
AC on surge	64	46	157
DC on surge	183	108	368
Idle	252	198	676
Operating	366	302	1030
Fuse 120 VAC		5 amp	

6250 bpi Tape

Table 3-15 *½-inch 6250 bpi Streaming Tape Power Requirements*

Streaming Tape Drive Power Requirements	*VA*	*Watts*	*BTUs/hr*
AC surge typical	293	269	918
Idle typical	397	265	904
Operating typical	711	537	1832
Worst-case	1232	800	2730
Circuit breaker 120/230 VAC		15 amps	

Table 3-16 *6250 Streaming Tape Drive Dimensions*

6250 Streaming Tape	
Height	61.7 cm (24.3 inches)
Width	48.3 cm (19 inches)
Depth	55.9 cm (22 inches)
Weight	90 kg (198 lbs.)

Deskside High-Performance Storage

Sun offers deskside Mass Storage Pedestals (MSP) to house disks that provide high disk capacity. A single-disk MSP can accommodate the 688 MB disk, while a dual-disk configuration can provide 1.3 GBof disk space. A second MSP can provide another 1.3 GB of disk space.

The new Expansion Pedestal accomodates up to 4 x 688 MB drives/pedestal and is used with the Sun-3/470 only.

Mass Storage Pedestal (MSP)

Table 3-17 *Single Disk Mass Storage Pedestal Power Requirements (688 MB)*

Single Disk Mass Storage Pedestal Power Requirements 120 VAC operation	*VA*	*Watts*	*BTUs/hr*
Surge	306	230	785
Typical	304	235	802
Worst-case	551	358	1222
Fuse		5 amps 250V slow-blow	

Table 3-18 *MSP Dimensions*

Deskside MSP	
Height	71.7 cm (28 inches)
Width	32.5 cm (12.8 inches)
Depth	59.7 cm (23.5 inches)
Weight	62 kg (135 pounds)

Table 3-19 *Dual Disk Mass Storage Pedestal Power (1.3 GB)*

Dual Disk Mass Storage Pedestal Power 120 VAC operation	*VA*	*Watts*	*BTUs/hr*
Surge	575	439	1498
Typical	515	382	1303
Worst-case	1101	715	2440
Fuse		5 amps 250V slow-blow	

NOTES

1. The 688 MB disk is not supported on the Xylogics 451 controller.
2. The SMD-4 and the Xylogics 451 can reside in the same system.
3. A maximum of (2) SMD-4 controllers are supported in a system with (1) Xylogics 451 installed. Only one 451 controller can be installed in the same system with an SMD-4 controller.
4. Disks of different capacities cannot be connected to the same controller.
5. Disks of different capacities cannot be installed in the same deskside mass storage pedestal due to the internal daisy-chaining inside of the pedestal.

Sun Expansion Pedestal (EXP)

Table 3-20 *Sun Expansion Pedestal Power Requirements*

Sun Expansion Pedestal (EXP) Power Requirements	*VA*	*Watts*	*BTUs/hr*
2 x 688 MB disk EXP*			
Surge	581	610	1982
Typical	450	441	1535
Maximum	586	586	1999
4 x 688 MB disk EXP†			
Surge	950	983	3241
Typical	780	779	2661
Maximum	1173	1173	4002

NOTES * 1 or 2 disks require a 410 watt power supply

† 3 or more disks require the 820 watt power supply

Table 3-21 *Sun Expansion Pedestal Dimensions and Weights*

EXP Dimensions and Weights	
Height	65.3 cm (25.7 inches)
Width	48.0 cm (18.9 inches)
Depth	72.6 cm (28.6 inches)
Weight 2 Drive Exp	106 kg. (235 lbs.)
Weight 4 Drive Exp	145 kg. (320 lbs.)

Data Center Storage

For large fileserver applications, Sun offers a high-performance 892 MB disk for the Sun-3/280 and 3/480. When using the Sun SMD-4 controller, up to sixteen 892 MB disks can be configured in 3 bay cabinets for a total of 14.3 Gbytes of data storage. Four disks per controller are allowed and up to four controllers can fit into a rack.

The next table shows the common mass storage configurations.

Table 3-22 *892 MB Disk Power Requirements*

892 MB Disk Power Requirements					
Line Voltage	*Line Frequency*	*Volt-Amps*		*Watts*	*BTU/hr*
VAC ± 10%	*Hz ± 2 Hz*	*Start-up**	*Running*		
100	50/60	920/860	581/576	533/497	1800/1700
120	50/60	1002/980	616/615	551/539	1900/1800
200	50/60	1056/1044	641/598	551/539	1900/1800
208	50/60	1099/1085	667/622	551/546	1900/1900
220	50/60	1162/1148	705/658	551/546	1900/1900
240	50/60	1217/1198	716/716	563/560	2000/1900

NOTE **Start-up Volt-Amps lasts for about 40 seconds.*

3.10. Desktop and Deskside Options

Printers

Sun workstations can be used with any serial printer.

This section lists power information on options available for desktop and deskside workstations.

Table 3-23 *LaserWriter Power Requirements*

LaserWriter Power Requirements	
Power rating	
100-120 VAC	690 watts
200-240 VAC	790 watts
Standby at any line voltage	120 watts
Thermal dissipation	
100-120 VAC	2354 BTUs/hr
220-240 VAC	2696 BTUs/hr
Any line voltage	410 BTUs/hr
Fuse 120 and 230 VAC	3 amps 250V slow-blow

Table 3-24 *LaserWriter II Power Requirements*

LaserWriter II Power Requirements	
Power rating	
120 VAC	900 watts max
220 VAC	780 watts max
240 VAC	880 watts max
Standby at any line voltage	170 watts average
Thermal dissipation	
120 VAC	3071 BTUs/hr
220 VAC	2661 BTUs/hr
240 VAC	3003 BTUs/hr
Fuse 120 and 230 VAC	3 amps 250V slow-blow

3.11. Maximum Configurations

The following two tables show the maximum number of each option that Sun offers for each system product. These tables provide an historical perspective of past and present options. Since not all options are currently available from the factory, please consult the current Sun price list for product availability.

NOTE *Not* **all** *maximum options can be installed at the same time.*

Table 3-25 *Maximum Allowable Options for Sun-3 Systems*

Option #	*Option Name*	*3/50*	*3/60*	*3/80*	*3/150*	*3/160*	*3/260*	*3/280*	*3/470*	*3/480*
104	4 MB memory expansion board	0	*	3	3	2	0	0	0	0
108A	8 MB ECC memory expansion board	0	0	0	0	0	4	4	4	4
116B	16 MB ECC memory expansion board	0	0	0	0	0	4	4	4	4
132A	32 MB ECC memory expansion board	0	0	0	0	0	4	4	4	4
150	Floating Point Accelerator	0	0	0	1	1	1	1	1	1
155A	FPA+	0	0	0	0	0	0	0	1	1
202	Graphics Buffer (GB) ζ	0	0	0	1	0	1	1	1	1
210	Graphics Processor (GP) ζ	0	0	0	1	0	1	1	1	1
211	Graphics Processor Plus (GP+) ζ	0	0	0	1	0	1	1	1	1
212	Graphics Processor Two (GP2) ††	0	0	0	1	0	0	1	1	1
221A	TAAC-1 Application Accelerator	0	0	0	1	1	1	1	1	1
222A	SunVideo - video I/O board & software	0	0	0	1	1	1	1	1	1
251	19" monochrome monitor (1152 x 900)	1	1	1	1	1	0	0	1	1
252	19" high res mono monitor (1600 x 1280)	0	1	1	0	0	1	1	1	1
253A	19" color monitor CG3	0	0	0	1	1	0	0	1	1
253B	19" color monitor CG4	0	0	1	1	1	0	0	1	1
254B	16" color monitor	0	1	0	0	0	0	0	0	0
321E	19-inch monochrome, mono frame buffer	0	0	0	0	0	0	0	0	1
331E	19-inch Trinitron Monitor, GX Frame Buffer	0	0	0	0	0	0	0	1	1
401A	SMD-4 Ctlr with 2M cables	0	0	0	0	0	0	0	0	4
402A	SMD-4 Ctlr with 6M cables	0	0	0	0	0	0	0	0	4
410A	SMD-4 controller	0	0	0	0	0	0	4	4	0
450A	2nd Ethernet controller	0	0	0	1	1	1	1	1	1
482A	ALM-2	0	0	0	4	2	4	4	4	4
504	141 MB disk subsystem	0	1	0	1	1	1	1	0	0
505	141 MB disk expansion	0	1	0	1	1	1	1	0	0
506	327 MB disk subsystem	1	1	0	1	1	0	0	0	0
507	327 MB disk expansion	1	1	0	1	1	0	0	0	0
509	654 MB (2 x 327) disk expansion	1	1	0	1	1	0	0	0	0
510	654 MB (2 x 327) disk subsys	1	1	0	1	1	0	0	0	0
514	141 MB disk subsys + ¼" tape	1	1	0	1	1	0	0	0	0
515	2 x 141 disk subsystem + 60 MB ¼" tape	0	0	0	0	0	0	0	0	0
516	327 MB disk subsys + 60 MB ¼" tape	1	1	0	1	1	1	1	0	0
517	2 x 327 disk subsys + ¼" tape	0	0	0	0	0	0	0	0	0

Table 3-25 *Maximum Allowable Options for Sun-3 Systems— Continued*

Option #	*Option Name*	*3/50*	*3/60*	*3/80*	*3/150*	*3/160*	*3/260*	*3/280*	*3/470*	*3/480*
526G	327 MB embedded SCSI disk subsystem	0	0	1	0	0	0	0	4	0
526K	327 MB SCSI internal expansion disk	0	0	1	0	0	0	0	4	0
527G	327 MB embedded SCSI disk expansion	0	0	1	0	0	0	0	0	0
529	2 x 327 embedded SCSI expansion disk	0	0	1	0	0	0	0	0	0
530G	2 x 327 embedded SCSI disk subsystem	0	0	1	0	0	0	0	0	0
539G	327 MB disk & 150 MB tape subsystem	0	0	1	0	0	0	0	0	0
550G	104 MB desktop disk pack	0	0	4	0	0	0	0	0	0
551G	104 MB SCSI internal disk	0	0	2	0	0	0	0	0	0
554G	1.44 MB 3.5-inch internal floppy drive	0	0	1	0	0	0	0	0	0
599K	SCSI-3 host adapter	0	0	0	1	0	1	1	1	1
615B	SMD-4 Ctlr + expansion pedestal w/one 688 MB disk	0	0	0	0	0	2	0	2	0
616B	SMD-4 Ctlr + expansion pedestal w/two 688 MB disks	0	0	0	0	0	2	0	2	0
641A	SMD-4 Ctlr, one 892 MB disk on 1 tray	0	0	0	0	0	0	4	0	4
642A	SMD-4 Ctlr, two 892 MB disks on 1 tray	0	0	0	0	0	0	4	0	4
643A	SMD-4 Ctlr, three 892 MB disks on 2 trays	0	0	0	0	0	0	4	0	4
644A	SMD-4 Ctlr, four 892 MB disks on 2 trays	0	0	0	0	0	0	4	0	4
645A	892 MB expansion disk no tray (SMD-4 based)	0	0	0	0	0	0	0	0	4
646A	892 MB disk, no ctlr 1 tray (SMD-4 based)	0	0	0	0	0	0	0	0	4
647A	2 x 892 MB with 2 x SMD-4	0	0	0	0	0	0	2	0	2
650	60 MB ¼" cartridge tape subsys	0	0	0	0	0	0	1	0	1
660G	150 MB ¼- i n c h external cartridge tape	0	0	1	0	0	0	0	0	0
660K	150 MB ¼- i n c h internal cartridge tape	0	0	0	0	0	0	0	1	0
675	6250/1600 bpi ½" tape drive subsys	0	0	0	0	0	0	2	0	2
730A	688 MB expansion disk	0	0	0	0	0	0	0	1	0
731K	688 MB disk/SMD-4 in EXP	0	0	0	0	0	2	0	2	0
732K	2 x 688 MB disk subsystem	0	0	0	0	0	2	0	2	0
733K	3 x 688 MB disk/SMD-4 in EXP	0	0	0	0	0	0	0	2	0
734K	4 x 688 MB disk subsystem	0	0	0	0	0	0	0	2	0
960	76" Data Center Cabinet per system configuration	0	0	0	0	0	0	0	0	3
GX	CG6 Graphics Accelerator	0	1	1	0	0	0	0	1	1
GXP	GP2 with CG9 24-bit VME Color Frame Buffer	0	0	0	0	0	1	1	1	1
IPC	Sun Integrated Personal Computer ‡‡	0	0	0	2	2	4	4	4	4
SCP	SunLink Communications Processor ‡‡	0	0	0	4	2	2	2	2	2

Table 3-25 *Maximum Allowable Options for Sun-3 Systems— Continued*

Option #	*Option Name*	*3/50*	*3/60*	*3/80*	*3/150*	*3/160*	*3/260*	*3/280*	*3/470*	*3/480*
MCP	Sun Multiprotocol ‡‡ Communications Processor	0	0	0	4	2	2	4	4	4
SCA	Sun Channel Adapter ‡‡	0	0	0	1	0	2	2	2	2
TFC	CG8 24-bit P4 Color Frame Buffer	0	0	1	0	0	0	0	0	0
MAPKIT	MAP Network (802.4) Adapter Kit ‡‡	0	0	0	2	1	1	2	0	0

NOTES

* The 3/60 ships from the factory with a minimum of 4 MB of memory. Memory modules (x104, x108, x112, x116, and x120) may be added in any combination that does not exceed the total 24 MB capacity of the CPU board.

ζ The GB works only with the GP (older systems) or GP+.

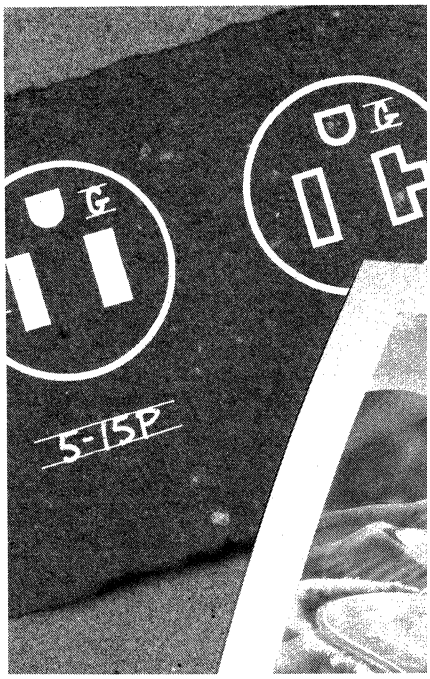
†† The GP2 requires the CG5 or CG9 Color Frame Buffer board.

‡‡ Consult your Sun Sales Office concerning software considerations for and availability of this unbundled product.

§§ Quantity is per installed primary disk subsystem.

4

Hardware Features



4

Hardware Features

This chapter reviews several hardware features such as the VMEbus and backplane, serial ports, and the Ethernet of Sun products.

