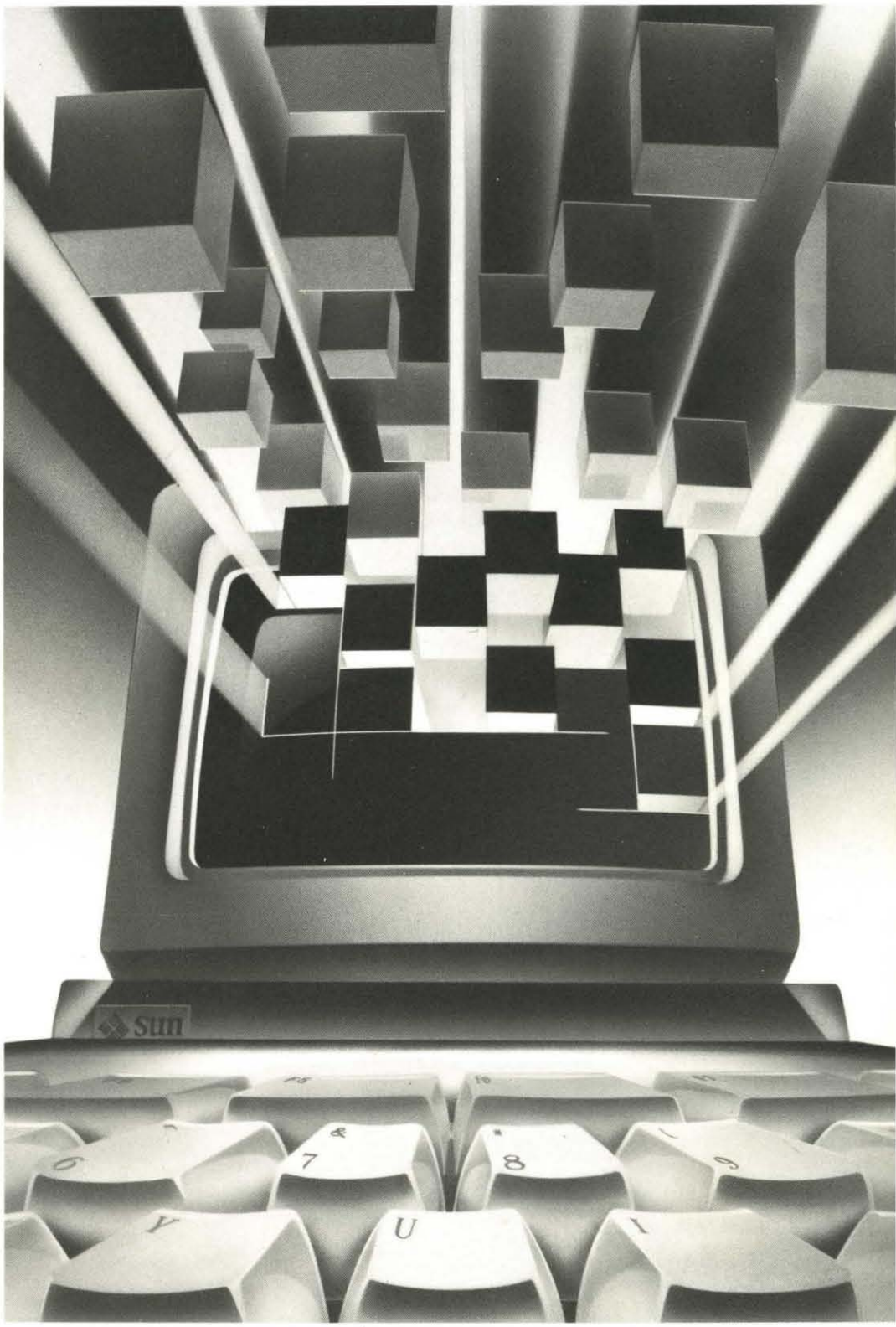
Sun Microsystems, Inc.
Configuration Guide

Sun-3 Product Family
October 1986



CONFIGURATION GUIDE
SUN-3 PRODUCT FAMILY

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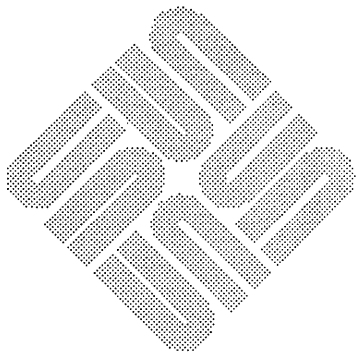

Preface

As a manager, engineer, or system architect evaluating a computer, you are often presented with two written descriptions of the product. These are the "brochure" and the "manual." Between these is a large gulf that makes it hard to get a moderately detailed picture of a system or a particular aspect of it. To help you understand Sun workstations 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 to install and use your Sun hardware and software in the manuals shipped with those products. This guide discusses hardware and software issues relevant to choosing the right configuration of hardware from the Sun-3™ product family.

What this Guide Contains

This guide has eight chapters and three appendixes:

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

Standard Configurations — describes standard Sun-3 configurations and lists the Sun-3 options.

Software Storage Requirements — discusses software issues, such as, main memory usage, disk storage requirements, and swap partition size.

Network Server Configurations — discusses network server issues.

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

Power Requirements — describes the power requirements of the Sun-3 products. It tells you how to calculate current draw and thermal dissipation of your configured system.

A Word on Software Products — describes the requirements for some of Sun's own software applications products.

Ordering Tips — gives some tips on ordering Sun workstations and peripherals.

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

Appendix B, ***Physical Space Requirements***, lists the physical dimensions and weights of most of the Sun-3 products.

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-3 Architecture: A Sun Technical Report*
- *The UNIX System: A Sun Technical Report*
- *Sun System Overview (800-1300)*
- *Card Cage Slot Assignment Backplane Configuration Procedure (813-2004)*
- *Catalyst (catalog of third party software and hardware)*

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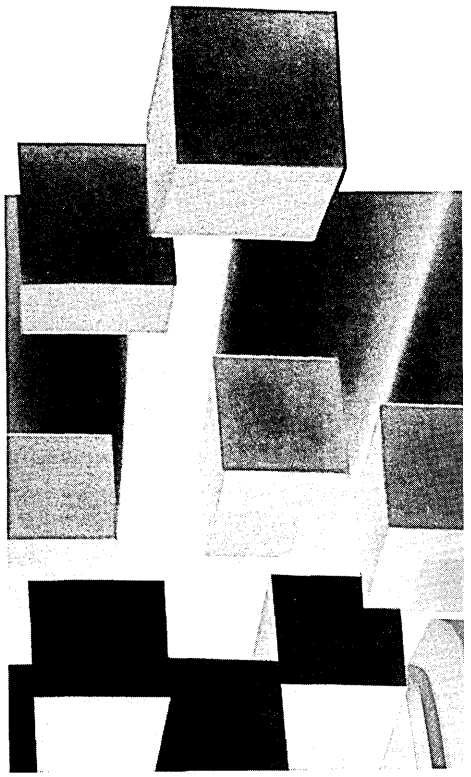
Introduction



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Introduction

Building an open network computing environment for your company is a complicated problem, one that means making some tough decisions. Where are workstations necessary? How much processing power does each node require? Can terminals be in the configuration? Does every workstation need its own local peripherals?

The Sun-3 product family may solve many, if not all, of your problems, offering high-performance workstations at an attractive price. The Sun-3 workstations and servers offer an integrated, high-speed and high-bandwidth network with links to mainframes, minicomputers, and personal computers.

1.1. Sun Workstation Overview

Sun workstations can increase your productivity through applications in engineering, management, architecture, publishing, etc. Applications for the Sun workstation have been created for fields from Architecture to Software Engineering:

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

- Securities Trading Automation
- Software Engineering

The list goes on. If you are looking for creative, state-of-the-art solutions, *Catalyst*, our third-party software and hardware catalogue, offers over 600 products.

1.2. Basic Hardware

Sun Microsystems has a full line of workstations and cabinet-mounted systems with a wide choice of peripheral equipment. The Sun-3 product line is the latest and most advanced product line Sun has introduced. Like the earlier Sun-2 line, the Sun-3 product family is built on **industry standard** chips, bus architectures, and network architectures. With Sun's commitment to *Open Systems for Open Minds*, compatability is part of the design criteria, not an afterthought. Sun's protocols, for instance, are in the public domain and are quickly being adopted by a variety of system vendors.

The Sun-3 product family is a group of 32-bit systems based on the Motorola MC68020 CPU chip and the high-speed 32-bit VMEbus. The Sun-3 family has three main lines: the Sun-3/50, the Sun-3/100, and the Sun-3/200 series.