4.1. VMEbus

The VMEbus is an interfacing system that connects data processing, data storage, and peripheral control devices in a closely coupled hardware configuration*. The VMEbus structure can be described mechanically and functionally.

The mechanical specification describes the dimensions of subracks, backplanes, front panels, plug-in boards, etc. The functional specification tells how the bus works, and describes the functional modules involved in each transaction and the rules that define their behavior.

VMEbus Mechanical Structure

The VME backplane is a single, large printed circuit board with 96-pin connectors and signal paths that bus the connector pins. In Sun models with 12-slot logic enclosures, the backplane has three 96-pin connectors per slot which are aligned vertically and labeled P1, P2, and P3.

Each connector has three columns (called A, B, and C) of pins aligned in 32-pin increments, and each column of pins serves a different function. These pins serve three functions or buses:

- VMEbus
- P2 bus
- Power bus

A VMEbus includes the backplane, its collection of electronic components, and its 96-pin connectors that you can plug into the VMEbus backplane connectors.

The following figures show P Connectors for the Sun-3/x60/x80 and the Sun-3/470 12-slot Backplanes.

*Sun follows the Motorola VMEbus specification, MVMEBS/D2, Rev. B.

Figure 4-1 *P Connectors for the Sun-3/x60 and 3/x80 Backplanes*

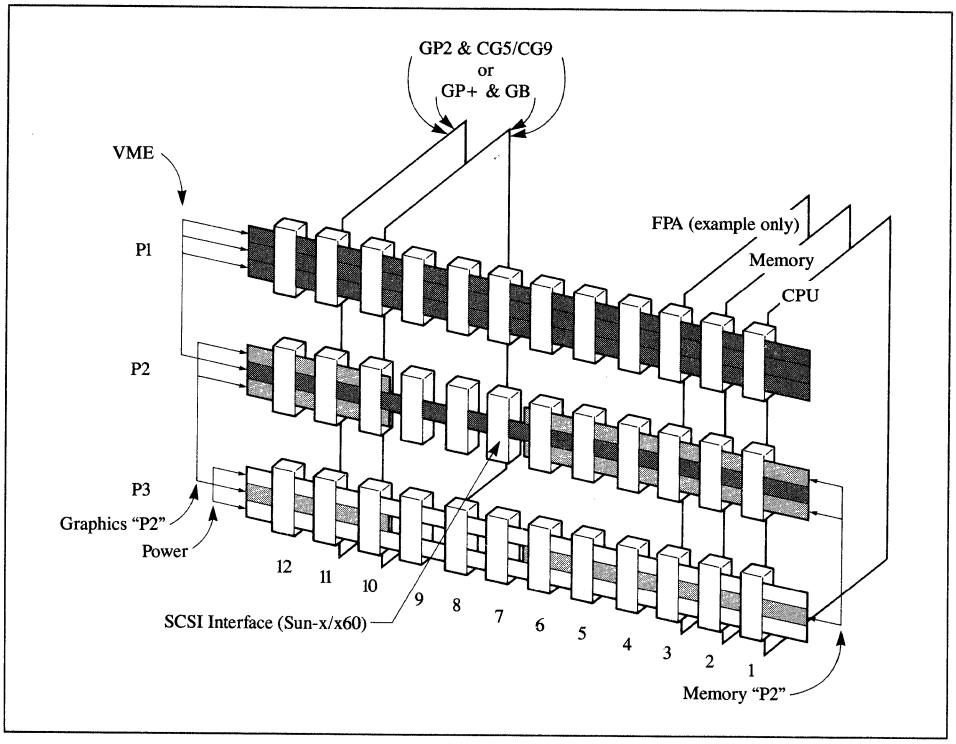


Figure 4-2 *Slot Numbering in the Sun-3/x60*

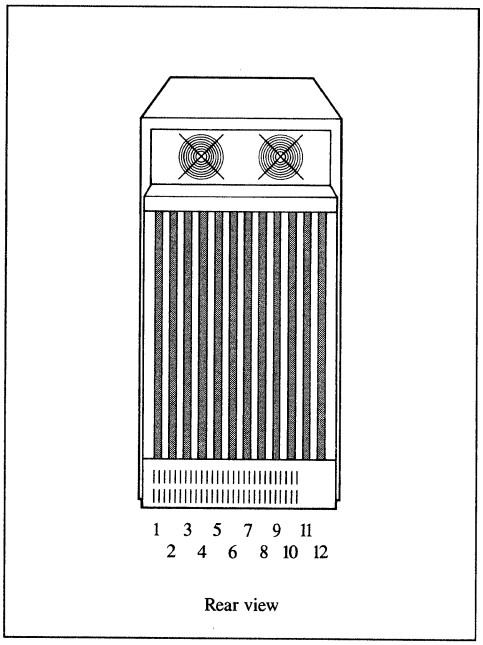


Figure 4-3 *Slot Numbering in the Sun-3/x80*

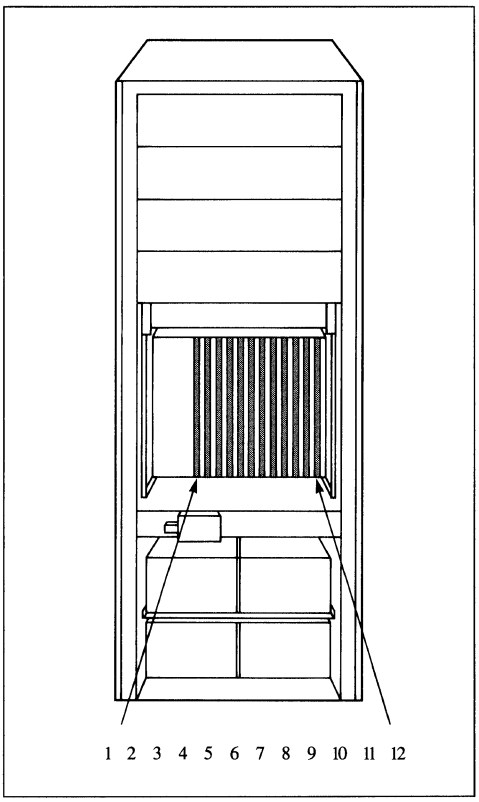


Figure 4-4 *P Connectors for the Sun-3/470 Backplane*

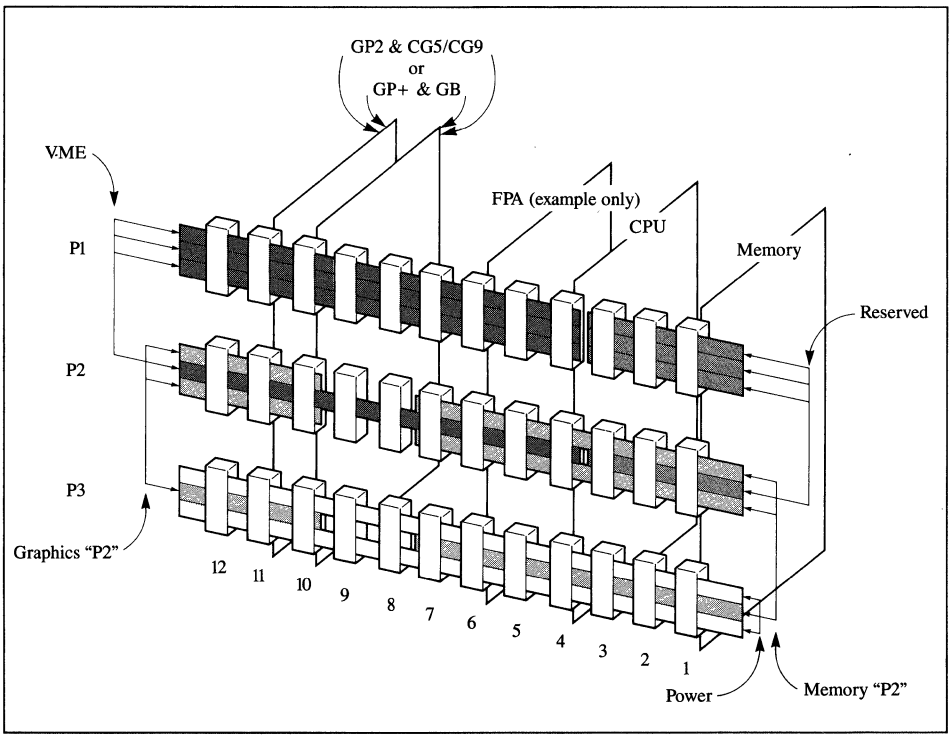


Figure 4-5 *Slot Numbering in the Sun-3/x50 (6-slot)*

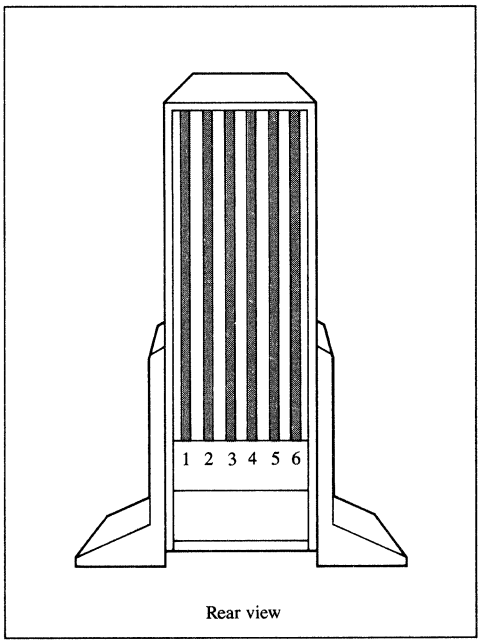
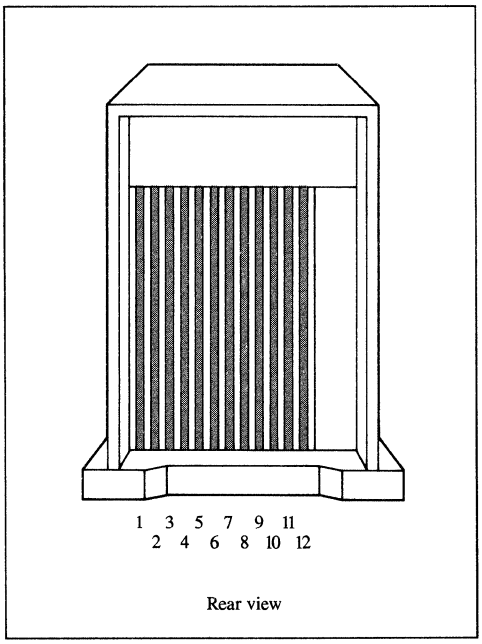


Figure 4-6 *Slot Numbering in the Sun-3/x70 (12-slot Office Pedestal)*



It may help to remember that a "bus" is completely different from a "connector"; thus the *P2* bus is not the same thing as the *P2* connector. Table 4-1 shows the associated pins on each connector.

Table 4-1 *Sun Backplane and Buses for 3/x50, 3/x60, and 3/x80*

Sun Backplane and Buses for 3/x50, 3/x60, and 3/x80					
Conn.	***Col.***	***Pins***	***Function***	***Bus Groups***	
				3/x50	***3/x60 3/x80***
P1	A	1–32	VME	1–6	1–12
	B	33–64	VME	1–6	1–12
	C	65–96	VME	1–6	1–12
P2	A	1–32	"P2" Address	1–4,5,6	1–6,7,8,9,10–12
	B	33–64	VME	1–6	1–12
	C	65–96	"P2" Signals	1–4,5,6	1–6,7,8,9,10–12
P3	A	1–32	Power (VCC +12V, -5.2V)	1–6	1–12
	B	33–64	"P2" Data	1–4,5,6	1–6,7,8,9,10–12
	C	65–96	Power (Gnd +12V, -5.2V)	1–6	1–12

Table 4-2 *Sun Backplane and Buses for 3/x70*

Sun Backplane and Buses for 3/x70				
Conn.	***Col.***	***Pins***	***Function***	***Bus Group 3/x70***
P1	A	1–32	Reserved VME	1–3 4–12
	B	33–64	Reserved VME	1–3 4–12
	C	65–96	Reserved VME	1–3 4–12
P2	A	1–32	"P2" Address	1–7,8,9,10–12
	B	33–64	Reserved VME	1–3 4–12
	C	65–96	"P2" Signals	1–7,8,9,10–12
P3	A	1–32*	Power (VCC +12V, -5.2V)	1–12**
	B	33–64	"P2" Data	1–7,8,9,10–12
	C	65–96	Power (Gnd +12V, -5.2V)	1–12

NOTES

* For the 3/x70 backplane, only pins 1–25 and 27–32 are used for power; pin 26 is not used.

** For the 3/x70 backplane, pin 26 of slots 1–3 are bussed together.

You will notice that the VMEbus is accommodated on **both** the P1 and P2 connectors. This is because the VMEbus has **over** 96 signals and there are only 96 pins per connector. Thus, some VMEbus signals are on the middle row of the P2 connector. The P2 bus is then accommodated on **both** the P2 and P3 connectors.

VMEbus Functional Structure

The VMEbus interface system consists of backplane interface logic, four groups of signal lines called "buses," and a collection of "functional modules" that can be configured to interface devices to the buses. The functional modules communicate with each other using the backplane signal lines.

The interface functions of the VMEbus are divided into four categories. Each category consists of a bus and associated functional modules that work together to perform specific duties within the system interface.

Data Transfer Bus
Contains the data and address pathways and associated control signals. Functional modules called "Data Transfer Bus (DTB) Masters" and "DTB Slaves" use the DTB to transfer data between each other.

DTB Arbitration
Area of the VMEbus specification that defines the signals (arbitration bus) and modules (DTB Requesters and DTB Arbiter) to perform the control transfer. This definition provides a way to transfer control of the DTB between Masters in an orderly manner and to guarantee that only one Master controls the DTB at a given time.

Priority Interrupt
Allows an interrupt handler to service devices that request interruption of normal bus activity. The interrupt requests are prioritized into a maximum of seven levels. The associated functional modules, called Interrupters and Interrupt Handlers, use signal lines called the Interrupt Bus.

Utilities
Include the system clock, initialization, and failure detection. The utility bus has a clock line and a system reset line.

VMEbus Master Features on the CPU Board

The VMEbus Master on the CPU board offers:

- Data Bus Size: D32 MASTER 32-bit, 16-bit, or 8-bit data transfers
- Address Bus Size: A32 MASTER 32-bit, 24-bit, 16-bit addresses
- Timeout Option: 737 microsecond timeout period including bus acquisition
- Sequential Access: None
- Interrupt Handler: IH(1-7) STAT Level 1 through 7
- Requester Option: ROR R(3) Release on Request, level 3
- Bus Busy Option: Release BBSY after AS assertion when releasing bus
- Read/Modify/Write: Will not release VMEbus during Read/Modify/Write cycles

The VMEbus Master Interface uses two page map Type codes, one for 16-bit data and the other for 32-bit data. For each Type code, the interface supports three VMEbus address spaces.

- Four gigabytes minus the top 16 megabytes for 32-bit addressing
- the top 16 megabytes minus the top 64 kilobytes for 24-bit addressing

Interrupt Handler

The Interrupt Handler option tells to which interrupt request line a given Interrupt Handler responds. The notation used is IH(x-y), where x is the lowest numbered interrupt request line number and y is the highest. X may equal y when the Interrupt Handler responds to only one level. Request lines are numbered from 1 (lowest) to 7 (highest).

Requester Options

The VMEbus has two requester options. Sun uses the Release on Request (ROR) option, which reflects the basic criteria the requester uses when determining when to release the DTB for arbitration. An ROR requester does not release the BBSY (bus busy) line each time its on-board Master indicates it no longer wants

the bus. Instead, it waits until some other requester requests the DTB. The ROR option is beneficial in systems where the maximum data transfer rate for a particular Master is desired and in which other Masters have a comparatively low bus usage.

The Arbiter/Requester is a synchronous state machine responsible for giving the CPU control over the VMEbus while holding off other devices wishing to control the VMEbus. The Arbiter/Requester grants control of the VMEbus to external VME devices when the CPU doesn't wish to access it.

VMEbus Slave Features on the CPU Board

The VMEbus Slave on the CPU board:

- Data Bus Size: D32 SLAVE 32-bit, 16-bit, or 8-bit data transfers
- Address Bus Size: A32 SLAVE 32-bit, 24-bit, (no 16-bit addresses)
- Sequential Access: None
- Special Access Mode: A high-speed access mode is engaged if the time from DTACK assertion to the next AS and DS assertion is less than 200 nanoseconds.
- Interrupter Options: None

The VMEbus Slave interface supports Direct Virtual Memory Access (DVMA) transfers into the CPU virtual address space. These transfers give direct access through the Memory Management Unit (MMU) to main memory and offer:

- Byte, word, and longword transfers
- Access defined entirely by the VMEbus 24- or 32-bit VMEbus address and the address modifiers identifying the address mode, AM <5..4>. The VMEbus Address Modifier bits AM<2..0> defining the access protection of the VMEbus request are ignored. The 16-bit address space is also ignored.
- Access to non-existing memory or other (non-Type 0) devices results in a VMEbus Bus Error return.
- A VMEbus Bus Error is also signaled if the DVMA cycle encounters a page fault, protection error, or (on read cycles only) a memory error. Memory errors that include parity errors and ECC errors that are not correctable and are also reported to the CPU as interrupts, if enabled.
- Direct Virtual Memory Access (DVMA) offers high-bandwidth burst modes of transfer that allow fast DVMA devices to increase throughput by eliminating repeated bus arbitration.

VME Address Space and Peripheral Devices

Sun designs have a VME I/O bus interface that supports 16-, 24-, or 32-bit address spaces and 8-, 16- or 32-bit data transfers. Each peripheral device installed in a Sun system is assigned a set of addresses in the I/O space for its device control registers and possibly a set of addresses for data buffers, depending on the device. The registers usually appear as memory locations. If an application requires adding non-Sun boards to a Sun system, its location in address

space may be critical.

Sun assigned standard addresses to all devices that may be supplied with a Sun workstation. Typically, the number of control registers for one device is small (2 to 64 contiguous addresses). Ample I/O space is available for more devices. A substantial portion of this 24- or 32-bit address space is also assigned to the devices that may be supplied with a Sun workstation, for example, a color frame buffer and Sun-3 Ethernet controller. If a non-Sun device uses an unusually large set of I/O registers or if the base registers of the device are not switch-selectable, ask Sun Technical Support to check the feasibility of installing that device on a Sun workstation.

The following tables list the 16-bit, 24-bit, and 32-bit VMEbus address space blocks.

Table 4-3 *16-bit VMEbus Address Space*

16-bit VMEbus Address Space Blocks			
Address	***KB***	***Alloc from***	***Use***
0x0000-0x8000	32	Low	Reserved for OEM/user devices

Table 4-4 *24-bit VMEbus Address Space*

24-bit VMEbus Address Space Blocks			
Address	***KB***	***Alloc from***	***Use***
0x000000-0x100000	1024		CPU board DVMA space
0x100000-0x200000	1024		Reserved for the Future.
0x200000-0x300000	1024	Low	Reserved for small Sun devices
0x300000-0x400000	1024	High	Reserved for large Sun devices
0x400000-0x800000	4096	(Taken)	Reserved for huge Sun devices such as color board and graphics in the Sun-4/260
0x800000-0xc00000	4096	High	Reserved for huge OEM/user devices
0xc00000-0xd00000	1024	Low	Reserved for large OEM/user devices
0xd00000-0xe00000	1024	High	Reserved for small OEM/user devices
0xe00000-0xf00000	1024		Multibus-to-VMEbus memory space
0xf00000-0xff0000	960		Reserved for the Future
0xff0000-0xffffff	64		Not addressable (CPU references 24 or 16-bit space)

NOTE *The Multibus-to-VME Adapter puts cards into the same place in 16-bit VMEbus space as in Multibus I/O space. This placement may move the standard Multibus addresses for some cards into the OEM/user area on the VMEbus.*

These same assignments apply to both 16-bit-data and 24-bit-data VMEbus accesses. The *Alloc from* field shows whether Sun allocates individual devices from the high end of the range or the low end. The maximum size "hole" is kept in the middle in case the boundary needs to be shifted later.

The next two tables show the specific VMEbus address space for 16-bit and 24-bit devices.

Table 4-5 *Sun-3 16-bit VMEbus Address Space Devices* *

	VME 16-Bit Space	
Device	***Address***	***Size***
tm0	0xa0	0x2
tm1	0xa2	0x2
mti0	0x620	0x8
mti1	0x640	0x8
mti2	0x660	0x8
mti3	0x680	0x8
xyc0	0xee40	0x6
xyc1	0xee48	0x6
xtc0	0xee60	0x6
xtc1	0xee68	0x6

NOTE * *See the Commands Reference Manual, Chapter 4S, for the complete list of options supported by the latest SunOS release.*

Table 4-6 *24-bit VMEbus Address Space Devices* †

	Sun-3 VME 24-Bit Space	
Device	***Address***	***Size***
sc0*	0x200000	0x10
si0	0x200000	0x22
gpone0	0x210000	0x10000
cgtwo0	0x400000	0x310600
ie1‡	0xe40000	0x40000
ie1	0xe88000	0x848

NOTE * *The si and sc boards are at the same address because a system can have one or the other, but not both.*

† See the Commands Reference Manual, Chapter 4S, for the complete list of options supported by the latest SunOS release.

‡ The ie1 board uses two separate pieces of the address space, thus two addresses are shown.

Table 4-7 *32-bit VMEbus Address Space*

Address and Data Type	*Physical Base Address*
VME A32D16	0x00000000
VME A24D16	0xff000000
VME A16D16	0xffff0000
VME A32D32	0x00000000
VME A24D32	0xff000000
VME A16D32	0xffff0000

VME Priority, DMA Devices, and Transfer Rates

The Sun-3 68020 and 68030 processors use Direct Memory Access (DMA) devices, which communicate over the P1 bus providing direct access through the MMU to main memory. This feature is known as Direct Virtual Memory Access (DVMA). DVMA means that I/O devices such as the network interface or the disk interface, as well as coprocessors, use virtual addresses to communicate with main memory. These references are translated, protected, and checked in identical fashion as those in the CPU. This process streamlines and insures the integrity of software on the system.

When the CPU is the VMEbus master, it can move data to an ideal VME device at a peak rate of 9.5 megabytes per second. When the CPU is the VMEbus slave, which means that DVMA is being performed, it can receive data at a peak rate of 7.8 megabytes per second.

During DMA activity, parallel priority arbitration means that access to the system bus is granted to the highest priority device that requests it. Priority is determined by the location of the card in the cardcage. The slot with the highest rank in the cardcage is slot one.

Finding the right order for DMA boards requires understanding device and bus latencies, bus and device bandwidths, and device or system performance penalties for missed transfers. It may take experimenting. The right order depends on the following.

- Data transfer rate of the device
- Amount of board buffering
- The characteristics and usage of other devices in the system

The Sun processor is always installed in slot one (or the lowest useable slot), making it the highest priority board. If you add non-Sun DMA boards, analyze and test the system to select the right slot.

4.2. Serial Port Configuration and Speed

A Sun processor board has two asynchronous serial ports (RS-423), compatible with RS-232 devices. These serial ports are configured as DTE (Data Terminal Equipment) with modem control signals. The ports are used for driving output devices such as printers or plotters, or connecting input devices such as modems and terminals.

The serial ports are programmed I/O devices (rather than DMA devices) and have only a three-character hardware buffer each although they support both high-speed output (up to 19.2 kbaud) and input (up to 9.6 kbaud).

The system may lose characters if the ports are connected to other computer systems or to high-bandwidth data acquisition devices that constantly send data. Continuously high data rates on the serial ports also significantly degrade the performance and responsiveness of other system activities.

For applications requiring multiple serial lines, high data rates, or continuous input activity at any speed, Sun offers a 16-channel asynchronous line multiplexer, the ALM-2.

4.3. External Cable Connections

The external connectors on Sun workstations are mounted directly on the printed circuit boards. Cabling is needed only for external options such as tape or disk drives. These connectors are provided for the external cables that connect the workstation to the peripheral device. Some options require only one connector (such as an Ethernet interface), while others require two or more connectors (such as SMD disk command and data cables).

The SunOS allows you to define the number of drives per controller and the number of controllers per system. However, Sun limits the numbers to two each for the Xylogics 451 controller and four each for the Sun SMD-4 controller. Data Center packaging restricts the total number of drives to 12. Deskside packaging restricts the total number of controllers to two with a limit of two drives per controller. If your configuration exceeds these numbers, you are responsible for all system engineering issues related to the FCC, UL, and CSA.

Table 4-8 shows the number of slots required for some of the options.

Table 4-8 *Sun Workstation VME Board Rear Panel Requirements*

VME Board	*External Connectors*	*Slots*
Sun-3 CPU (Sun-3/400 CPU)	(2) Serial Ports Video, Keyboard/Mouse Ethernet connectors	1(2) 1
Sun-3/50 CPU	Thin Ethernet BNC Coaxial Cable (4)	2 1
System Options		
ALM-2	2-37 pin connectors 2-25 pin connectors 1-25 pin printer port	1
Color Display Controller	1-13W3-Type	1
FDDI/DX	RS-232, 2 FDDI	1
HSI	RS-449(2), V.35(2)-15 pin D	1
SunLink Channel Adapter	Tag In(1),Tag Out(1), BusIn(1),BusOut(1)	2
SMD-4 Disk Controller	SMD Command (1) Data (2)	1
TAAC-1	BNC coaxial cable(8)	3
Second Ethernet	1	1
Memory Expansion, GP+, GB,FPA,GP2	0	1
½" Tape Controller	Tape Control (2)	1
Color Display Controller(RGB and Sync)	BNC Coaxial Cable (5*)	1
SunLink SCP or MCP	RS-449(2),RS-423(2)	1
SunIPC	Printer port, floppy port	1
Sun-3 SCSI, Sun-2 SCSI	1-50 pin connector	1
SunVideo	8BNC, 2-13W32, YC3,58DIN-4pin	1

NOTE ** Four of the five connectors are used; one is reserved.*

4.4. FDDI/DX

The SunNET FDDI/DX (Fiber Distributed Data Interface/Dual Attach) Controller is a part of SunNet's family of Standard Network Products designed to expand connectivity through the implementation of industry standard communications protocols. SunNet FDDI/DX offers an industry standard network interface for high bandwidth FDDI connections. The American National Standards Institute (ANSI) has developed the Fiber Distributed Data Interface definition, a 100 Mbit per second token ring networking standard based on fiber optic physical media.

The SunNet FDDI/DX Controller consists of a triple-height (9U) VME printed circuit board assembly, driver software, and networking monitoring utilities. Together, these components allow the Sun host to interface to the ANSI FDDI

Dual Attachment Network and connect to two fiber optic rings for high network availability.

Ethernet will continue to be used in many applications. Any Sun server or desk-side workstation that supports FDDI can act as a router between an Ethernet and an FDDI network, via the on-board Ethernet port and the bundled routing software in SunOS.

Supported Hardware Systems

The SunNet FDDI/DX Controller works with currently shipping Sun-3, Sun-4, and SPARCsystem workstations with an available VME slot. (Some workstations need to be upgraded to work with FDDI.) If users wish to boot their workstations over an FDDI link (diskless booting), they will require Version 3.0 or greater of the CPU boot PROM. Customers who have older versions of Sun-3/1xx, 3/2xx, 4/1xx, and 4/2xx workstations would need to upgrade their boot PROMs in order to perform network booting over the FDDI. The boot PROM number is displayed as the "ROM Rev" on the monitor when the Sun workstation is turned on.

Table 4-9 *Supported SunOS Software Level*

Product/Release Supports:	Sun-2	Sun-3	Sun-4	SPARCsystem	SunOS
SunNet FDDI/DX 1.0	No	Yes	Yes	Yes	4.03

Table 4-10 *FDDI/DX Power Requirements*

FDDI/DX Power Requirements	
+5 vdc	11.2 amps
-5.2 vdc	0.1 amps
+12 vdc	1.9 amps
-12 vdc	0.7 amps
Total Watts	87.72 Watts

Table 4-11 *FDDI/DX Dimensions*

FDDI/DX Dimensions	
9U VME card	400mm x 367mm (15.7" x 14.4")

Supported Hardware Configurations

The FDDI controller can be used in a similar manner as the second Ethernet controller. Up to two FDDI controllers will be allowed per workstation. In all configurations it will be possible, but not required, to utilize the built-in Ethernet controller. In most configurations it will be possible to utilize a 2nd Ethernet controller in addition to the FDDI controller (s).

Table 4-12 *FDDI/DX Supported Hardware Configurations*

FDDI/DX Supported hardware Configurations		
Workstation	***# controllers***	***O/S release***
Sun-3 Desktop:		
3/50	none	n/a
3/60	none	n/a
3/80	none	n/a
3/110	none	n/a
3/140	1	4.0.3
Sun-3 Deskside:		
3/150	1	4.0.3
3/160	1	4.0.3
3/260	2	4.0.3
3/460 (upgrade from 3/260)	2	4.0.3
3/470	2	4.0.3
Sun-3 Rackmount:		
3/180S	1	4.0.3
3/280S	2	4.0.3
3/480	2	4.0.3

4.5. Ethernet

For small or localized Ethernet installations, you may purchase 15-meter lengths of Ethernet transceiver cable from Sun Microsystems. These 15-meter lengths should be used only as a single piece and should not be used as extensions with other pieces of cable. These branch cables come with three transceiver types.