All Sun-3 workstations (except for the Sun-3/110LC) have a 19-inch bit-mapped monochrome, grayscale, or color display, with a resolution of 1152 by 900 pixels or better. You use a keyboard and a mouse pointing device to interact with the system.

All Sun workstations have an integrated Ethernet interface for local area networking. Other Sun features include the MC68881 floating point coprocessor (available on all Sun-3 systems either as standard or optional equipment) and the proprietary Memory Management Unit (MMU).

1.3. Operating System

Sun workstations run an enhanced version of the 4.2BSD UNIX operating system developed at the University of California at Berkeley. The UNIX system comes with a host of software as a base level package and includes languages such as C, FORTRAN-77, Pascal, and Assembler. Originally developed in an environment of computer scientists doing programming research, the UNIX system has many tools for software development and utilities for text processing and document preparation.

The 4.2BSD UNIX operating system supports interprocess communications, networking, and a fast file system. The Sun operating system (SunOS) builds on this to offer a Network File System (NFS), System V compatibility, diskless operation and SunView, an advanced user interface. The Network File System allows you to access files on remote workstations as easily as files on your own machine. SunView, Sun's user interface, comes with overlapping windows and libraries of graphics packages that work with the common graphics standards.

1.4. Features and Packaging

All Sun-3 workstations have these features:

- Full 32-bit architecture
- Integrated bit-map frame buffer
- Low profile keyboard and mouse pointing device (optional on servers)
- Two RS-423 serial ports with modem control
- At least 4 megabytes of main memory, with some workstation memory expandable to 32 megabytes
- 256-megabyte virtual address space per process*
- Integrated Ethernet interface
- SunOS, NFS, SunPro, SunView, C, Pascal, FORTRAN, SunCore, and SunCGI at no cost for all single-user workstations and servers

Packaging

The Sun-3 systems come in 3 types of packaging:

- Desktop

This means the entire system fits on your office desktop.

- Deskside

This means the system enclosure stands next to your desk.

- 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 a computer room.

Displays

Sun workstations come with a variety of displays. The type of display is shown by the letter appended to the model number:

- M - Monochrome display
- C - Color display
- G - Grayscale display
- LC - 15-inch color display
- HM - High resolution monochrome display
- S - Server (no display)

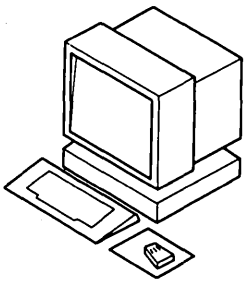
*SunOS uses 16 MB of this virtual address space when it is installed.

1.5. Sun-3/50 Series

The Sun-3/50 series has these standard features:

- 15 MHz MC68020 CPU
- 1.5 MIPS system performance
- Four megabytes of main memory
- High resolution 19-inch landscape monitor with 1152 x 900 pixel resolution and 66 Hz, non-interlaced refresh
- Desktop packaging
- Series includes the Sun-3/50M and Sun-3/52M

Sun-3/50/52M



Designed to be an inexpensive node in a computer network, the Sun-3/50M has the functionality of a higher-priced workstation in an economical desktop package. Because of the workstation's single-board "no bus " design, no add-on memory boards are possible. The Sun-3/52 is the same as the Sun-3/50M with the addition of mass storage. The Sun-3/50 series has these features:

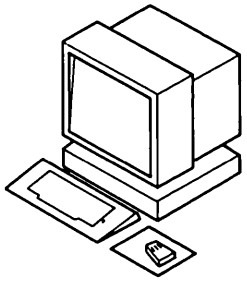
- Optional MC68881 floating point coprocessor for speeding up floating-point calculations
- Built-in SCSI host adapter allowing optional add-on mass storage
- Built-in Thin Ethernet transceiver
- Single-board design

1.6. Sun-3/100 Series

The Sun-3/100 series has these standard features:

- 16.67 MHz MC68020 CPU
- 2 MIPS system performance
- 16.67 MHz MC68881 floating point coprocessor
- VMEbus architecture
- Four megabytes of main memory
- High resolution 19-inch monitor (optional for servers;15-inch monitor is standard for the Sun-3/110) with 1152 x 900 pixel resolution and 66 Hz, non-interlaced refresh
- Desktop, Deskside, or Data Center cabinet packaging
- Series includes the Sun-3/75, Sun-3/110, Sun-3/160, and Sun-3/180 workstations and servers.

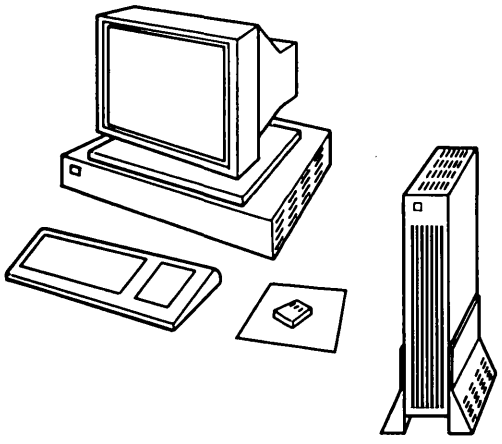
Sun-3/75M



The Sun-3/75M workstation is a powerful, general-purpose workstation designed to be either a "diskless node" in a distributed computing environment or a low-cost standalone system. It has these features:

- Main memory expandable from four to eight megabytes
- Optional add-on mass storage
- A desktop package that holds two Eurocard format (triple-height VME) boards. This provides one expansion slot for a memory expansion board and a SCSI adapter.

Sun-3/110C, G, LC



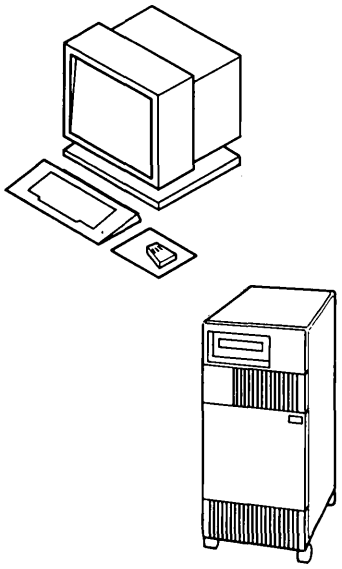
The Sun-3/110 color workstation provides unmatched power and capabilities for low-cost color applications. By using state-of-the-art technology, such as 1-Mbit DRAMs and high-speed video RAMs, Sun has built a powerful color workstation on a single board.

The Sun-3/110 comes with three different monitors. The Sun-3/110 LC has a 15-inch color monitor; the Sun-3/110C has a 19-inch color monitor; and the Sun-3/110G has a 19-inch grayscale monitor.

The Sun-3/110 has these features:

- Main memory expandable from 4 to 12 megabytes
- A desktop package that will hold up to three Eurocard-format (triple-height VME) boards. This provides up to two expansion slots for user-supplied VME or Multibus (with adapter) cards.
- CPU with on-board color circuitry, B/W frame buffer, and on-board memory
- Floating Point Accelerator (FPA) option
- Mass storage subsystem option

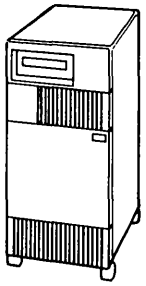
Sun-3/160M, G, C



The Sun-3/160 offers the power of an MC68020-based workstation with the flexibility of VME-based architecture. This combination means a high-performance expandable system well suited to a variety of applications that need high resolution graphics. The Sun-3/160C brings these features to applications that need high speed color graphics while the Sun-3/160G offers superior performance in applications that require detailed image analysis and composition without color. The Sun-3/160 has these features:

- Main memory from 4 to 16 megabytes
- Deskside pedestal with a 12-slot VME card cage
- Ability to handle 16 asynchronous terminals with optional asynchronous multiplexer card
- Choice of monochrome, color, or grayscale monitors. The color option offers 8 planes of color, 256 simultaneously displayed colors from a palette of over 16 million colors. The grayscale monitor has an 8-plane system capable of 256 simultaneously displayed shades of gray.
- Optional graphics accelerators, the GP+ and GB (Graphics Buffer), SunIPC, SunLink, and Floating Point Accelerator (FPA)

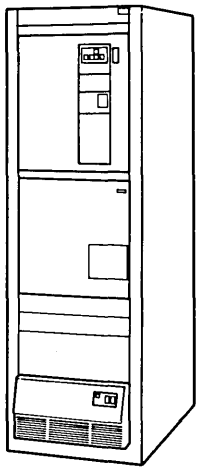
Sun-3/160S



The Sun-3/160S is a **deskside** fileserver based on the VMEbus. The Sun-3/160S features:

- Main memory available from 4 to 16 megabytes.
- Mass storage expandable to 1.1 gigabytes in a separate deskside disk expansion pedestal.
- Ability to handle up to 16 asynchronous terminals with optional Asynchronous Line Multiplexer (ALM)
- Optional graphics accelerators, the GP+ and GB (Graphics Buffer), SunIPC, SunLink, and Floating Point Accelerator (FPA)

Sun-3/180S



The Sun-3/180S is a **cabinet-mounted** fileserver based on the VMEbus. It has these features:

- Main memory available from 4 to 16 megabytes
- Mass storage expandable to 2.3 gigabytes
- Ability to handle up to 48 asynchronous terminals with optional Asynchronous Line Multiplexer cards and additional software licensing
- 12-slot VMEbus card cage
- Optional graphics accelerators, the GP+ and GB (Graphics Buffer), SunIPC, SunLink, and Floating Point Accelerator (FPA)

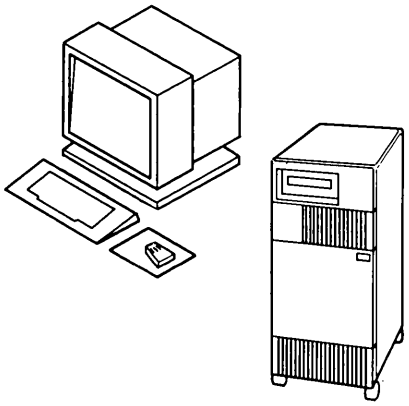
The Data Center cabinet shown in the illustration is optional and must be ordered separately.

1.7. Sun-3/200 Series

The Sun-3/200 series is Sun's newest and most powerful series of workstations and servers. As a workstation or a timesharing machine, the Sun-3/200 series provides the performance of a super-minicomputer, such as the VAX 8600, at a fraction of the cost. The Sun-3/200 series has these features:

- 25 MHz MC68020 CPU
- 20 MHz MC68881 Floating Point Coprocessor
- 64 kilobyte virtual address, write-back cache
- High bandwidth 64-bit processor-to-memory bus
- 4 MIPS system performance
- 125 kiloflops floating-point performance (expandable to over 1 mflop with optional FPA)
- 8 megabytes ECC main memory standard (32 megabytes maximum)
- 19-inch display (optional for servers) with 1600 x 1280 pixel resolution for monochrome monitors and 1152 x 900 pixel resolution for color and grayscale monitors
- Deskside or Data Center cabinet packaging
- Series includes the Sun-3/260 and Sun-3/280 workstations and servers

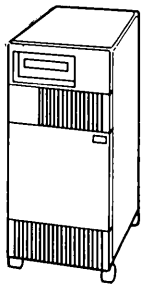
Sun-3/260HM, C, G



The Sun-3/260 is a deskside workstation with a choice of high resolution monochrome, color, or grayscale monitors. It has these features:

- Deskside pedestal with 12-slot VMEbus card cage
- Main memory from 8 to 32 megabytes
- Mass storage expandable to 1.1 gigabytes in a separate deskside disk expansion pedestal.
- Optional graphics accelerators, the GP+ and GB (Graphics Buffer), SunLink, and Floating Point Accelerator (FPA)
- Ability to handle up to 16 asynchronous terminals with optional Asynchronous Line Multiplexer (ALM) card

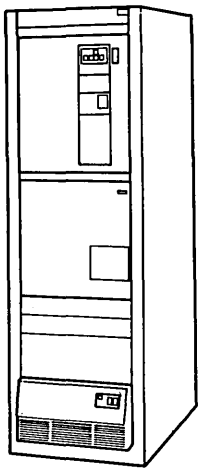
Sun-3/260S



The Sun-3/260S is a **deskside** fileserver based on the VMEbus. The Sun-3/260S features:

- Deskside pedestal with a 12-slot VMEbus card cage
- Mass storage expandable to 1.1 gigabytes
- Ability to handle up to 16 asynchronous terminals with optional asynchronous multiplexer card
- Optional graphics accelerators, the GP+ and GB (Graphics Buffer), SunLink, and Floating Point Accelerator (FPA)

Sun-3/280S



The Sun-3/280S is a **cabinet-mounted** fileserver based on the VMEbus. It has these features:

- Mass storage expandable to 2.3 gigabytes
- Ability to handle up to 48 asynchronous terminals with optional asynchronous line multiplexers
- 12-slot VMEbus card cage
- Optional graphics accelerators, the GP+ and GB (Graphics Buffer), SunLink, and Floating Point Accelerator (FPA)

The Data Center cabinet shown in the illustration is optional and must be ordered separately.

1.8. Configuration Issues

Before deciding on a specific configuration for your Sun-3 workstations, you should keep in mind three major factors:

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

Role of the Workstation

You should examine carefully the role of each workstation, whether it is a standalone machine, a fileserver, diskless client, or diskful client. These terms are defined here:

Standalone
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 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 can support from 1 to 20 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 diskful clients. They also make system administration easier for the client user since administration is centralized.

Diskful 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 and disadvantages. A server with large disk storage and a number of diskless clients is sometimes less expensive than the same number of standalone workstations. A server configuration reduces disk requirements by allowing clients to share common libraries and binaries.

In comparing diskful and diskless clients, remember that a diskful client may be somewhat faster, but also more expensive. The performance advantage of a local disk is lessened when a server can share the cost of a higher performance SMD drive with its clients. Chapter 5, *Network Server Configurations*, has more information on these issues.

Application Needs

Besides your networking needs, you also need to understand 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. If you are planning to run one of Sun's unbundled software products, see Chapter 7, *A Note on Software Products*. To expand your software horizons, take a look at *Catalyst*, Sun's catalog of third-party software and hardware with over 600 products.

For each basic configuration question, there is a related application question and implication.

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 calculations are substantially faster than software floating-point calculations.

Disk Storage

Another factor you should consider is disk storage. Consider these issues:

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

See Chapter 4, *Software Storage Requirements*, for more information.

Site Requirements

You may also have specific site requirements. You should plan ahead for:

- physical space
- power needs
- environmental factors

See Chapter 6, *Power Requirements*, and Appendixes A and B for more details.

Table 1-1 *Sun-3 Configuration Overview@*

Function	3/50 Desktop workstation	3/75 Desktop workstation	3/110 Desktop or deskside workstation	3/160 Deskside workstation	3/180 Data Ctr SunServer	3/260 Deskside SunServer	3/280 Data Ctr SunServer
Processor							
CPU	MC68020	MC68020	MC68020	MC68020	MC68020	MC68020	MC68020
CPU clock (MHz)	15	16.67	16.67	16.67	16.67	25	25
FPC	MC68881*	MC68881	MC68881	MC68881	MC68881	MC68881	MC68881
MMU	Sun-3	Sun-3	Sun-3	Sun-3	Sun-3	Sun-3	Sun-3
Virtual Memory	256 MB#	256 MB	256 MB	256 MB	256 MB	256 MB	256 MB
Hardware Contexts	8	8	8	8	8	8	8
CPU Performance	1.5 MIPS	2 MIPS	2 MIPS	2 MIPS	2 MIPS	4 MIPS	4 MIPS
Memory							
Standard	4 MB	4 MB	4 MB	4 MB	4 MB	8 MB	8 MB
Maximum	4 MB	8 MB	12 MB	16 MB	16 MB	32 MB	32 MB
Error Detection	byte parity	bp	bp	bp	bp	ECC	ECC
Cycle Time	270 ns	270 ns	270 ns	270 ns	270 ns	120 ns†	120 ns†
Coprocessor Options							
Floating Point Accelerator (FPA)	no	no	yes*	yes*	yes*	yes*	yes*
Graphics Processor/ Graphics Buffer	no	no	no	yes**	yes**	yes**	yes**
Sun IPC	no	no	no	yes*	yes*	no	no
Display/Server Options							
Monochrome (/M)	yes	yes	no	yes	yes	yes††	yes††
Color (/C)	no	no	yes	yes	yes	yes	yes
Grayscale (/G)	no	no	yes	yes	yes	yes	yes
Server (/S)	no	no	no	yes	yes	yes	yes
Input/Output (I/O)							
Ethernet	yes	yes	yes	yes	yes	yes	yes
Onboard Transceiver	yes	no	no	no	no	no	no
Two serial ports	yes	yes	yes	yes	yes	yes	yes
SCSI	yes	yes*	yes*	yes*	yes*	yes*	yes*
VMEbus	no	yes	yes	yes	yes	yes	yes
SMD	no	no	no	yes*	yes*	yes*	yes*
ALM	no	no	no	yes*	yes*	yes*	yes*
Gateway Ethernet (/S)	no	no	no	yes*	yes*	yes*	yes*
SCP	no	no	yes*,yes*	yes*	yes*	yes*	
IPC	no	no	yes*	yes*	yes*	yes*	yes*
Disk Drive Options (in formatted MB)							
SCSI	71/142	71/142	71/142	71/142	no	no	no
SMD 8-inch	no	no	no	130/260	no	no	no
SMD 8-inch	no	no	no	280/560	no	280/560	no
SMD 10.5-inch	no	no	no	380	380	no	no
SMD 10.5-inch	no	no	no	575	575	no	575
Tape Drive Options							
1/4-inch	yes	yes	yes	yes	yes	yes	yes
1/2-inch	no	no	no	yes	yes	yes	yes
Card Cage Slots							
	no	no	3	12	12	12	12

@ Explanatory notes are shown on the next page.