- Vampire tap
- N-series in-line
- Thin Ethernet BNC

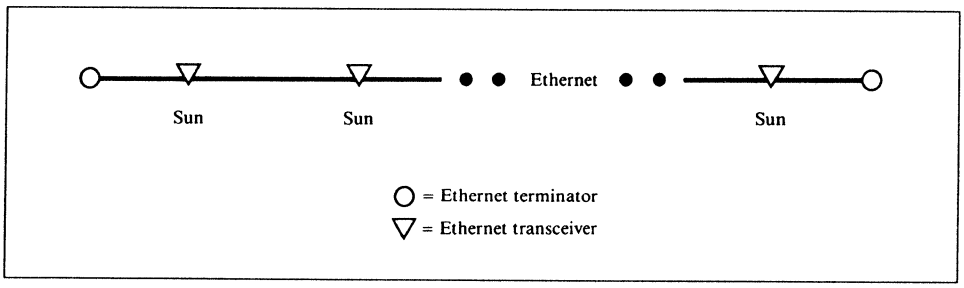
Sun workstations may serve as gateways between physically separate Ethernets. When a gateway is in place, users see a single logical network and have transparent access to all the systems on both physical networks. For performance reasons, SunOS places two limits on this transparency.

- First, a fileserver node and its clients **must be on the same physical network.**
- Second, a fileserver serves clients on **only one physical network** even if the fileserver node is also a gateway node.

A gateway workstation simply has one Ethernet connection to each of the separate Ethernet cables. The software that performs the internetwork routing is included in the standard SunOS software release. The Sun workstation comes with only one Ethernet controller so you must order another Ethernet interface and transceiver to connect to a second network.

The figure below shows the general structure of an Ethernet cable installation.

Figure 4-7 *General Structure of Installed Ethernet Cable*



Thin Ethernet

The Sun-3/50 series has a built-in Thin Ethernet transceiver with a BNC-type T connector that links other nodes with a 50 ohm, ¼-inch diameter, RG-58 coaxial cable. You can connect to a standard Ethernet by using "fat" coaxial cable and external transceivers with a "barrel" connector that has a BNC female connector on one end and a Type N female connector on the other end. For more information, see the *Sun-3/50 Hardware Installation Manual.*

Ethernet Cabling

An 802.3 (IEEE standard) Ethernet can operate with all level 1, or 2, or 1 and 2s mixed. You must set the station for the type of transceiver through which it will talk. Both Thin Ethernet and the 802.3 standard are 50 ohms, 10 megabit networks. Thin Ethernet is limited to 150 meters per segment; standard Ethernet is limited to 500 meters per segment. This means you can have 30 nodes maximum for Thin Ethernet. Thin Ethernet is installed in a daisy-chain fashion with one end terminated with a special terminator. Thin Ethernet can have stations at shorter intervals, with minimum spacing of .5 meter. Thin Ethernet transceivers are usually internal, but can be external. The cable comes in sections that use a T-type BNC connector.

NOTE *Sun recommends that you do* **not** *mix Thin and standard Ethernet.*

Ethernet Q and A

Q1 What is the longest length of Ethernet cable in a network?

A The longest length possible is 500 meters. This can be composed of one full continuous piece of cable or segments, but the segments must be either 23.4, 70.2 or 117 meters for electrical reasons.

Q2 What is the maximum amount of time between recognition of a collision and repeating of a collision?

A The maximum amount of time between recognition of a collision and the repeating of a collision (excluding carrier sense or retiming delays) is 200 nanoseconds.

Q3 Should I ground the system?

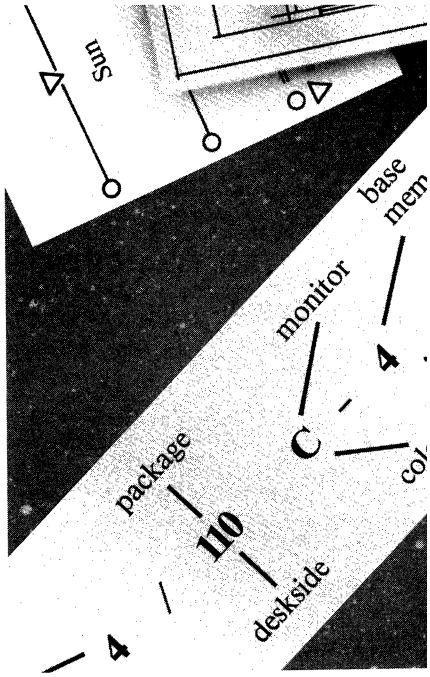
A The sheath conductor of the transceiver cable should be connected to an earth ground.

Q4 What are the proper lengths for adding transceivers?

A Transceivers should be no closer than 2.5 meters from each other.

5

Power Requirements



5

Power Requirements

This chapter discusses the power requirements for the Sun-3 workstations and servers. See Appendix A for more site Environmental requirements.

5.1. System-level Configuration Issues

For the system-level options described in Chapter 3, the volt amp (VA), watts and BTU/hr figures show what the option uses if it is the only device accessed. Because the hardware and software design of Sun products does not allow all options to function fully at the same time, the sum of the options' values does not reflect the actual requirements of an operating configuration. Since the real values for VA, watts, and BTU depend on your application, only approximations can be made.

As a general rule, the ½-inch tape subsystem does not run 24 hours per day. Thus, both of the drive's standby (with full power on) and run time values are presented. Please consider which set of values to use when calculating your installation's requirements.

The disk drive values are calculated for one disk while it is doing random seeks about the disk and writing/reading 8K byte transfers. An application with the ratio of seeks per data transfer is less (such as large data file applications) makes less load on the AC branch circuit because the drive uses more power during a seek cycle than a data transfer cycle.

To estimate the power needs of a Data Center Cabinet and peripherals, take 75% of the total power needs of the system level components. This is the average component use over a three hour period. If you need more precise figures, characterize the AC load for each system-level option. Doing an in-line circuit measurement with a meter that displays true root mean square (rms) values for both current and watts lets you compute the BTU values using the formulas in this section. One meter available for such a measurement is the Model 2101 Digital Power Analyzer from Valhalla Scientific in San Diego. If your measurement needs are temporary, you can rent equipment from several vendors in the U.S. For areas outside the U.S., contact your local Sun Sales Office for recommendations.

All electrical values are rms and are subject to change without notice. Power information is shown in three different formats.

- Volt-Amps to find your AC wiring needs

- Watts to estimate your power bills
- BTUs per hour to find your cooling requirements

Each of the major power formats is explained below.

5.2. Volt-Amps

Volt-Amps (VA) determine the AC wiring requirements for your system configuration. When determining the AC wiring requirements, keep in mind two items.

- Number of AC outlets
- AC branch circuit capacity

To determine the number of AC outlets you will need, count the number of AC power plugs for your system and peripherals. Note that some Sun desktop products have a convenience outlet at the rear of the base housing for connecting the AC power cord of the monitor or another peripheral device.

To find the AC branch circuit you need, you must add the volt-amps value for each component in your configuration. Divide this sum by the typical line voltage (100, 120, 200, 220, or 240 VAC) to get the final value in amps.

Example

Here is an example for a Sun-3/50 with a Mass Storage Subsystem with a disk and tape in a 120 VAC installation.

Typical VA = 196 (Sun-3/50M) + 114 (MSS)
Typical VA = 310
Typical Amps = 310 / 120 = 2.7 Amps

We show volt-amps in both typical and worst-case categories. The typical values shown are calculated by multiplying a measured rms AC current value by 120 VAC (the line voltage when the measurement was made). Worst-case values shown are calculated by multiplying the worst-case watts by the reciprocal power factor, 1.54.

5.3. Watts

We list watts to help you project your power bills. To do this, you will need to know your local utility rates and the number of hours per month that your systems are on.

Example

Typical Watts = 143 (Sun-3/50M) + 80 (MSS)
Typical Watts = 223

Watts (P_{true} in formula A) are shown in both typical and worst-case categories. Typical values are measured rms values. Worst-case values are the DC wattage ratings for power supplies (when known) multiplied by the reciprocal power supply efficiency, 1.43.

5.4. BTUs/hour

To help you find your air conditioning requirements, we provide BTUs/hour. Your cooling requirements will depend on your local climate and the total BTUs/hour from your configuration. BTUs/hour are calculated by multiplying watts by a BTUs conversion constant of 3.412.

5.5. Power Calculations

Because Sun products can have many different configurations, you must calculate the current draw and thermal dissipation of your system according to your specific configuration.

To calculate the current draw of your configuration.

- Find the power required by the display.
- Add the power required by the peripherals by referring to the tables in this chapter.
- Calculate the power required by the logic enclosure (the box that contains the CPU and other plug-in boards) by referring to the tables in this chapter. Multiply the total power required by the power factor explained below.

Calculate the current draw of your configuration with these formulae. Examples are given later in the procedures in this chapter.

Calculating AC Watts (Formula A)

$$P_{true} = P_{DC} x \frac{1}{PS_{Eff}} (true\ AC\ power\ in\ watts)$$

where:

P_{DC} = *total DC power in watts user–calculated*

$\frac{1}{PS_{Eff}}$ = *reciprocal of power supply efficiency* ($\frac{1}{0.7} = 1.43$)

Calculating Thermal Dissipation (Formula B)

All Sun products have approximately the same power supply efficiency.

$$BTU_{nom} = P_{true} \times 3.412 \frac{BTU}{watt}$$

where: P_{true} = true AC power in watts from above.

Calculating Volt-Amps (Formula C)

$$VA = P_{true} x \frac{1}{PF}$$

Where: P_{true} is from above formula.

$\frac{1}{PF}$ = reciprocal of Power Factor ($\frac{1}{0.65} = 1.54$ or $\frac{1}{0.715} = 1.4$)

Where the Power Factor for the Sun-3/60/80/160 = 0.65.

Where the Power Factor for the Sun-3/260/280 = 0.715.

Where the Power Factor for the Sun-3/150 = 0.9 at full load.

Where the Power factor for the Sun-3/470 = 1.0.

Calculating Sun Product Requirements

VA_{total} = Sum of VA values for logic enclosure + VA values for each Sun device

$Watts_{total}$ = Sum of watts value for logic enclosure + watts values for each Sun device

BTU/hr_{total} = Sum of BTU/hr value for logic enclosure + BTU/hr values for each Sun Device

Calculating Current Draw for the AC Branch Circuit

$$I_{nom} = \frac{VA_{branchtotal}}{VAC_{nom}}$$

where: $VA_{branchtotal}$ = Sum of the VA values for each device (Sun and non-Sun) sharing the same AC branch circuit.

VA_{nom} = *typical AC line voltage* (100, 120, 200, 208, 220, 230, 240)

5.6. AC Branch Circuit Limitations

This section helps you find if you must make any changes to your facility to use Sun products. When configuring and installing your Sun products, you should be aware of AC branch circuit current limitations imposed by local electrical codes. Individual products or groupings of Sun products may exceed the limitations discussed in this section. Make sure not to exceed the local electrical code's limitations when configuring these Sun products.

A fully configured logic pedestal will draw 12 Amps in the 100 to 120 volt operating range. Treat the logic pedestal as fully configured so that site planning will allow for upgrades.

U.S. and Canadian electrical codes allow only an 80% load on any given branch circuit. The 80% derating limit does not apply in other countries. Make sure that the total current does not exceed the branch circuit limits for your installation. Check the local electrical codes to be sure you do not overload a circuit.

The cords will plug into 15 amp (maximum load is 12 amps) and 20 amp (maximum load is 16 amps) outlets in the U.S. Other areas have typical branch circuit ratings of 10, 13, 15, or 16 amps depending on the country.

A number of outlets may be connected to a single branch circuit. Ask a facilities manager to be sure for your installation. Many electricians include this information inside circuit breaker panels. Additional circuits may be required to handle the monitor and/or expansion pedestal.

The U.S. National Electric Code (sections 210-22[c], 210-23, and 64S-2[a]) limits the total current of connected devices to 80% of the AC branch circuit's maximum capacity averaged over a three hour period. For the United States, the standard AC branch circuit is 15 amps at 120 volts AC (VAC). Table 5-1 presents all of the different 120 VAC branch circuits that may be used by Sun equipment and their maximum permissible current loads in the U.S.

Table 5-1 *Circuit Breaker and Maximum Current*

Circuit Breaker Rating	*Maximum Allowed Current*
15 A	12 A
20 A	16 A
30 A	24 A

For areas outside the United States, contact the agency responsible for local electrical codes about specific information on local AC branch circuit limitations. Make sure that the total current load of the branch circuit to which Sun equipment is to connected does not exceed the figures in the above table. In some cases, the logic enclosure alone will require its own branch circuit.

Impact of Non-Sun Devices on the Same AC Branch Circuit

You must also calculate the volt amp values for non-Sun electrical devices on the same branch circuit. Some non-Sun device calculations are as follows.

- For a lamp with a 100 watt light bulb, the volt amp equivalent is 100 volt amps because the light bulb is a purely resistive device.
- For a small electrical office appliance such as an air purifier, consult the manufacturer's manual or look for a rating that is probably located on the outside of the device close to where the power cord enters the casework. If the rating is in amps and volts, just multiply the two values together. If the only value available is in watts, multiply the watts value by 1.67 to be on the safe side. The 1.67 value is the reciprocal of a 0.60 power factor (usually the worst-case rating any product has).

Sun Product Power Limits

All Sun 6-slot and 12-slot products are rated to work without failing to voltages as low as 90 VAC on a 120 VAC branch circuit. At the lowest working voltage, the current draw increases to maintain the power applied to the unit at the higher voltage. Since 15 amps at 90 VAC is about equal to 12 amps at 120 VAC, a 15 amp line fuse is used for these products. Sun power supplies are rated for operation between 47 Hz to 63 Hz.

For each type of AC branch circuit, Table 5-2 presents the maximum DC loads in watts that are for each Sun product when no other electrical loads are connected to the same AC branch circuit. Variations between the products are the result of power supply design differences (for instance, Sun-3/160 vs. Sun-3/260).

CAUTION **Phase currents into many Sun products (or any other products using switching power supplies without power factor correction) do not cancel in the neutral of a three-phase distribution system. This can result in the neutral carrying excess currents when the distribution system is heavily loaded with switching power supply loads. Contact your facilities manager or a qualified electrician if you suspect this problem might occur.**

Table 5-2 *Maximum Allowed Load* (DC WATTS) For Standard Nominal VAC Levels*

Sun Product	*Maximum Rated Power Supply Output (DC watts)*	*Maximum Allowed Load* (DC WATTS) For Standard Nominal VAC Levels*					
		100 VAC	120 VAC	200 VAC	208 VAC	220 VAC	240 VAC
3/50/60 (before 12/15/88)	100	100	100	100	100	100	100
3/50/60 (after 12/15/88)	116	116	116	116	116	116	116
3/80	85	85	85	85	85	85	85
3/150	575	575	575	575	575	575	575
3/160	825	546	655	546	568	600†	655†
3/260/280/480**	850	600	690‡	600	624	660	690‡
3/470	925	925	925	925	925	925	925
3/480††	925	690‡	690‡	690‡	690‡	690‡	690‡

NOTES

* "Maximum allowed load" values may be less than "maximum rated power supply output" values due to AC line current limitations.

† VAC values shown represent nominal line voltage values (+/- 10% variation is assumed). 100 VAC and 200 VAC are for Japan. 120 VAC is for North America. 220 VAC is for continental Europe. 240 VAC is for the United Kingdom, Ireland, and Australia. Consult your local sales office for information in other areas.

‡ Because of cooling constraints of the logic pedestal, no more than 690 Wdc is allowed.

** Systems shipped before 10/1/89

†† Systems shipped after 9/30/89

When determining DC power requirements for your specific configuration, you must include backplane and cooling fan(s) loads. Table 5-3 presents DC power requirements for all Sun provided options.

Early European Sun-3/160 products were shipped with a 5 amp 250 VAC line fuse. If your unit has a 5 amp fuse and more DC power is required, a 6.3 amp fuse may be installed to allow for an additional power capability. Contact your local Sun Customer Service Office for information on the fuse.

Beside checking that the overall DC wattage capacity of the power supply is not exceeded, use the following table to make sure that none of the individual DC output current ratings for the power supply are exceeded when configuring your system. To calculate your needs, use the values in Table 5-3.

Table 5-3 *DC Output Current Ratings for Configurable Sun Products*

	DC Output Capacity					
Output	***3/50 & 3/60***	***3/80***	***3/150***	***3/160/260/280****	***3/260/280/480******	***3/470***
+ 5.0	15/20 amps*	12 amps	100 amps	120 amps	150 amps	150 amps
- 5.2	2.0/1.0 amps*	-	8 amps	10 amps	15 amps	15 amps
+12.0	1.3/0.5 amps*	0.4 amps	3.0 amps	15 amps	15 amps	15 amps
+12.0 MTR	2.0 amps	2.0 amps	-	-	10 amps	15 amps
-12.0	n/a	0.1 amps	1.5 amps	5 amps	10 amps	10 amps

NOTE ** 2nd value for Sun-3/60 systems manufactured after 12/15/88.*

** For systems shipped before 10/1/89

*** For systems shipped after 9/30/89

If the stable line voltage is lower or higher than 120 VAC, you may calculate the maximum allowed DC load using one of the following product's formulas.

Sun-3/50/60/140/150 and Sun-4/110/150

These products draw less than 15 amps at 90 VAC. They will not exceed the 12 amp limit at 120 VAC.

5.7. Safety Agency Approvals

The deskside and Data Center cabinet products have operating voltage range limitations relative to safety agencies' approvals. UL and CSA approvals cover only the 120 VAC operating range. TUV GS approval covers only the 230 VAC operating range. All other products are approved for both ranges.

5.8. Power Connections

In the U.S., your configuration may need a 15, 20, or 30 amp branch circuit. Table 5-4 and Figure 5-1 show the National Electrical Manufacturers Association (NEMA) receptacle you will need to match the Sun-supplied plug. If you are not in the United States, please contact the local Sun Sales Office for information regarding connectors and receptacles needed.

All older "V4" products (220/240 VAC nominal) leave the Sun factory with "pigtail" (stripped wires with no connector) cables. The only exception to this policy is the "V4" 76-inch rack products, which have a 32 amp, 220-240 VAC

single phase IEC 309 connector. New products have country kits. Distribution centers may remove "pigtail" cords and update with different cables.

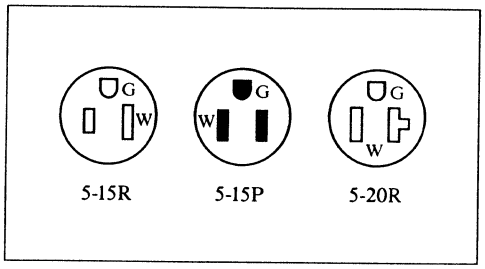
NOTE *Contact your Sun Customer Service office for assistance if the power cord provided with your system is not the correct type for your wall outlet.*

Table 5-4 *NEMA Power Connections*

NEMA Power Connections		
	Plug	***Receptacle***
120 V at 15 amps	5-15P	5-15R/5-20R
120 V at 20 amps	N/A	5-20R
120 V at 30 amps	L5-30P	L5-30R
230 V* at 30 amps	L6-30P	L6-30R

NOTE ** denotes "V3"*

Figure 5-1 *Deskside/Desktop NEMA Receptacles and Plugs*



Calculating Typical Power Consumption for the Sun-3/60

For the Sun-3 products, typical power consumption values for VA, watts, and BTUs/hr depend on the product's configuration. Follow the procedure below to calculate these values.

As an example, we show how these values are calculated for a standalone Sun-3/60 with four megabytes of expansion memory and one mass storage subsystem (disk and tape). The mass storage subsystem is connected to the four megabyte expansion memory which has a SCSI controller piggy-backed to it. This configuration would run at 120 VAC.

1. Make a table listing the individual DC voltage ampere values and the total watts values for each option in your configuration.

Component	+5A	-5.2A	+12A	Total Watts
2-slot backplane	1.4	-	-	7.0
Keyboard	0.4	-	-	2.0
Mouse	0.2	-	-	1.0
CPU (4 MB)	15.0	0.8	-	80.2
Memory (4 MB)	2.4	-	-	12.0
Sun-2 SCSI	2.8	-	-	14.0
TOTAL	22.4	0.8	-	116.2

1. Add up the "total" value for each column of values in your table. See previous example.
2. Each of the calculated "DC voltage ampere" columns' "total" values have a corresponding limitation. Note that none of the totals from Step 1 and 2 exceed their corresponding limits in Table 4-9.
3. To calculate "AC Watts" for projecting your power bills, insert the total DC watts value calculated in Step 2 into Formula A in Section 4.4. Total DC watts value is P_{dc} in Formula A.

   $P_{DC} = 116.2\ watts\ (from\ Step\ 2)$

   $P_{true} = (116.2\ watts) x\ 1.43$

   $P_{true} = 166\ watts$

4. To calculate BTUs/hr for projecting your cooling requirements, insert the P_{true} calculated in Step 4 into Formula B in Section 4.4 .

   $$BTU_{nom} = P_{true}\ x 3.412 \frac{BTU}{watt}$$

   $$\frac{BTU}{hour} = 166x3.412$$

   $$\frac{BTU}{hour} = 566$$

5. To calculate Volt-Amps, insert the P_{true} value calculated in Step 4 into Formula C in Section 4.4.

   $$VA = P_{true} x \frac{1}{PF}$$

   $$VA = 166x\,1.54$$

   $$VA = 256$$

6. Now that you have calculated the logic enclosure's AC watts, BTUs/hr, and Volt-Amps values, add these values and the typical values presented in the tables for the other Sun devices used to find your overall installation needs.

	VA	Watts	BTU/hr
Monitor	96	66	225
3/60	256	166	566
MSS	114	80	273
TOTAL	466	312	1064

1. To find your overall installation requirements, add in the values for non-Sun product needs. See the section *Impact of non-Sun Devices On the Same AC Branch Circuit* for more information.

Note that the AC branch required is 15 amps if these are the only Sun devices installed because of the following.

$$I_{nom} = \frac{Volt\text{–}Amps}{VAC_{nom}}$$

$$I_{nom} = \frac{466}{120}$$

$$I_{nom} = 3.9\ Amps$$

5.9. Sun-3/50/60 Series

The next chart shows the power requirements for the Sun-3/50M. The values shown include both the logic enclosure **and** the monochrome display.

Table 5-5 *Sun-3/50/60M Desktop Workstation Power Requirements*

Sun-3/50/60M Desktop Workstation			
	VA	***Watts***	***BTUs/hr***
Surge/typical	196	143	488
Worst-Case	366	238	812
Fuse			
120 VAC		7 amps, 250 V slow-blow	
230 VAC		4 amps, 250 V slow-blow	

5.10. Maximum Power Consumption

For Maximum (worst-case) power consumption, use Table 5-6. These values must also be added to the worst-case values for whatever device is plugged into the enclosure's AC Convenience Outlet.

Table 5-6 *Maximum Power Consumption* by Voltage Range*

Sun Product †	*Line Current By VAC Range*		*100/120 VAC*			*120/240 VAC*			*220 VAC*		
	100-120	200-240	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr	AC watts	VA	BTUs/hr
3/50 (100 WDC)**	6***	3	143	220	488	143	220	488	143	220	488
3/50 (116 WDC)	6	3	166	255	566	166	255	566	166	255	566
3/60 (100 WAC)	6	3	143	220	488	143	220	488	143	220	488
3/60 (116 WAC)	6	3	166	255	566	166	255	566	166	255	566
3/80	2	1	122	188	416	122	188	416	122	188	416
3/150	12	6	821	1264	2803	821	1264	2803	821	1264	2803
3/160	12	6	780	1200	2661	936	1440	3193	857	1319	2925
3/260/280/480‡,	12	6	857	1199	2925	987	1382	3368	943	1319	3217
3/470	12	6	1380	1380	4709	1380	1380	4709	1380	1380	4709
3/260/280/480‡‡	12	6	987	987	3368	987	987	3368	987	987	3368

NOTES

* Based on power supply capacity, power available through the AC convenience outlets for 3/50/60, 6-slot packages are ignored.

** Units produced after 12/15/88 have a 116 WDC power supply.

*** 3/1.5 for the base unit. 6/3 reflects 3/1.5A available at output connector for monitor.

† Maximum surge for any Sun product is 75 Amp peak for 20 ms after each unit is off for 30 minutes.

‡ For systems shipped before 10/1/89 (850 watt version).

‡‡ For systems shipped after 9/30/89 (925 watt version).

5.11. Fuse Ratings for the 6-slot, and 12-slot Products

This section provides fuse ratings for all Sun-3 products.

The fuse ratings are shown in Table 5-7.

Table 5-7 *Fuse Ratings*

Fuse Ratings (all rated at 250 VAC)			
Product	***Nominal AC Volts***	***Fuse Rating V3 (North America)***	***Fuse Rating V4†***
Sun-3/50/60	120	7 amps slow-blow	
Sun-3/50/60	230	-	4 AT†
Sun-3/80	120	**	**
Sun-3/80	230	**	**
Sun-3/150/160	120	15 amps	-
Sun-3/150/160	230	-	6.3 AT†
Sun-3/260	120	15 amps	-
Sun-3/260	230	-	6.3 AT†
Sun-3/280/480	120	15 amps	-
Sun-3/280/480	230	6 amps slow-blow	6.3 AT†
Sun-3/280R1	120	15 amps	-
Sun-3/280R1	230	6 amps slow-blow	6.3 AT†
Sun-3/470	N/A		

NOTES

* Sun-3/160's ordered with Option 910A were shipped with either a 5 or 6.3 Amp 250 V AC line fuse. If your unit has a 5 Amp fuse and you want to install a 6.3 Amp line fuse, contact your local Sun Sales Office for information regarding the fuse.

** The Sun-3/80 and 3/470 does not have a line fuse.

† "T" denotes time delay type fuse.

Calculating Typical Power Consumption

The typical power consumption values for VA, watts, and BTUs/hr depend on the product's configuration. You must calculate these values at the time the product is ordered as follows.

1. Make a table listing the individual DC voltage ampere values and the total watts values for each option in your configuration. See Table 5-8.
2. Add up the total value for each column of values in your table.
3. Each of the calculated columns' total values have a corresponding limitation, which is presented in the following table. If the calculated value is greater than that limitation, you must delete one or more of the selected options until the limitation is no longer exceeded. The total watts value may be exceeded because the sum of each output's maximum watts value is greater than the overall rating of the supply.

4. To calculate AC watts for projecting your power bills, insert the total DC watts value calculated in Step 2 and verified in step 3 into formula for P_{true} in Section 4.4. This calculated total DC watts value is the formula's P_{DC}.
5. To calculate BTUs/hr for projecting your cooling requirements, insert the P_{true} value calculated in Step 4 into Formula B in Section 4.4.
6. To calculate Volt-Amps for determining the AC Branch Circuit requirements, P_{true} value calculated in Step 4 into Formula C in Section 4.4.
7. Now that you calculated the product enclosure's AC watts, BTUs/hr, and Volt-Amps values, add these values and the typical values presented in the tables for the other Sun devices used to find your Sun installation requirements.
8. To find your overall installation requirements, add the non-Sun devices to your Sun installation requirements. See the section *Impact of non-Sun Devices on the Same AC Branch Circuit* for more information.

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
Section A: Desktop Products					
Sun-3/60 Product Assemblies:					
540-1540 Fan	-	-	0.2	-	2.4
501-1109 Backplane	-	0.5	-	-	2.7
501-1205 CPU (4 MB, Mono)	10.1	0.7	*	-	54.1
501-1322 CPU (4 MB, no FB)	8.9	0.3	*	-	48.1
501-1334 CPU (0 MB, no FB)	8.5	0.3	*	-	46.1
501-1345 CPU (4 MB, no FB)	8.9	0.3	*	-	48.1
501-1547 4 MB SIMM Upgrade (standby)	0.4	-	-	-	2.0
501-1210 3/60 Color FB	2.6	-	-	-	13.0
501-1532 P4 CG6 CX1 FB	4.6	-	-	-	23.0
370-1063 Sun-3 Keyboard	0.4	-	-	-	2.0
320-1005 Type 4 Keyboard	0.2	-	-	-	1.0
370-1058 Sun-3 Mouse	0.2	-	-	-	1.0
370-1058 Sun-4 Mouse	+++	-	-	-	0.0
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
Sun-3/75 Product Assemblies:					
540-1068 Fan	-	-	0.3	-	3.6
501-1093 2-Slot Backplane	1.4	-	-	-	7.0
501-1163 CPU (2MB)	14.6	0.8	*	-	77.2
501-1164 CPU (4MB)	15.2	0.8	*	-	80.2
501-1208 CPU (4MB)	15.2	0.8	*	-	80.2
501-1111 2MB Exp Mem	1.9	-	-	-	9.5
501-1122 4MB Exp Mem	2.4	-	-	-	12.0
501-1045 Sun-2 SCSI Ctlr	2.8	-	-	-	14.0
370-1063 Sun-3 Keyboard	0.4	-	-	-	2.0
320-1005 Type 4 Keyboard	0.2	-	-	-	1.0
370-1058 Sun-3 Mouse	0.2	-	-	-	1.0
370-1058 Sun-4 Mouse	+++	-	-	-	0.0
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
Sun-3/80 Product Assemblies:					
501-1401 CPU(4MB) (F/Bless)	4.6	-	*	-	23.0
501-1408 1 MB SIMM Module (use 4x) (standby)	0.1	-	-	-	0.5
501-1247 P4 MG3 Hi-Res FB	2.7###	###	-	-	13.5
501-1402 P4 MG4 Mono FB	3.3	-	-	-	16.5
501-1443 P4 CG4 Color FB	3.8	-	-	-	19.0