NOTE *# = SunOS uses 16 MB of this virtual address space when it it installed.*

** = optional*

*** = systems with Sun color board only*

† = cycle time for cache access

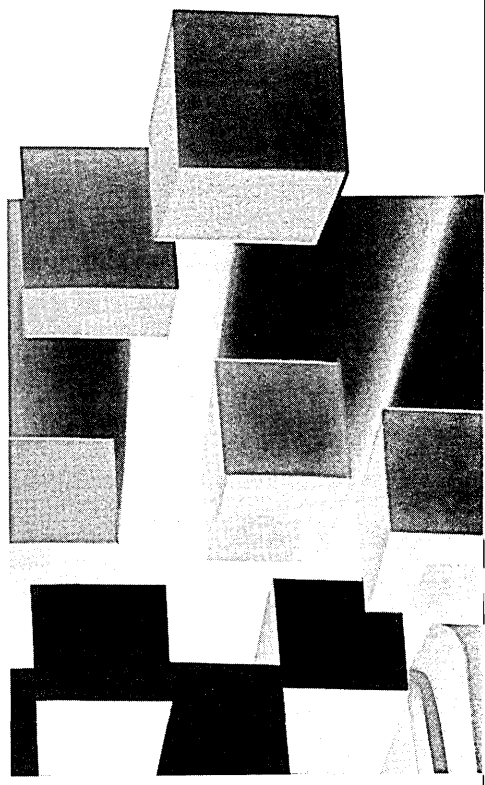
†† = high resolution 1600 x 1280 pixels

Table 1-2 *Sun-3 Industry Standards*

Sun-3 Industry Standards	
Microprocessor	MC68020
Bus	32-bit VMEbus
Floating Point	IEEE standard 754
Local Area Network	Ethernet, SunNet
Tape Interface	Pertec-formatted (1600 BPI) or GCR (6250 BPI), SCSI QIC 11, QIC 24 (¼-inch tape)
Disk Interface	SCSI ST-506 5 1/4-inch Winchester drives (for 71-MB drives). SMD 130-MB 8-inch drives and 380-MB 10.5-inch drives. ESMD for 280-MB 8-inch and 575-MB 10.5-inch drives.
Operating System	UNIX 4.2BSD, SunOS release 3.2 compatible with System V
Network Protocols	TCP/IP; ISO OSI Model; Network File System (NFS); Internetwork Router
Data Communications	X.25, SNA 3270; BSC 3270; BSC RJE
Languages	ANSI FORTRAN-77, Pascal, C, CommonLisp, Modula 2
Graphics	ACM Core, GKS, CGI, Sun Pixrect, PostScript™

2

Standard Configurations



2

Standard Configurations

This chapter describes the standard configurations for the Sun-3 workstations and servers. It includes sections on single board options, mass storage subsystems, and board arrangement.

2.1. Sun-3/50 Series

Because of its single board design, the Sun-3/50 series offers relatively few options. The Sun-3/50 series has a SCSI (Small Computer Systems Interface, pronounced "scuzzy") host adapter on the CPU board to connect local mass storage. The Sun-3/50 series can also have an optional MC68881 floating point coprocessor to improve floating-point calculations performance.

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, 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-3/50M can support a 71-megabyte disk with or without a 60-megabyte ¼-inch cartridge tape drive. The disk and tape units are housed in a desktop mass storage subsystem (MSS). You can add a second 71-megabyte expansion disk for a total of 142 megabytes. The Sun-3/52 comes standard with a single disk and tape drive.

NOTE *Disk capacity is given in formatted megabytes.*

2.2. Sun-3/75M

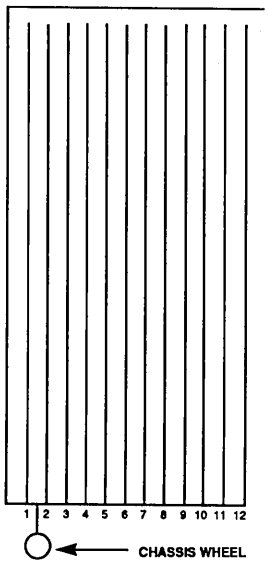
Although the Sun-3/75M is a member of the Sun-3/100 series, we describe its options in a separate section because, unlike the other members of the Sun-3/100 series, it has a very limited configuration set. The Sun-3/75M has four megabytes of memory on its CPU board and can have four megabytes on a memory expansion board and a SCSI controller.

Mass storage on the Sun-3/75 is housed in a desktop mass storage subsystem like the one with the Sun-3/50. You can also use a disk-only box without tape when doing backups and the installing of SunOS be done over a network.

2.3. Sun-3/100 and Sun-3/200 Series

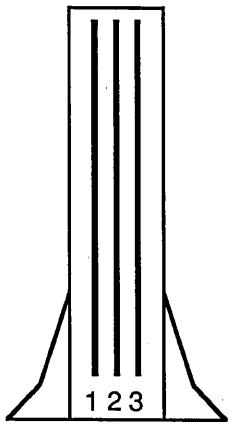
Before we discuss the options available for the Sun-3/100 and Sun-3/200 series, you should understand how the card cage is structured. Figure 2-1 shows how the slots are numbered in the 12-slot models.

Figure 2-1 *Slot Numbering in the 12-slot Enclosure*



The Sun-3/110 has a three-slot card cage. The next figure shows how the slots are numbered in the Sun-3/110. The Sun-3/110 can be arranged vertically or horizontally and can be either deskside or desktop.

Figure 2-2 *Slot Numbering in the 3-slot Enclosure*



All boards are inserted or extracted from the back of the pedestal or cabinet. **Bus priority** is determined by that board's position relative to the CPU board in the card cage; a board in slot two has a higher bus priority than a board in slot three.

2.4. Board Options

This section briefly describes the options available with the Sun-3/100 and Sun-3/200 series. The options are listed in the order they are usually found in the card cage.

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

Memory Expansion Board

These four and eight megabyte 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 systems. In the Sun-3/100 deskside systems, a single memory expansion board goes into slot two. If you are using more than one memory expansion board, each successive board goes into the slot to the right of the last — for instance, the second memory expansion board goes into slot 3, and the third into slot 4. In the Sun-3/200 systems, the first memory expansion board goes into slot 6, and each successive memory expansion board goes into slots 2 through 4.

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

Table 2-1 *Maximum On-board Memory*

	Maximum On-Board Memory			
Model No.	*Memory on CPU*	*MB/Memory Bd*	*No. of Bds*	*Total Memory*
50/52	4 MB	no	0	4 MB
75	4-MB	4 MB	1	8 MB
110	4 MB	4 MB	2	12 MB
160/180	4 MB	4 MB	3	16 MB
260/280	no	8 MB	4	32 MB

Floating Point Accelerator

The Floating Point Accelerator (FPA) speeds up high-speed floating-point calculations. This board usually goes into slot 5 in the 12-slot logic enclosure. The CPU, memory expansion and Floating Point Accelerator (FPA) boards must go into slots one to six because the CPU, expansion and FPA boards must share a common memory (*P2*) bus, available in the 1-6 slot arrangement. See Chapter 5, *Hardware Configuration*, for more information on the memory bus.

SCSI Controller

The SCSI (Small Computer Systems Interface) is an industry standard bus. The SCSI controller connects the 71-MB disk and ¼-inch tape drive to the workstation.

The SCSI controller board plugs into a VME(2)-to-VME(3) adapter board and goes into slot seven in the 12-slot logic enclosure. In the data center cabinet, the

board may go into other slots if the VME(2)-to-VME(3) adapter board has no P2 connections. The SCSI interface is built-in on the Sun-3/50 series workstations.

Graphics Processor/Graphics Buffer Boards

The 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. These options are available only for systems with the Sun-3 color board (the Sun-3/160C/G, Sun-3/180C/G, the Sun-3/260C/G and Sun-3/280C/G systems).

The GP+ moves graphics functions normally done in software into efficient, tuned hardware pipelines. For instance, the GP+ accelerates vector drawing, either two- or three-dimensional, integer or floating-point coordinates. The GB is a hardware 'z-buffer' that speeds three-dimensional hidden-surface removal.

Two GP+/GB configurations are possible:

- installing the GP+ only
- installing both the GP+ and GB

The GP+ and GB are usually installed in slots 10 and 11 in a 12-slot logic enclosure and must be connected by a private P2 bus.

Second Ethernet Controller

You can add a second Ethernet controller to your system to make your workstation a gateway. The adapter board with the second Ethernet controller is usually installed in slot seven or eight in a 12-slot logic enclosure.

Tape Controller

The ½-inch tape controller connects a ½-inch tape drive to the workstation. You can have up to two tape controllers. They are usually installed in slots seven, eight, or nine in a 12-slot logic enclosure.

SMD Controller

SMD (Storage Module Device) is an industry standard interface for high-performance drives. The SMD controller connects SMD disk drives (any of 130, 280, 380 or 575-MB) to the workstation. SMD controllers are usually installed in slots seven through 11 in a 12-slot logic enclosure. The Xylogics 451 controller is used with the 280 and 575-MB drives; the Xylogics 450 controller with the 130 and 380-MB drives.

NOTE *Sun sells two controllers per system. Each controller can handle two drives per controller. If you want to install more than two controllers, you are responsible for technical issues, such as, power supply capacity, slot assignment and safety.*

Color Video Board

You can upgrade your system to color by adding a color board and adding a color display. This upgrade is not available for the for the Sun-3/110 series which comes standard with a color or grayscale display.

The color video board usually goes into slot eight. If slot eight is already taken, the board can go in slots two through 12.

ALM

The Asynchronous Line Multiplexer (ALM)* board connects multiple terminals or other serial devices to Sun network fileservers or workstations. The ALM in the Sun-3/160 and Sun-3/260 takes up two slots. It is installed in one slot, but the slot next to it must be left empty. The ALM in the Sun-3/180 and Sun-3/280, however, takes up only one slot. The ALM board in the Sun-3/180 and Sun-3/280 can be installed in any slot as long as the cables do not interfere with the other boards. You can have three ALM boards in the Sun-3/180 and Sun-3/280. The ALM boards are usually installed in slots 10 through 12 in a 12-slot logic enclosure.

SCP

The SunLink Communications Processor (SCP) board works with the SNA 3270, IR, OSI, and X.25 SunLink software products to speed up communications. You can have up to two SCP boards per system that are generally installed in slots six through 12. If you want to install more than two SCP boards, contact Sun Technical Support.

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

SunIPC

The SunIPC (Sun Integrated Personal Computer) board gives you the full-functionality of an MS-DOS system without losing any of the performance and 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. The SunIPC board has a 10 MHz Intel 80286 microprocessor and one megabyte of memory.

An optional Intel 80287 math coprocessor is available for increased performance. The board executes applications written for MS-DOS 3.1 or later and included with the package is Microsoft's GWBASIC compiler. Either color or monochrome applications can run in SunWindows display while UNIX applications are running in other windows. An optional external 1.2 megabyte floppy disk drive is available for PC software. The SunIPC board is usually installed in slots seven through 12 in a deskside pedestal.

2.5. Board Arrangement

The tables on the following pages show the arrangement of boards as configured, tested, and delivered from the factory. These tables are subject to change without notice. To receive the latest information, order Sun document 813-2004, *Card Cage Slot Assignment Backplane Configuration Procedure.*

Slot Precedence

Slot allocations are assigned by precedence — "A" is the first recommended slot position for the board, "B" is next, and so on. If the slot is already occupied, move the board to the next recommended slot.

For instance, if you have a VME SCSI controller already in slot 7, and you want to add a second Ethernet controller, the Ethernet controller goes into slot 8 — precedence "B."

*ALMs shipped in 1985 or early 1986 have a PS connector and interface with other boards and must be isolated in slots 10, 11, 12. Graphics Processor and Graphics Buffer options are not allowed with these ALMs.

Accordingly, if you want to add a ½-inch tape controller, and slots 7 and 8 are filled, put the ½-inch tape controller into slot 9 — precedence "C."

Unused Slots

Any empty slot must have an airflow restricter in it. This restricter must be removed before you try to put a board into its slot. Whenever you have a vacant slot between any two used slots, you must short certain pins on the backplane of the vacant slot. This procedure is described in the Installation Manual shipped with your system.

Table 2-2 *Sun-3/110 Card Cage Slot Assignments*

Board Name	***Sun-3/110 Backplane***		
	1	2	3
501-1134 Sun CPU Board	A		
1st 4MB 501-1164 Sun Mem Exp		A	
2nd 4MB 501-1164 Sun Mem Exp			A
501-1105 Sun FPA		A	B
1st 501-1158 Sun SCP		A	B
2nd 501-1158 Sun SCP			A
501-1138 VME SCSI Ctlr		B	A

Table 2-3 *Sun-3/160 Card Cage Slot Assignments*

Board Name	*Sun-3/160 Backplane*											
	1	2	3	4	5	6	7	8	9	10	11	12
Sun CPU†	A											
1st Sun Mem Exp†		A										
2nd Sun Mem Exp†			A									
3rd Sun Mem Exp†				A								
501-1105 Sun FPA					A							
Sun GP†										A		
501-1058 Sun GB											A	
501-1157 Sun ALM**											**	A
501-1149 Sun VME SCSI Ctlr							A					
1st 501-1158 Sun SCP		A	B	C	D	E						
2nd 501-1158 Sun SCP			A	B	C	D	E	F				
Sun VME Color†		A	B	C	D	E	F	G	H			
501-1153 2nd Ethr Ctlr		A	B	C	D	E	F	G	H	I	J	K
1st 1/2" Tape Ctlr†							A	B	C	D	E	F
2nd 1/2" Tape Ctlr†								A	B	C	D	E
1st SMD Ctlr†							A	B	C	D	E	F
2nd SMD Ctlr†								A	B	C	D	E
1st 501-1125 Sun IPC		D	E	F	G	H	A	B	C	I	J	K
2nd 501-1125 Sun IPC		C	D	E	F	G		A	B	H	I	J
3rd 501-1125 Sun IPC		B	C	D	E	F			A	G	H	I
4th 501-1125 Sun IPC		A	B	C	D	E				F	G	H

NOTE ** *The ALM takes up two slot spaces.*

† These boards have one of the following descriptions:

2MB 501-1163 Sun CPU
4MB 501-1164 Sun CPU

2MB 501-1131 Sun Memory Exp.
4MB 501-1132 Sun Memory Exp.

501-1055 Graphics Processor
501-1139 Graphics Processor Plus

501-1156 CPC 1/2" Tape Ctlr (1600 BPI)
501-1155 Xylogics 472 1/2" Tape Ctlr (6250 BPI)

501-1154 Xylogics 450 SMD Ctlr
501-1166 Xylogics 451 SMD Ctlr

501-1014 Sun-2 Color
501-1116 Sun-3 Color

Table 2-4 *Sun-3/180S Card Cage Slot Assignments*

This configuration uses the Sun-3 3x2 Adapter (501-1191) as the SCSI Controller. Configurations with another version of the SCSI controller will vary.

Board Name	*Sun-3 /180S Backplane*											
	1	2	3	4	5	6	7	8	9	10	11	12
Sun CPU†	A											
1st Sun Mem Exp†		A										
2nd Sun Mem Exp†			A									
3rd Sun Mem Exp†				A								
501-1105 Sun FPA					A							
Sun GP†										A		
501-1058 Sun GB											A	
1st 501-1165 Sun ALM												A
2nd 501-1165 Sun ALM											A	
3rd 501-1165 Sun ALM										A		
1st 501-1158 Sun SCP		A	B	C	D	E						
2nd 501-1158 Sun SCP			A	B	C	D	E					
501-1138 VME SCSI Ctlr		A	B	C	D	E	F	G				
Sun VME Color†		A	B	C	D	E	F	G	H			
501-1153 2nd Ethr Ctlr		A	B	C	D	E	F	G	H	I	J	K
1st 1/2" Tape Ctlr†		A	B	C	D	E	F	G	H	I	J	K
2nd 1/2" Tape Ctlr†			A	B	C	D	E	F	G	H	I	J
1st SMD Ctlr†		A	B	C	D	E	F	G	H	I	J	K
2nd SMD Ctlr†			A	B	C	D	E	F	G	H	I	J
1st 501-1125 Sun IPC									D	C	B	A
2nd 501-1125 Sun IPC								D	C	B	A	
3rd 501-1125 Sun IPC							D	C	B	A		
4th 501-1125 Sun IPC						D	C	B	A			

NOTE *† These boards have one of the following descriptions:*

2MB 501-1163 Sun CPU
4MB 501-1164 Sun CPU

2MB 501-1131 Sun Memory Exp.
4MB 501-1132 Sun Memory Exp.