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
501-1518 P4 CG8 24-bit FB	4.8	-	-	-	24.0
501-1532 P4 CG6 CX1 FB	4.6	-	-	-	23.0
320-1005 Type 4 Keyboard	0.2	-	-	-	1.0
370-1058 M4 Mouse	+++	-	-	-	0.0
370-1200 3-1/2" 104 MB Disk	0.7@##	-	0.5	-	9.5
370-1207 3-1/2" Floppy Disk	0.3@	-	-	-	1.5
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
SECTION B: 3-slot package products (x10 & x40 chassis)					
1-Common Assemblies:					
501-1193 3-slot Fan Tray	-	-	(+18 vdc =	0.3 A)	5.4
501-1127 3-Slot Backplane	1.3	-	-	-	6.5
2-Options receiving power from Sun CPU board					
370-1063 Sun-3 Keyboard	0.4	-	-	-	2.0
370-1058 Sun-3 Mouse	0.2	-	-	-	1.0
370-1058 Sun-4 Mouse	+++	-	-	-	0.0
3-Network options receiving power from a Sun Ethernet I/O connector					
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
4-Individual Product Assemblies: †					
Sun-3/110 Product Assemblies:					
501-1134 Sun-3/110 CPU (4MB)	14.7	4.1	0.15*	-	96.6
501-1209 Sun-3/110 CPU (4MB)	14.7	4.1	0.15*	-	96.6
501-1131 2MB Exp Mem	1.8	-	-	-	8.5
501-1132 4MB Exp Mem	2.3	-	-	-	11.5
Sun-3/140 Product Assemblies:					
501-1163 Sun-3/100 CPU (2MB)	14.0	0.8	*	-	74.2
501-1164 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1208 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1131 2MB Exp Mem	1.8	-	-	-	8.5
501-1132 4MB Exp Mem	2.3	-	-	-	11.5

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
SECTION D: 6-slot package products (x50 chassis)					
1-Common Assemblies:					
540-1409 6-slot Fan Tray	-	-	(+18 vdc =	1.0 A)	18.0
501-1128 6-Slot Backplane	1.3	-	-	-	6.5
2-Options receiving power from Sun CPU board:					
370-1063 Sun-3 Keyboard	0.4	-	-	-	2.0
370-1058 Sun-3 Mouse	0.2	-	-	-	1.0
370-1058 Sun-4 Mouse	+++	-	-	-	0.0
3-Network option receiving power from a Sun Ethernet I/O connector					
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
4-Individual Product Assemblies: † sp 5p					
Sun-3/150 Product Assemblies:					
501-1164 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1208 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1131 2MB Exp Mem	1.8	-	-	-	8.5
501-1132 4MB Exp Mem	2.3	-	-	-	11.5
SECTION E: 12-slot package products (x60 chassis)					
1-Common Assemblies:					
540-1252 12-slot Pedestal					
Fans:					
each:	-	-	(0.33)	-	-
6 per unit:	-	-	2.0	-	24.0
8 per unit (latest):	-	-	2.7	-	32.4
501-1092 12-Slot Backplane	1.3	-	-	-	6.5
2-Options receiving power from Sun CPU board:					
370-1063 Sun-3 Keyboard	0.4	-	-	-	2.0
370-1058 Sun-3 Mouse	0.2	-	-	-	1.0
370-1058 Sun-4 Mouse	+++	-	-	-	0.0

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
3-Network option receiving power from a Sun Ethernet I/O connector					
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
4-Options not residing in cardcage					
370-1010 Adaptec SCSI Disk Controller	1.5 +	-	0.1	-	8.7
370-1034 5-1/4" 71 MB Disk	2.0@+	-	3.1	-	47.2
370-1011 Sysgen 1/4" Tape Controller	2.0#	-	-	-	10.0
370-1037 1/4" Tape Drive plus formatter	3.0@#	-	1.9	-	37.8
370-1061 Emulex MT-02 1/4" Tape Controller	1.5#	-	0.04	-	8.0
370-1076 1/4" 60 MB Tape Drive less formatter	1.0@#	-	1.9	-	27.8
370-0552 Emulex MD-21 ESDI SCSI Disk Controller	1.6 +	-	-	-	8.0
370-0551 5-1/4" 141 MB Disk	1.4@+***	-	2.4	-	35.8
370-1133 5-1/4" 327 MB Disk	1.3@+****	-	1.9	-	29.3
5-Individual Product Assemblies: †					
Sun-3/160 Product Assemblies:					
501-1163 Sun-3/100 CPU (2MB)	14.0	0.8	*	-	74.2
501-1164 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1208 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1131 2MB Exp Mem	1.8	-	-	-	8.5
501-1132 4MB Exp Mem	2.3	-	-	-	11.5
Sun-3/260 Product Assemblies:					
501-1100 CPU	22.5	0.6	*	-	115.6
501-1206 CPU	22.5	0.6	*	-	115.6
501-1102 8 MB Exp Mem:					
Standby:	10.0	-	-	-	50.0
Active:	12.3	-	-	-	61.5
501-1576 16 MB Exp Mem:					
Standby:	9.1	-	-	-	45.5
Active :	10.5	-	-	-	52.5
501-1254 32 MB Exp Mem:					
Standby:	9.8	-	-	-	49.0
Active :	14.0	-	-	-	70.0

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
Sun-3/460 Product Assemblies (Field Upgrade Only):					
501-1299 Sun CPU w/o FPA+ or P4 FB	24.5	-	0.3	-	126.0
501-1550 Sun CPU w/o FPA+ or P4 FB	24.5	-	0.3	-	126.0
501-1446 FPA+	2.3	-	-	-	11.5
501-1532 P4 CG6 CX1 FB	4.6	-	-	-	23.0
501-1102 8 MB Exp Mem:					
Standby:	10.0	-	-	-	50.0
Active:	12.3	-	-	-	61.5
501-1576 16 MB Exp Mem:					
Standby:	9.1	-	-	-	45.5
Active:	10.5	-	-	-	52.5
501-1451 32 MB Exp Mem:					
Standby:	9.8	-	-	-	49.0
Active:	14.0	-	-	-	70.0
SECTION F: 12-slot package products (x70 chassis)					
1-Common Assemblies:					
540-1751 12-slot Office Pedestal Fan Tray	-	-	4.8	-	60.5
501-1439 12-Slot Office Pedestal Backplane	2.1	-	-	-	10.5
2-Options receiving power from Sun CPU board:					
320-1005 Type 4 Keyboard	0.2	-	-	-	1.0
370-1058 M4 Mouse	+++	-	-	-	0.0
3-Network option receiving power from a Sun Ethernet I/O connector					
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
4-Options not residing in cardcage					
370-1230 5-1/4" 327 MB Disk	1.5@	-	1.4	-	24.3
370-1206 5-1/4" 150 MB Tape	0.7@	-	1.5	-	21.5
370-1061 Emulex MT-02 1/4" Tape Controller	1.5#	-	0.04	-	8.0
370-1076 1/4" 60 MB Tape					

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
Drive less formatter	1.0@#	-	1.9	-	27.8
5-Individual Product Assemblies: †					
Sun-3/470 Product Assemblies:					
501-1299 Sun CPU w/o FPA+ or P4 FB	24.5	-	0.3	-	126.0
501-1550 Sun CPU w/o FPA+ or P4 FB	24.5	-	0.3	-	126.0
501-1446 FPA+	2.3	-	-	-	11.5
501-1532 P4 CG6 CX1 FB	4.6	-	-	-	23.0
501-1102 8 MB Exp Mem:					
Standby:	10.0	-	-	-	50.0
Active:	12.3	-	-	-	61.5
501-1576 16 MB Exp Mem:					
Standby:	9.1	-	-	-	45.5
Active:	10.5	-	-	-	52.5
501-1451 32 MB Exp Mem:					
Standby:	9.8	-	-	-	49.0
Active:	14.0	-	-	-	70.0
SECTION G: 12-slot package products (x80 chassis)					
1-Common Assemblies:					
540-1129 12-slot Rack Fans:					
each:	-	-	(0.4)	-	-
4 per unit:	-	-	1.6	-	19.2
501-1092 12-Slot Backplane	1.3	-	-	-	6.5
2-Options receiving power from Sun CPU board:					
370-1063 Sun-3 Keyboard	0.4	-	-	-	2.0
370-1058 Sun-3 Mouse	0.2	-	-	-	1.0
370-1058 Sun-4 Mouse	+++	-	-	-	0.0
3-Network option receiving power from a Sun Ethernet I/O connector					
Level 1 or Level 2 Ethernet Transceiver Box	-	-	0.4	-	4.8
4-Options not residing in cardcage					
370-1061 Emulex MT-02 1/4" Tape Controller	1.5@#	-	0.04	-	8.0
370-1076 1/4" 60 MB Tape					

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
Drive less formatter	1.0@#	-	1.9	-	27.8
5-Individual Product Assemblies: †					
Sun-3/180 Product Assemblies:					
501-1163 Sun-3/100 CPU (2MB)	14.0	0.8	*	-	74.2
501-1164 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1208 Sun-3/100 CPU (4MB)	14.6	0.8	*	-	77.2
501-1131 2MB Exp Mem	1.8	-	-	-	8.5
501-1132 4MB Exp Mem	2.3	-	-	-	11.5
Sun-3/280 Product Assemblies:					
501-1100 CPU	22.5	0.6	*	-	115.6
501-1206 CPU	22.5	0.6	*	-	115.6
501-1102 8 MB Exp Mem:					
Standby:	10.0	-	-	-	50.0
Active:	12.3	-	-	-	61.5
501-1576 16 MB Exp Mem:					
Standby:	9.1	-	-	-	45.5
Active:	10.5	-	-	-	52.5
501-1254 32 MB Exp Mem:					
Standby:	9.8	-	-	-	49.0
Active:	14.0	-	-	-	70.0
Sun-3/480 Product Assemblies:					
501-1299 Sun CPU w/o FPA+ or P4 FB	24.5	-	0.3	-	126.0
501-1550 Sun CPU w/o FPA+ or P4 FB	24.5	-	0.3	-	126.0
501-1446 FPA+	2.3	-	-	-	11.5
501-1532 P4 CG6 CX1 FB	4.6	-	-	-	23.0
501-1102 8 MB Exp Mem:					
Standby:	10.0	-	-	-	50.0
Active:	12.3	-	-	-	61.5
501-1576 16 MB Exp Mem:					
Standby:	9.1	-	-	-	45.5
Active:	10.5	-	-	-	52.5
501-1451 32 MB Exp Mem:					
Standby:	9.8	-	-	-	49.0
Active:	14.0	-	-	-	70.0

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
Section I:Card cage-based Options: VME 9U form-factor boards					
501-1138 Sun-2 SCSI Ctlr	2.7	-	-	-	13.5
501-1149 Sun-2 SCSI Ctlr	2.7	-	-	-	13.5
501-1167 Sun-2 SCSI Ctlr	2.7	-	-	-	13.5
501-1217 Sun-3 SCSI Ctlr	4.8	-	-	-	24.0
501-1170 Sun-3 SCSI Ctlr	4.8	-	-	-	24.0
501-1383 Sun TAAC-1	23.9	0.4	0.2	-	123.9
501-1447 Sun TAAC-1	23.9	0.4	0.2	-	123.9
501-1055 Sun GP	16.4	-	-	-	82.0
501-1058 Sun GB	2.1	-	-	-	10.5
501-1139 Sun GP "Plus"	14.6	-	-	-	73.0
501-1268 Sun GP2	12.1	-	-	-	60.5
501-1267 Sun Color (CG5)	8.8	3.2	0.2	0.1	64.2
501-1434 Sun Color (CG9)	14.6	-	-	-	73.0
501-1014 Sun-2 Color (CG2)	15.0	5.7	-	0.2	107.0
501-1116 Sun-3 Color (CG3) (single buffered)	8.2	2.9	0.1	0.2	59.0
501-1157 Sun VME ALM	7.1	-	0.6	0.4	47.5
501-1165 Sun VME ALM	7.1	-	0.6	0.4	47.5
501-1221 Sun ALM-2	7.0	0.2	++	++	36.0
501-1154 Xylogics 450 SMD Controller	8.0	0.6	-	-	43.1
501-1166 Xylogics 451 SMD Controller	6.3	0.6	-	-	34.6
501-1249 Sun SMD-4 Controller	4.8	-	-	0.6	31.2
501-1539 IPI-2 Disk Controller	11.8	-	-	-	59.0
501-1156 CPC 1/2" Tape Ctlr	5.1	-	-	-	25.5
501-1155 Xylogics 472 1/2" Tape Controller	6.0	-	-	-	30.0
370-1128 SunLink Channel	8.6	-	-	-	43.0

Table 5-8 *DC Power Requirements for Released Sun VME System Assemblies— Continued*

Part/Assembly Description	+5 vdc Amps	-5.2 vdc Amps	+12 vdc Amps	-12 vdc Amps	Total Watts
501-1153 2nd Ethernet Ctlr	5.8	-	*	-	29.0
501-1125 SunIPC without 80287	5.6	-	-	-	28.0
501-1214 SunIPC with 80287	5.6	-	-	-	28.0
501-1105 Sun FPA	12.9	-	-	-	64.5
501-1158 SunNet SCP	5.6	-	0.2	0.1	31.6
501-1221 SunNet MCP	7.3	0.1	++	++	37.0
501-1338 SunLink HSI	5.3	0.3	-	-	28.1
501-1276 SunNet FDDI/DX	11.2	0.1	1.9	0.7	87.7
OEM INI MAP Board Set	4.9	-	0.3	0.1	29.3
501-1191 VME 3X2 Adapter (Option 160A)	-	-	-	-	-
501-1054-04A (or later) VME/Multibus Adapter (Option 161A)	2.0	-	-	-	10.0

NOTES

* For each ethernet cable connection, include the requirements of either a Level 1 or a Level 2 Ethernet Transceiver Box.

** All indicates every Sun multi-slot product except the Sun-3/75.

*** Figures only for Micropolis 1355 Disk Drive.

**** Figures only for Micropolis 1558 Disk Drive.

@ Temporary peak current draw values of the hard & floppy disk and the QIC tape devices are not presented. Peak current values are not used to calculate power budget. The Sun power supplies are designed to handle peak current demands when 100% loaded.

The Sysgen and 1/4" Tape Drive plus formatter are a matched set. The Emulex MT-02 and 1/4" Tape Drive less formatter are a matched set. The MT-02 set is the later of the product technology used.

Figures only for Quantum 105S Disk Drive.

Includes the 1.9 A load on the +5 vdc by the -5.2 vdc dc-to-dc converter.

+ The Adaptec SCSI Disk Controller and the 5-1/4" 71 MB Disk Drive are a matched set. The Emulex MD-21 SCSI Disk Controller and the 5-1/4" 141 MB or 327 MB Disk Drive are a matched set.

++ The measured current for the ALM2's RS-232 and MCP's RS-232 & RS-449 interface ICs was less than 20 mA. Values of this magnitude have minimum impact to power budgeting considerations and should be ignored.