501-1055 Graphics Processor
501-1139 Graphics Processor Plus

501-1156 CPC 1/2" Tape Ctlr. (1600 BPI)
501-1155 Xylogics 472 1/2" Tape Ctlr. (6250 BPI)

501-1154 Xylogics 450 SMD Ctlr.
501-1166 Xylogics 451 SMD Ctlr.

501-1014 Sun-2 Color
501-1116 Sun-3 Color

Table 2-5 *Sun-3/260 Card Cage Slot Assignments*

Board Name	*Sun-3/260 Backplane*											
	1	2	3	4	5	6	7	8	9	10	11	12
501-1100 Sun CPU Board	A											
1st 501-1102 Sun Mem Board@						A						
2nd 501-1102 Sun Mem Board@		A										
3rd 501-1102 Sun Mem Board@			A									
4th 501-1102 Sun Mem Board@				A								
501-1105 Sun FPA					A							
Sun GP†										A		
501-1058 Sun GB											A	
501-1137 Sun ALM											**	A
501-1149 Sun VME SCSI Ctlr							A					
1st 501-1158 Sun SCP		A	B	C	D		E	F				
2nd 501-1158 Sun SCP			A	B	C		D	E	F			
Sun VME Color†		A	B	C	D		E	F	G	H	I	J
501-1153 2nd Ethr Ctlr		A	B	C	D		E	F	G	H	I	J
1st CPC 1/2" Tape Ctlr							A	B	C	D	E	F
2nd CPC 1/2" Tape Ctlr								A	B	C	D	E
1st 501-1166 Xylogics 451 SMD Ctlr+							A	B	C	D	E	F
2nd 501-1166 Xylogics 451 SMD Ctlr+								A	B	C	D	E

NOTE *@ Slot 6: If only one memory board is installed, it must be placed in Slot 6. A memory board must always reside in Slot 6, and it must have 220/270Ω Terminating Resistor Network, Sun P/N 120-1613, installed at location 34-F for P2 bus termination.*

† These boards have one of the following descriptions:

501-1055 Graphics Processor
501-1139 Graphics Processor Plus

501-1014 Sun-2 Color
501-1116 Sun-3 Color

501-1156 CPC ½" Tape Controller (1600)
501-1155 Xylogics 472 ½" Tape Controller (6250)

*** The 501-1157 Sun ALM takes up two slot spaces.*

+ 501-1154 Xylogics 450 SMD Controller (when transferred from another system) may be used instead of the 501-1166. It is not offered on the price list.

Table 2-6 *Sun-3/280S Card Cage Slot Assignments*

This configuration uses the Sun-3 3x2 Adapter (501-1191) for the SCSI Controller. Configurations with another version of the SCSI controller will vary.

Board Name	*Sun-3 /280 Backplane*											
	1	2	3	4	5	6	7	8	9	10	11	12
501-1100 Sun CPU Board	A											
1st 501-1102 Sun Mem Board@						A						
2nd 501-1102 Sun Mem Board@		A										
3rd 501-1102 Sun Mem Board@			A									
4th 501-1102 Sun Mem Board@				A								
501-1105 Sun FPA					A							
Sun GP†										A		
501-1058 Sun GB											A	
1st 501-1165 Sun ALM												A
2nd 501-1165 Sun ALM											A	
3rd 501-1165 Sun ALM										A		
1st 501-1158 Sun SCP		A	B	C	D		E					
2nd 501-1158 Sun SCP			A	B	C		D	E				
501-1138 Sun VME SCSI Ctlr		A	B	C	D		E	F	G			
Sun VME Color†		A	B	C	D		E	F	G	H	I	J
501-1153 2nd Ethr Ctlr		A	B	C	D		E	F	G	H	I	J
1st 1/2" Tape Ctlr†		A	B	C	D		E	F	G	H	I	J
2nd 1/2" Tape Ctlr†			A	B	C		D	E	F	G	H	I
1st 501-1166 Xylogics 451 SMD Ctlr+		A	B	C	D		E	F	G	H	I	J
2nd 501-1166 Xylogics 451 SMD Ctlr+			A	B	C		D	E	F	G	H	I

NOTE *@ Slot 6: If only one Memory Board is installed, it must be placed in Slot 6. A Memory Board must always reside in Slot 6, and it must have 220/270Ω Terminating Resistor Network, Sun P/N 120-1613, installed at location 34-F for P2 bus termination.*

† These boards have one of the following descriptions:

501-1055 Graphics Processor
501-1139 Graphics Processor Plus

501-1014 Sun-2 Color
501-1116 Sun-3 Color

501-1156 CPC ½" Tape Controller (1600 BPI)
501-1155 Xylogics 472 ½" Tape Controller (6250 BPI)

+ 501-1154 Xylogics 450 SMD Controller (when transferred from another system) can be used instead of the 501-1166. It is not offered on the current price list.

2.6. 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 Drive (SMD) and Enhanced Storage Module Drive (ESMD) standard interfaces. For price-sensitive needs, Sun uses the SCSI bus. Sun's mass storage subsystems are fully integrated and tested and meet all pertinent safety requirements.

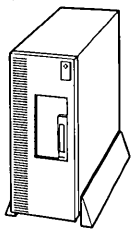
Sun's mass storage devices are available in a variety of sizes and packaging configurations to meet your needs:

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

Low-Cost Storage

For smaller disk storage needs, Sun has the 71-megabyte disk drive. Designed for the Sun-3/50/52/75/110 desktop workstations, this subsystem fits either horizontally or vertically on or under a desk. For more disk space, you can daisy chain a second 71-megabyte disk in a separate enclosure. The Sun-3/160 can also have up to two 71-megabyte disks installed in a system pedestal.

Backup



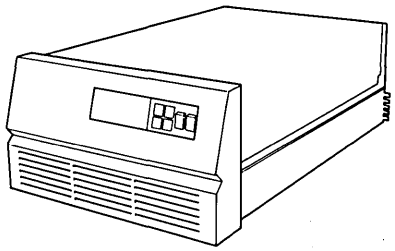
Sun has three options for your backup needs.

- The dual-speed/dual-density 1600/6250 bpi tape drive backs up fileservers in a cost-effective way. This dual-speed drive provides 150 megabytes of data storage on a single reel of tape.
- The 1600 bpi tape drive offers another alternative for those who want a ½-inch reel-to-reel backup. This drive provides 40 megabytes of formatted data storage.
- For local backup for workstations, Sun has a ¼-inch cartridge with 60 megabytes of storage.

Deskside High-Performance Storage

Sun offers deskside expansion pedestals to house disks for those who need high disk capacity with their workstations. A single-disk pedestal can accommodate a 280-megabyte disk, while a dual-disk configuration can provide 560 megabytes of disk space. A second expansion pedestal can provide another 560 megabtyes of disk space.

Data Center Storage



For large fileserver applications, Sun offers a high-performance 575-megabyte disk for the Sun-3/180 and Sun-3/280 fileservers. You can put up to four disks on a system in a dual-bay cabinet for more than two gigabytes of data storage. You can have a maximum of four SMD or ESMD disks per system (two per controller), and 2 SCSI disks per system (on one controller).

Table 2-7 *Mass Storage Overview*

Mass Storage Overview		
Application	***Disk Storage***	***Backup***
Fileservers	575 MB	6250 bpi ½-inch tape
Fileservers & Workstations	280 MB	1600 bpi ½-inch tape ¼-inch cartridge
Workstations	71-MB	¼-inch cartridge

The table below shows the common mass storage configurations.

Table 2-8 *Mass Storage Configurations*

Mass Storage Configurations			
	50/75/110	***160/260***	***180/280***
71-MB	MSS	System Pedestal*	no
71-MB Expansion	MSS	no	no
2 x 71-MB	no	System Pedestal*	no
Cartridge Tape	MSS	System Pedestal*	integral
71-MB & Cartridge	MSS	System Pedestal*	no
2 x 71-MB & Cartridge	MSS	System Pedestal*	no
130-MB	no	Expansion Pedestal	no
2 x 130-MB	no	Expansion Pedestal	no
280-MB	no	Expansion Pedestal	no
2 x 280-MB	no	Expansion Pedestal	no
380-MB	no	Meter-high cabinet*	Data Center Cabinet†
380-MB Expansion	no	Data Center Cabinet*	Data Center Cabinet†
575-MB	no	no	Data Center Cabinet
575-MB Expansion	no	no	Data Center Cabinet
6250 bpi Tape	no	Data Center Cabinet	Data Center Cabinet
1600 bpi Tape	no	Meter-high Cabinet*	Data Center Cabinet

NOTE *MSS = Mass Storage Subsystem (also known as the Shoebox)*
Expansion Pedestal = Mass Storage Pedestal
** not available for the Sun-3/260*
† not available for the Sun-3/280

2.7. Maximum Configurations

Table 2-9 shows the maximum number of each option offered by Sun for a single workstation.

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

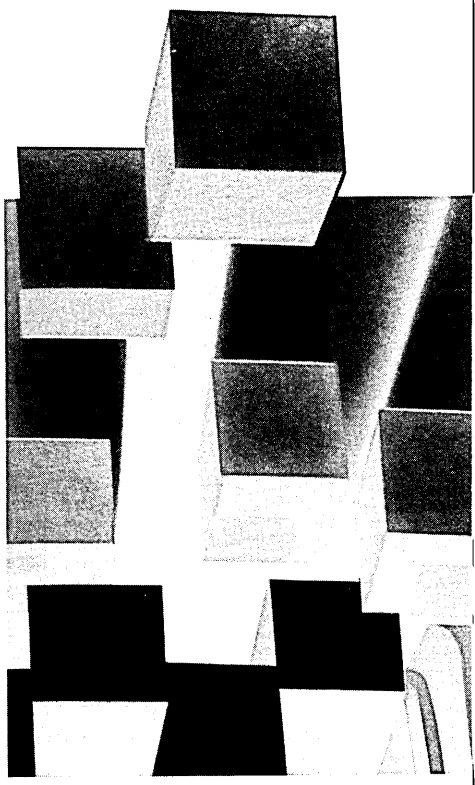
Table 2-9 *Maximum Configurations*

Option No.	*Option Name*	*50*	*75*	*110*	*160*	*180*	*260*	*280*
104	4 Megabyte Memory Exp. Boards	0	1	2	3	3	0	0
108	8 Megabyte Memory Exp. Boards	0	0	0	0	0	3	3
150	Floating Point Accelerator	0	0	1	1	1	1	1
160	VME (2) to VME (3) Adapter	0	0	2*	*	*	*	*
211	GP Plus	0	0	0	1	1	1	1
202	Graphics Buffer	0	0	0	1	1	1	1
450	Second Ethernet Interface	0	0	0	1	1	1	1
481	16-Channel ALM	0	0	0	1	3	1	3
501	71-MB disk	1	1	1	1	0	0	0
502	2 x 71-MB disk	0	0	0	1	0	0	0
503	71-MB expansion disk	1	1	1	0	0	0	0
511	71-MB disk with ¼" tape	1	1	1	1	0	0	0
512	142-MB disk with ¼" tape	1	1	1	1	0	0	0
601	130-MB disk	0	0	0	2	0	0	0
605	280-MB disk	0	0	0	2	0	2	0
606	2 x 280-MB disk	0	0	0	2	0	2	0
620	380-MB disk	0	0	0	2	2	0	0
621	380-MB Expansion	0	0	0	2	2	0	0
625	575-MB disk	0	0	0	0	2	0	2
626	575-MB Expansion	0	0	0	0	2	0	2
650	¼-inch tape drive	0	0	0	1	1	1	1
670	½-inch tape drive(1600 bpi)	0	0	0	2	2	2	2
675	½-inch Tape (6250/1600 bpi)	0	0	0	2	2	2	2
n/a	SCP	0	0	2	2	2	2	2
n/a	SunIPC	0	0	0	4	4	0	0

NOTE ** Adapter boards are limited only by space and power requirements of the interfaced accessory board.*

3

Software Storage Requirements



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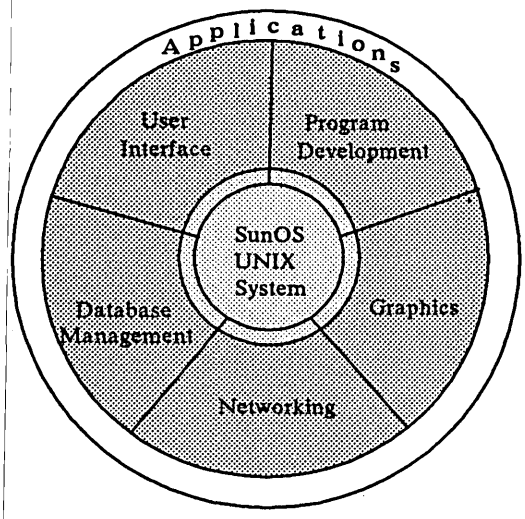
Software Storage Requirements



Sun's Operating System, SunOS, is the foundation on which the software environment is built. Based on the converged Berkeley 4.2BSD and AT&T System V, it is enhanced to give high-performance facilities for all software packages and to maximize system throughput on heterogeneous networks.

As Sun adds enhancements to its operating system, system management becomes easier with selective installation of modules and subsystems. This minimizes the required memory and disk space for loading SunOS. In planning your workstation configuration, you should be aware of all these software issues:

- Main Memory Usage
- Disk Storage
- Standard and Optional Software Size
- Swap Partition Size and Process Virtual Address Space

The figures in this chapter reflect the SunOS, Release 3.2.

3.1. Main Memory Usage

The minimum memory for the Sun-3/50 and Sun-3/100 series is four megabytes; the minimum memory for the Sun-3/200 series is eight megabytes. The SunOS kernel uses a portion of the first megabyte of memory. Also in that first megabyte are the basic system disk cache buffers. The remainder is available for user programs.

The SunView system, Sun's window-based user environment, works as a collection of user programs. A portion of the memory available to user programs is used for window system memory before you begin running your own programs in the windows. When deciding on main memory needs, you should consider these window system memory pages resident. If they are swapped out, window system response slows down.

Page size on the Sun-3 workstations is eight kilobytes. Virtual memory behavior depends heavily on the number of pages as well as the total amount of main memory.

On the Sun-3/50 series, the kernel automatically allocates 128 kilobytes for a frame buffer. On the Sun-3/100 series you can configure the kernel to allocate a shadow frame buffer. As the size of physical memory increases, the system also automatically allocates additional I/O buffers for use as disk cache.

Table 3-1 shows the approximate allocation from four megabytes of memory in a typical Sun workstation.

Table 3-1 *SunOS 3.2 Main Memory Allocation*

Allocated To	*Memory Used*	*Total Available User Memory*	*Total Main Memory*
SunOS Kernel (Code)	593 KB†		
SunOS Kernel (I/O buffers)	350 KB		4 MB
SunWindows (Minimum Working Set)	244 KB		
SunOS Kernel (Shadow Frame Buffer)	128 KB‡		
Available to User Programs	2752 KB	2752 KB	
SunOS Kernel (additional disk cache)	200 KB		6 MB
Additional Avail. to User Programs	1800 KB	4552 KB	
SunOS Kernel (additional disk cache)	200 KB		
Additional Avail. to User Programs	1800 KB	6352 KB	8 KB
SunOS Kernel (additional disk cache)	200 KB		
Additional Avail. to User Programs	1800 KB	8152 KB	10 MB
SunOS Kernel (additional disk cache)	200 KB		
Additional Avail. to User Programs	1800 KB	9952 KB	12 MB
SunOS Kernel (additional disk cache)	200 KB		
Additional Avail. to User Programs	1800 KB	11752 KB	14 MB
SunOS Kernel (additional disk cache)	200 KB		
Additional Avail. to User Programs	1800 KB	13552 KB	16 MB

NOTE *† This is the size for a GENERIC kernel. Sun recommends you reconfigure your kernel to your needs.*
‡ The shadow frame buffer is required with the Sun-3/50 series and optional with the Sun-3/100 series.

3.2. Disk Storage Requirements

The capacity of the disk drive options is given in *formatted* megabytes (for example, 71 megabytes for the integral 5 ¼-inch disk option on the Sun-3/160). When configuring a system, you will probably find this number more useful than the unformatted capacities typically quoted by disk drive vendors. However, you need to consider more than formatted capacity in deciding on disk storage size.

Disk Partitions

Software divides the formatted disk into a number of "logical disks," or *partitions*. One or more of these partitions are used for swap space. For these swap partitions, the usable capacity is the full formatted capacity.

In the SunOS filesystem, the usable capacity (megabytes of user data that fit in the partition) is reduced from the formatted capacity by approximately 10 percent. Operating system data structures that maintain directory and allocation information for the partition take up the overhead space and are not available to users.

The SunOS filesystem, by default, reserves part of a partition's available storage for free space. This allows the operating system to make efficient disk sector allocation decisions. You can change this parameter to recover some of the reserved free space, but using this reserved space may result in reduced performance due to excessive disk seeking.

SunOS with all its utilities, on-line documentation, configuration modules for the kernel, and games can take up a large amount of disk storage. Running processes with large virtual address spaces also requires large swap space for the data part of that address space.