+++ The Sun-4 Mouse draws less than 20 mA of +5 vdc. A value of this magnitude has minimum impact to power budgeting considerations and should be ignored.

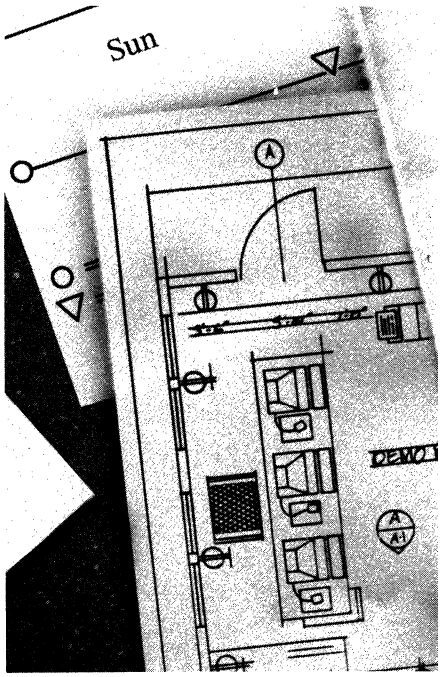
† See section I for the dc power requirements of cardcage based VME 9U form-factor board options. Sun document 813-2004, CCSA, and supplemental CCSA documents for recently announced products define which options are supported for each system.

Details of the dc current measurement environment:

1. Each dc output was set to +2% of the nominal value. 1% for adjustment variation during the manufacturing process and 1% maximum drift over time during all input/output and environmental parameter variations.
2. Measurements were made while the hardware was being exercised by several software environments, i.e. "sundiag" (a UNIX-based multi-tasking test program), demo programs, "idle" (waiting for keyboard input) UNIX, "idle" monitor and standalone diagnostics. The highest observed value is used as the "base" for step 4.
3. Peak values sustained for at least two seconds are used. Peak values of less than two seconds' duration are not used because those surges are accommodated by the power supply's design.
4. Each published value includes a 5% fudge factor to allow for variation of individual component load requirements from one manufacturing lot to another. For example, the 501-1164 CPU measured 13.9 Amps @ 5.1 vdc. Multiplying 13.9 Amps by the 1.05 fudge factor results in 14.6 Amps.

A

Environmental Requirements



A

Environmental Requirements

This section details the operational and storage environment for Sun products. If a product does not meet these standards, then that product's requirements are described in Section A.1.

CAUTION **This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications. This equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.**

Table A-1 *Sun Environmental Requirements*

Sun Environmental Requirements	
Power Cycle	
Operating	20 power resets: 1 minute on 1 minute off
Mechanical Connection Repetitions	
Non-Operating	100 insertions at each I/O port on the unit
Ripple Voltage	
Operating Ripple Voltage Frequency	3v rms @ 30 Hz to 1.5 KHz Down to 1 Vrms @ 1.5 KHz to 50 KHz
Spike (Line Transient Susceptibility)	
	All Phase Angles:
120 V Operating Spike	+/- 100 V p @ 0.5, 60, 100, 250, 500 pps
230 V Operating Spike	+/- 100 V p @ 0.5, 60, 100, 250, 500 pps
Brownout	60% +/- 1 volt of product's stated voltage
Line Deviation	
Operating	90 V @ 66 Hz and 47 Hz 132 V @ 66 Hz and 47 Hz 198 V @ 66 Hz and 47 Hz 264 V @ 66 Hz and 47 Hz
Temperature	
Operating:	
Temperature	0 to +40 ° C
Humidity	20% +/5% RH non-condensing at all temperatures
Gradient	20 ° C per hour
Non-Operating	
Temperature	-40 to +75 ° C
Humidity	20% +/-5% non-condensing at all temperatures
Gradient	20 ° C per hour
Exceptions:	
1) Product containing hard disk drives	
Operating	+10 to +40 ° C
Non-Operating	-20 to +60 ° C
Gradient	15 ° C per hour
2) Product containing ¼" tape drives	
Non-Operating	-20 to +60 ° C
Gradient	15 ° C per hour
3) Product containing ½" tape drives	
Operating	+5 to +40 ° C
Non-Operating	0 to +50 ° C
Gradient (Op and Non-Op)	10 ° C per hour

Table A-1 *Sun Environmental Requirements— Continued*

Sun Environmental Requirements	
Humidity	
Operating:	
Humidity/Temperature	20% to 80% RH non-condensing @ 40 ° C
Gradient	30% RH per hour
Non-Operating:	
Humidity/Temperature	95% RH non-condensing @ 40 ° C (humidity constant)
Gradient	30% RH per hour
Exception: Product containing hard disk drives or ¼" tape drives	
Gradient	15 ° C per hour
Acoustic Noise	
Sound Pressure Level @ 1 Meter	
Desktop Unit	45 dBA maximum
Deskside Unit	55 dBA maximum
Data Center Cabinet	Not applicable
Altitude	
Operating:	
Altitude/Temperature	10,000 ft (3048 meters) from 10 to 40 ° C
Non-Operating:	
Altitude/Temperature	50,000 ft (15,2440 meters) at 0 ° C
Exception: Product containing hard disk drives	
Non-Operating	40,000 ft (12,000 meters)

Table A-1 *Sun Environmental Requirements— Continued*

Sun Environmental Requirements	
Shock	
Operating	
Magnitude	5 G's (peak)
Duration	11 ms
Waveform	Half Sine
Repetitions	18 (3 times each on all 6 surfaces)
Non-Operating	
Magnitude	30 G's (peak)
Duration	11 ms
Waveform	Half Sine
Repetitions	18 (3 times each on all 6 surfaces)
Vibration (Unpackaged)	
Operating	
Frequency Range	5 to 500 to 5 Hz
Magnitude	0.03 inch (.76 mm) p-p disp. to .25 G's (peak) continue at 0.25 G's (peak)
Sweep Rate	1 octave per minute
Duration	10 minute dwells at each resonant frequency (up to 4) on each axis
Repetitions	A minimum of one sweep on each axis three sweeps total
Non-Operating	
Frequency Range	5 to 500 to 5 Hz
Magnitude	0.15 inch (3.81 mm) p-p disp. to 1.0 G (peak) continue at 1.0 G (peak)
Sweep Rate	1 octave per minute
Duration	10 minute dwells at each resonant frequency (up to 4) on each axis
Repetitions	A minimum of one sweep on each axis three sweeps total
Fragility	
Non-Operating	No minimum requirement

Table A-1 *Sun Environmental Requirements— Continued*

Sun Environmental Requirements	
Transportation	
Single Container Resonance	
Frequency Range	3 to 200 to 3 Hz
Sweep Rate	1 octave per minute
Magnitude	0.5 G's
Duration	15 minute dwells at each resonant frequency (up to 4)
Repetitions	3 mutually perpendicular axis
Unitized Load	Multiple unit load or stack
Frequency Range	3 to 200 to 3 Hz
Sweep Rate	1 octave per minute
Magnitude	0.5 G's
Duration	15 minute dwells at each resonant frequency (up to 4)
Drop	Based on weight of packaged unit
Compression	Tested to failure as shown in Table A-2
Compression Rate	C12-inch per minute Load must exceed the greatest of the following. 1) 4 times expected load in storage 2) 10 times weight of unit 3) 300 lbs.
Stability	Minimum tip of 22° without tipping over
Tip Over	If unit does not meet stability requirement, it must be tipped from the point of equilibrium in that axis.

Table A-2 *Drop Compression Testing*

Packaged Weight	*Test Procedure*	*Drop Height*	*Number of Drops*
0-20 lbs	free fall	42 inches	10
21-20 lbs	free fall	36 inches	10
31-45 lbs	free fall	30 inches	10
45-60 lbs	free fall	24 inches	10
61-80 lbs	free fall	21 inches	10
81-100 lbs	free fall	18 inches	10
101-200 lbs			
unpalletized:	free fall	15 inches	10
palletized	free fall	9 inches	1
	rotational	9 inches	4
201-500 lbs	free fall	6 inches	1
palletized:	rotational	6 inches	4
501 + lbs			
palletized:	rotational	6 inches	4

A.1. Electro-static Discharge

The following performance levels are provided to classify product operational requirements by degrees of severity. These performance levels are related to the probabilities of occurrence of various susceptibility signal amplitudes in the environment. Only those susceptibility responses that are directly correlated to the present performance when exposed to the EMI envrionments are described herein.

Susceptibility Criteria

The product must demonstrate compliance with the performance level definitions below. The signal amplitudes quoted are the minimum susceptibility threshold levels for each category.

Electrostatic Discharge (ESD) Events

The following requirements are the voltages applied to a standard ESD resistive-capacitive network (1500 ohm, 100 pf) prior to discharge to the product, for case direct and radiated field methods, and they apply to products to be installed in any normal uncontrolled ESD environment.

Level 1: 10,000 volts

The product may exhibit only minor operational responses up to level 1. No loss or corruption of data may occur up to this level. No permanent component damage may occur up to this level.

Level 2: 14,000 volts

The product may exhibit permanent loss or corruption of data at this level for up to 5% of the applied ESD events. At this level, minor operational responses as defined above are permitted for 100% of the applied ESD events; no permanent component damage may occur at this level.

Level 3: 25,000 volts

The product must not sustain permanent component damage at level 3 voltage for more than 5% of the applied ESD events. At this level, various operational responses are permitted to 100% of the applied ESD events, provided that they are exhibited only during the susceptibility test signal application, and are not related to component damage. The operator must be able to restart the operation using the operator controls provided on the product.

A.2. Environmental Exceptions

Certain peripherals have different environmental standards from the ones given in the last section. These exceptions are noted here.

Table A-3 *½-inch 1600 bpi Tape Drive Environmental Exceptions*

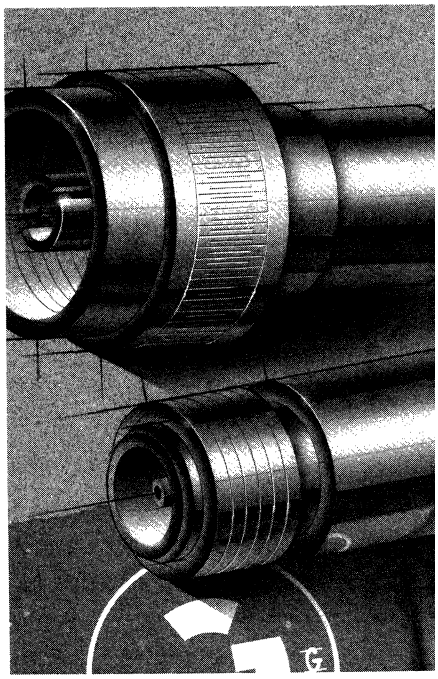
1600 bpi Tape Drive Environmental Exceptions	
Storage Altitude	12,192 meters (40,000 ft)

Table A-4 *½-inch 6250 bpi Streaming Tape Environmental Exceptions*

6250 Streaming Tape Drive Environmental Exceptions	
Storage humidity	8% to 90% RH, non-condensing
Operating humidity gradient	30% per 24 hours, non-condensing
Storage altitude	12,192 meters (40,000 ft)
Storage vibration	0.4 G
Input line frequency for all voltages	48 to 61 Hz

B

Sun SCSI Information



B

Sun SCSI Information

This section contains information about Sun SCSI devices and how to configure them.

Table B-1 *SCSI Information for the Sun-3/80 Product*

Device Description	Address Selection Method	SCSI Target ID	UNIX Device ID	Boot Device ID	External SCSI Termination Type/Location
		Sun-3/80 SCSI Information			
3/80 Base Unit's 1st Internal Disk	Preset Jumper	3	sd6	sd(0,18,0)	none required
3/80 Base Unit's 2nd Internal Disk	Preset Jumper	1	sd2	sd(0,8,0)	none required
Base Unit's Floppy Disk Drive	Preset Jumper	N/A	fd0	N/A	N/A / N/A
1st Desktop Disk Pack	Selector Switch	0	sd0	sd(0,0,0)	mini-/ unused port SCSI / of any / Storage Pack
2nd Desktop Disk Pack	Selector Switch	2	sd4	sd(0,10,0)	mini-/ unused port SCSI / of any / Storage Pack
3nd Desktop Disk Pack	Selector Switch	1	sd2	sd(0,8,0)	mini-/ unused port SCSI / of any / Storage Pack
4th Desktop Disk Pack	Selector Switch	3	sd6	sd(0,18,0)	mini-/ unused port SCSI / of any / Storage Pack
1st Desktop Backup Pack	Selector Switch	4	st0	st(0,0,0)	mini-/ unused port SCSI / of any / Storage Pack
2nd Desktop Backup Pack	Selector Switch	5	st1	st(0,28,0)	mini-/ unused port SCSI / of any / Storage Pack
ESM's 1st Disk Drive	Preset Jumper	0	sd0	sd(0,0,0)	D- / ESM's bottom SCSI / SCSI port

Table B-1 *SCSI Information for the Sun-3/80 Product— Continued*

Device Description	*Sun-3/80 SCSI Information* Address Selection Method	SCSI Target ID	UNIX Device ID	Boot Device ID	External SCSI Termination Type/Location
ESM's 2nd Disk Drive	Preset Jumper	2	sd4	sd(0,10,0)	D- / ESM's bottom SCSI / SCSI port
ESM's 1/4-inch Tape Drive	Preset Jumper	4	st0	st(0,0,0)	D- / ESM's bottom SCSI / SCSI port
EEM's 1st Disk Drive	Preset Jumper	1	sd2	sd(0,8,0)	D- / ESM's bottom SCSI / SCSI port

NOTES

ESM = External Storage Module

EEM = External Expansion Module

N/A = not applicable

1. Two "SCSI Target ID" values do not appear in the preceding table. "6" is reserved for future use by Sun. "7" is the value used by the SCSI host interface on the Sun-3/80 CPU board.

2. The maximum number of Sun SCSI devices that the Sun-3/80 can support is six. The devices supported are up to two external tape drives and up to four disk drives (internal and external).

3. Options with the "preset jumper" address selection method are not re-configurable by the user. As such, options with identical "SCSI Target ID" values that use the "preset jumper" scheme are mutually exclusive options.

4. When Desktop Storage Packs (disk or tape) are connected to a system with internal disks and/or Expansion Storage Modules, a conflict of "SCSI Target ID" values may occur. When a conflict exists, the SCSI Target ID value of the Desk-top Storage Pack(s) should be changed to resolve the conflict.

5. Even though address selection schemes may seem to allow up to six external devices, the resulting physical length of the SCSI cables may prevent such a configuration from working. The next section provides the necessary data to ver-ify that your configuration's overall cable length does not exceed six meters.

Sun-3/80 SCSI Subsystem Cable Lengths

The physical cable length of a SCSI subsystem may not exceed 6.0 meters. The following table provides cable lengths for each subsystem component. Verify your intended configuration is 6.0 meters or less in length.

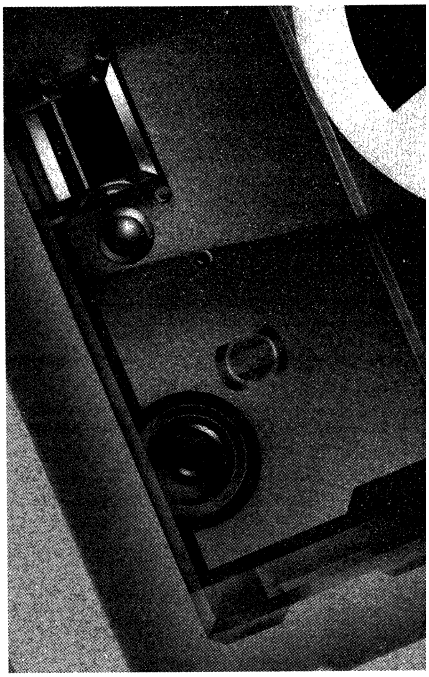
Length (meters)	Device/Cable Description
0.3	Sun-3/80 CPU traces and Base Unit's internal cables
0.0	Desktop Storage Pack internal cable
0.8	Desktop Storage Pack External Cable
1.0	External Storage Module's internal cable
2.0	ESM/EEM External Cable
1.0	External Expansion Module's internal cable
0.4	ESM Daisy-Chain Cable

NOTES

When both Desktop Storage Packs and External Storage Modules are connected to the same system, the Storage Packs are daisy-chained from the system's SCSI port and then the External Storage Modules are daisy-chained from the unused SCSI port of the last Storage Pack.

C

Glossary



C

Glossary

68020
Microprocessor by Motorola that is the basis of the Sun-3/50/60/100/200 processors. The MC68020 is the first full 32-bit implementation of the M68000 family of microprocessors from Motorola. Using VLSI technology, the 68020 has 32-bit registers and data paths, 32-bit addresses, a rich instruction set, and versatile addressing modes.

68030
Microprocessor by Motorola that is the basis of the Sun-3/80 and Sun-3/400 processors.

68881
See *floating point coprocessor.*

Address
A number used by the system software to identify a storage location.

Address space
The set of all possible addresses that can be used by a process. For instance, virtual address space is the set of all possible virtual address; physical address space is the set of all possible physical addresses.

Asynchronous Line Multiplexer
(ALM-I, ALM-II), a device that connects multiple terminals or other serial interface devices to Sun network fileservers or workstations. Also known as Multiple Terminal Interface (MTI). The SunLink Communication Processor (SCP) is an example of one.

Block
A unit of data that can be transferred by a device, usually 512 bytes long.

Bit-mapped screen
A screen in which a memory location is assigned for every pixel on the screen.

bp
Byte parity.

Buffer
Memory that holds data that is to be eventually transmitted to another device.

A circuit over which data or power is transmitted, one that often acts as a common connection among a number of locations.

Bus device
An external device that connects to the bus and has an assigned device address and/or priority level.

Bus master
A device on the bus that has control of the bus.

Bus priority
A scheme for allocating preferential access to the VMEbus.

Bus request
A request from a device on the bus for control of the bus to become the bus master and to start an interrupt of perform data transfer.

Bus slave
The peripheral device that is communicating with the bus master.

Cabinet-mounted
This means the system can be mounted in cabinets, generally appropriate for a data center or machine room. These systems can support more terminals than deskside systems and usually have mass storage capacity suitable for an operations environment.

Cache
A buffer of high-speed memory filled at medium speed from main memory, often with instructions and programs. A cache increases effective memory transfer rates and processor speed.

Compiler
A utility program that translates a source (symbolic) program file into a relocatable binary-coded program.

CPU
Central Processing Unit; the main board in a computer system that contains the circuits that control and perform the execution of instructions.

Daisy-chain
A specific method of propagating signals along a bus. This method is often used in applications in which devices not requesting a daisy-chained signal respond to a signal by passing it on. In practice, the first device requesting the signal responds to it by performing an action, breaking the daisy-chained signal continuity. The daisy-chain scheme permits assignment of device priorities based on the electrical position of the device along the bus.

Data Transfer Bus
Part of the VMEbus specification that contains data and address pathways and associated control signals. Functional modules called Data Transfer Bus (DTB) masters and DTB slaves use the DTB to transfer data between each other.

Demand paging
This allows a program's required area to be noncontiguous and partially

nonresident. This permits the maximum use of system's total available memory by allowing the computer system to execute programs that are larger than the allocated physical main memory within the processor.

Deskside
This means the system enclosure stands next to your desk.

Desktop
This means the entire system fits on your office desktop.

Device An external device or peripheral.

Diagnostic A program that tests logic and reports any problems or errors it finds.

Direct Memory Access
(DMA), transfer of data directly into memory without supervision of the processor. The data is passed on the bus directly between the memory and another device.

Direct Virtual Memory Access
(DVMA) The feature that allows I/O devices such as the network or disk interface to access directly the main memory through Memory Management Unit (MMU).

Disk
A mass-storage device; types include rigid (hard), flexible (floppy).

Drive
The electro-mechanical part of a mass-storage device on which the recording medium is mounted.

DTB Arbitration
Area of the VMEbus specification that defines the signals (arbitration bus) and modules (DTB Requesters and DTB Arbiter) that performs the control transfer. This definition provides a way to transfer control of the DTB between masters in an orderly manner and to guarantee that only one master controls the DTB at a given time.

DIN connectors
Connectors that are compliant with Deutsche Industrie Normong standards. ie. 96 PIN DIN CONNECTOR.

Diskfull client
A client on a network that relies on a server for resources, such as files, but has its own local disk storage. Some of its files are local, and others are remote. The remote files can be obtained from any machine running as a network fileserver.

Diskless client
A client on a network that relies on a server for all of its disk storage. Diskless clients reduce the system price and are quieter than diskful clients. They also make system administration easier by having administration centralized at the server.

DMA devices
Devices capable of being the VMEbus Master.

DTB Arbitration
Mechanism used to decide which board is the next VMEbus Master.

DTE
Data Terminal Equipment

ECC
Error Correction Code corrects single bit errors and detects 2 bit errors in memory circuits, a feature of the Sun-3/200 and 3/400 series workstations and servers.

Ethernet
A type of network that allows real-time communication between machines, connected directly together through cables of a certain type.

Eurocard form factor
A set of international standard board dimensions.

Floating Point Accelerator
(FPA) board that speeds up floating point calculations.

Floating Point Coprocessor
A special chip (also known as the Floating Point Processor (FPP)) that does floating point calculations on the CPU board.

Formatted megabytes
The number of megabytes of space left on the disk for information after subtracting overhead space, such as track 0 and spare cylinders.

Frame buffer
Memory allocated for display information.

Gateway
A link between two networks.

GKS
The Graphical Kernel Standard, a two-dimensional graphics standard, as adopted by ANSI. Although GKS is currently two-dimensional, the standards committee is planning to add limited three-dimensional extensions.

Graphics Buffer
An auxiliary data-storage device that works with the graphics processor (GP+) to do hidden surface removal at rates in excess of one million pixels per second.

Graphics Processor
The GP/GP+ performs graphics functions on a special board, instead of in the CPU and significantly improves applications with transformation, scaling, and rendering of two- and three-dimensional objects.

Hardware context
The values in the following registers while a process is running: the Program Counter; the Processor Status Word; the 6 general registers (R0 through R5); the Stack Pointer for the current access mode as well as the contents to be loaded in

the stack pointer for every access mode other than the current access mode.

Interrupt
An event which changes the normal flow of instruction execution. They are generally external to the process running when the interrupt occurs.

I/O
Input/Output. Refers to equipment used to communicate with a computer, the data involved in that communication and the media carrying the data, and/or the process of communicating that information.

I/O intensive
Using or requiring frequent transmission of information from an external source to the computer or from the computer to an external source.

Kernel
The kernel manages the hardware (for example, processor cycles and memory) as well as supplies fundamental services such as filing that the hardware does not provide.

Logical disk
A section of the formatted disk allocated by software, also known as a partition.

Mass-storage device
A device that reads and writes data on mass-storage media (e.g., disk or tape).

Memory management
The system functions including the hardware's page mapping and protection.

MHz
MegaHertz, one million cycles per second.

MIPS
Million Instructions Per Second.

Mouse
A hand-manipulated cursor control device used with a mouse pad. The mouse has logic components that track and digitally encode information on the position of the cursor.

Multibus
Intel's proprietary bus with specific board dimensions and standards.

Network
A group of systems and devices connected together so they can exchange data. There are two kinds of networks, local area and wide. A local area network is a high speed network connecting machines at one site. A wide area network connects two or more sites over significant distances.

Network File System
(NFS) part of Sun's network services architecture that allows any number of remote filesystems to appear to be mounted locally. In other words, NFS allows files to be accessed with standard UNIX I/O calls, independent of the location of the files.

Node
An addressable point on a network. Each node in a Sun network has a different name. A node can connect a computing system, a terminal, or various other peripheral devices to the network.

OEM
Original Equipment Manufacturer. A manufacturer that sells equipment for resale under an equipment manufacturers trademark or name.

Page

1. A block of 8192 contiguous byte locations used for memory mapping and protection.
2. The data between the beginning of a file and a page marker or between two markers or between a marker and the end of a file.

Paging
The process of replacing the contents of page frames with different pages. A page is a fixed size unit of memory. The physical address space is conceptually divided into page-size units called page frames.

Partitions
The unit into which the disk space is divided by the software.

Physical address space
The set of all possible 22-bit physical addresses that can be used to refer to locations in memory (memory space) or I/O space (device registers).

Physical memory
Main memory; the memory connected to the processor that store instructions which the processor directly fetches and executes and any other data the processor must manipulate.

Pixel
Picture Element, the smallest element of a display surface that can be independently assigned a color or intensity.

Priority Interrupt
Part of the VMEbus specification that allows devices that request interruption of normal bus activity to be serviced by an interrupt handler. Interrupt requests are prioritized into a maximum of seven levels. The associated functional modules, called Interrupters and Interrupt Handlers, use signal lines called the Interrupt Bus.

Process
The basis entity managed by system software that provides the context in which an image executes. Roughly similar to a job or task. A process is made of an address space and the hardware and software contexts.

Protocol
A "language" that networks use to communicate with each other — IP (internet protocol), TCP, and UDP are examples.

QIC
Working Group for Quarter-inch Cartridge Drive Compatibility; a number of standard interfaces to ¼-inch tape drives.

Raster graphics
In this type of graphics, the computer orders each picture element (pixel) to be darkened or not, usually in a regular pattern such as a television scan. See **vector graphics**

RasterOp processors
Custom VLSI chips used on the color graphics board to speed-up display operations.

Root filesystem
One filesystem, residing on the root device (a device predefined to the system at initialization) designated to anchor the overall filesystem.

SCP
SunLink Communications Processor; a printed circuit board that allows multivendor connection with either synchronous or asynchronous operation. The SCP works with SNA 3270, IR, OSI, and X.25 SunLink software products.

SCSI
Small Computer Systems Interface, an industry standard bus that is primarily used to connect disk and tape devices to a computer.

Serial ports
Ports for serial transmission, a method in which bits that compose a character are transmitted sequentially as contrasted with parallel or simultaneous transfer.

Server
A computer system that provides storage and compute resources for other machines on a local network. A suitably configured server can support a range of from 1 to 20 clients, depending on the network configuration.

SMD
(Storage Module Device) An industry standard interface used for large capacity, high-performance disks.

SNA
(Systems Network Architecture) The IBM standardized relationship between its virtual telecommunication access method (VTAM) and the network control program (NCP/VS).

SPARC
The 32-bit Scalable Processor ARChitecture from Sun. SPARC is based on a reduced instruction set computer (RISC) concept. The architecture was designed by Sun and its suppliers in an effort to significantly improve price and performance. Sun is licensing SPARC to various microprocessor manufacturers in order to be positioned to take advantage of the most advanced process technology expertise available as well as to promote its use as an industry standard.

Standalone

1. A computer that does not require support from any other machine. It must have its own disk; it may or may not be attached to an Ethernet. It may or may not have a local tape drive. However, a tape drive or Ethernet connection is required for software installation.
2. A standalone diagnostic means the program can load from either local disk or Ethernet and runs in a non-UNIX environment.

SunLink
A group of data communications products that allow Sun workstations to operate with systems by other vendors. This group includes SunLink BSC RJE, SunLink SNA 3270, SunLink IR, SunLink X.25 and SunLink OSI.

Sun CommonLisp
Sun's implementation of Lucid's Common Lisp.

SunUNIFY
Relational database software based on UNIFY Corporation's system with Sun extensions.

SunView
Sun's window-based environment, (Sun Visual/Integrated Environment for Workstations), is really two things: a user interface and SunGuide. As a user interface, SunView is accessible via the Suntools package that provides multiple overlapping windows on the screen. Each window runs user tasks independent of the other windows of the screen. SunGuide (Sun General User Interface Design Environment) is a programming interface accessible via a collection of subroutine libraries.

Swapping area
The memory used for the transfer of a currently operating program from system memory to an external storage device.

Text, data, and stack
In the UNIX system, a process is represented by three memory segments, called the text (or code), data, and stack segments and by a set of data structures collectively known as the process environment. A text segment contains code and constant data; a data segment contains variables; and a stack segment holds a process' stack.

Time-out
A specific amount of time (often 10 microseconds) for which the system waits for a response from an address. If there is no response in this amount of tie, a time-out error occurs.

Time sharing
Allocating processor time and computer services among many users so that a computer looks as though it is processing a number of programs "simultaneously."

Utilities
The standard programs that are usually furnished at no charge with the purchase of a computer that do housekeeping functions. In the VMEbus architecture, utilities include the system clock, initialization, and failure detection. The utility bus

has a clock line and a system reset line.

uucp
UNIX to UNIX copy.

Vector graphics
A common class of graphics; all vector output has lines and curves drawn point-to-point by the output device as instructed by the computer. The other class of graphics is raster. See **Raster graphics.**

Virtual address
A 16-bit integer identifying a byte "location" in virtual address space. The memory management unit translates the virtual address into a physical address. Also the address used to identify a virtual block on a mass-storage device.

Virtual address space
The virtual address space is the virtual storage assigned to a job, terminal user or system task.

Virtual memory
When a system has virtual memory, user programs can be larger than physical memory. This is done through a storage hierarchy in that a virtual image of a program is stored in a secondary storage while main memory only stores active program segments.

VMEbus
The VMEbus is an interfacing system that connects data processing, data storage, and peripheral control devices in a closely coupled configuration. The VMEbus structure can be described in two ways, mechanically and functionally. The mechanical specification includes physical dimensions of subracks, backplanes, and plug-in boards. The functional specification describes how the bus works, what functional modules are involved in each transaction, and the rules that define their behavior.

VMEbus master
The device that initiates a particular data transfer over the VMEbus.

VMEbus slave
The device that responds to a particular data transfer over the VMEbus. A device may be a VMEbus master sometimes and a VMEbus slave at other times.

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