The SunOS programming environment is file-intensive; many programs create temporary files for scratch storage, buffers, or failure protection. Printing, electronic mail, and *uucp* (UNIX to UNIX copy) all use temporary files for spooled messages and output. Because of this, configuring Sun workstations and networks with enough disk capacity is important to get the best performance.

NOTE *All of the values for disk space are estimated and depend on your application.*

Standalone Systems

A standalone system requires at least one 71-megabyte disk for a single-user configuration. This will be enough disk space for standard software, but not for all optional software. Here is a summary of the disk space for a standalone system with a 71-megabyte disk.

Table 3-2 *Disk Allocation for Standalone System with 71-MB Disk*

Disk Space Use	*Standalone System* *MB*
Required operating system software	22 MB
Required swap space (single-user)	16 MB
Disk management overhead (directories, etc.)	3 MB
Remaining for optional software and user space	31 MB
Typical optional software installed	
Minimum, run-only system (SunView loaded)	1.5 MB
Development system (min. + compilers, libraries)	5 MB
User Space	24.5 MB

This is sufficient memory for a program development system and some applications, but large CAD and artificial intelligence programs need more disk space.

Software that should not be loaded onto a 71-megabyte disk are on-line manual pages, demo programs, and games. These three areas alone add up to 9.5 MB. If you use a Versatec printer, you should add 6 MB to your requirements.

Networked Systems

For a workstation that is on a network, a 71-megabyte disk provides a good solution for a single-user station. You may put a small, bootable portion of the operating system on the local disk, including all portions of the operating system configured for the local system configuration. An alternate configuration would allow the workstation to boot and swap from a server and use the local 71-megabyte disk for user space. Another configuration might be to have root and swap on the local system and use the Network File System (NFS) for user space because this is faster. See Chapter 4, *Network Server Configurations* for more information.

A large portion of optional software should be loaded on another system on a network. All other users on the network can use the Network File System to mount these files onto their local directory and access them as freely as if they were on their local disk without duplicating unnecessary files.

We do not recommend running multiple users on a single 71-MB disk. A single-user configuration follows:

Table 3-3 *Disk Allocation of 71-MB Disk for Single User on a Network*

Single User on a Network	
Disk Space Use	***MB***
Operating system and swap space	34-38 MB
Disk management overhead	3 MB
User space	30 MB

Multi-user Systems

For each person using a workstation (or each add-on terminal), an additional amount of user space must be available on the disk. Typically, five to ten megabytes per use is generous, but this depends on the application. You will have to specify this amount according to your application needs. Keep in mind that each user increases the requirements, another reason that we recommend the 71-megabyte disk for single-user only. Adding a second disk or using a larger disk is recommended for running configurations with more than one user.

Servers

A fileserver has more disk space requirements. If the server is supporting both Sun-2's and Sun-3's (heterogeneous), it needs copies of both versions of the operating system to reside on disk. Also, each client workstation needs about 16 megabytes swap space and 5 megabytes root space on the server. This means that each client needs 21 megabytes **plus** user space on the server. If more than one user is using a client, one or more SMD disk drives is recommended.

The following are some typical configurations to be used as guidelines for servers:

Table 3-4 *Disk Allocation for Server with More Than One User*

Multi-User Server with 5 homogeneous clients	
Disk Space Use	***MB***
Operating system required space	14 MB
Swap space required for server and clients	96 MB
Root space required for clients	25 MB
Optional software*	34 MB
Total required	169 MB
Add user space	10 MB per user

NOTE **This figure represents all optional software; you may not want to load all of it.*

Sun Software Size

This next two tables show the sizes of standard and optional Sun software.

Table 3-5 *Size of Standard SunOS Software*

Standard Software	
Software Category	***MB***
Basic System (root and usr)	***36.29***
Kernel Configuration Files	(-).94*

NOTE **The minus sign before this number means that you can remove the software after you have configured your system kernel.*

The software categories are listed in the order that they appear on the distribution tape.

Table 3-6 *Sizes of Optional Software*

Optional Software	
Software Category	***MB***
*Networking	2.28
*Debugging tools	1.02
User's SunView	1.92
Programmer's SunView	2.17
SunView and Demo Program Source	.40
*Text Processing tools	.77
*Setup Tools	(-).95
Standalone Diagnostics	.004
FORTRAN compiler and libraries	1.03
User Level Diagnostics	1.69
SunCore and CGI Libraries	2.81
Pascal Interpreter and Libraries	1.03
Profiled Libraries	.88
uucp programs	.53
*System V Programs and Libraries	3.48
Manual Pages	4.17
Demonstration Programs	2.27
Games	2.34
Versatec Printer software	6.07

NOTE * *Categories with an asterisk are new programs offered with SunOS, release3.2. (-) The minus sign after the figure for setup tools means that the setup will run and then remove itself and the software it uses to do your system installation. This saves about one megabyte.*

Partitioning Tables

In the partitioning tables, 3-7 and 3-8, the number of megabytes indicates formatted disk space before SunOS filesystems are constructed in any partitions. Note that the sizes shown are the recommended minimum. Running large virtual address space applications, especially with many active windows, will probably need much larger swap partitions than those shown. You can change your swap partition size from the default when you install the software.

Table 3-7 *Normal Disk Partitioning for a Standalone System*

Standalone System	
Partition Contents	***Partition Size (71-MB Disk)***
Root filesystem (/)	8 MB
[Swap space]	16 MB
User filesystem (/usr)	47+ MB

In the homogeneous server configuration (shown in Table 3-8) the root filesystem for each node contains private data belonging to that node and its swap space. The public filesystems are accessible to all nodes.

Table 3-8 shows the partitions for a typical Network Disk (ND) server that is also a Network File System (NFS) server. This table shows a Sun-3 server; a Sun-2 server would have */pub* in partition e and */usr* in partition g instead.

Table 3-8 *Partitions for a Homogeneous NFS Server Disk*

NFS Server Disk	
Partition	***Contents***
a	Server's root filesystem area
b	Server's swapping area
c	ND partitions
d	Home directories
e	unused
f	*/pub*
g	unused
h	*/usr*

3.3. Swap Partition Size and Process Virtual Address Space

When SunOS is running in multiuser mode, several processes are running that perform system-related housekeeping functions. The operating system requires that swap space be available for these processes as well as for user programs. If one user is logged in at the Sun workstation console and is idle, these processes need just under two megabytes of swap space. One user, running the window system with four "virtual terminal" windows and no application programs, needs about four megabytes of total swap space.

The total allocatable address space is not more than the swap partition size. In other words, the sum of all the virtual memory in use by all of the running processes cannot exceed the swap partition size. For instance, if you have only 12 megabytes for your swap partition size, you will not get more than 12 megabytes for virtual address space. Table 3-9 shows this relationship.

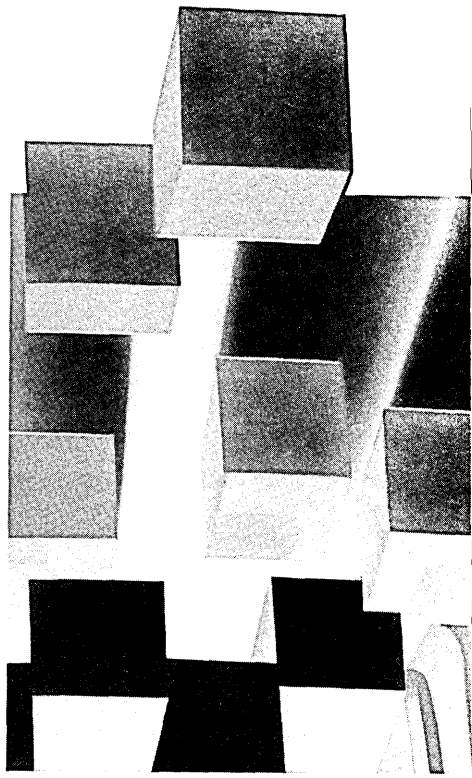
Table 3-9 *Swap Partition Size and Maximum Virtual Address Space*

Swap Partition Size	*Maximum Virtual Address Space*
6 MB	4.3 MB
8 MB	8.0 MB
24 MB	16.3 MB
40 MB	31.7 MB
100 MB	61.4 MB
200 MB	118.7 MB

Other factors affect the maximum virtual address space. For example, all of the quoted maximum virtual address spaces in Table 3-9 include eight kilobytes of per-process virtual memory management overhead. This space is not available to the application program. Because swap space usage is dynamic, calculating precise swap space needs is difficult. For example, the code part of a program is usually sharable among all users of the program, so *text* swap space is needed only for the first instance of a process running that program. When setting up disk configurations, you should allocate swap space with a generous margin over estimated application needs.

4

Network Server Configurations



4

Network Server Configurations

Any Sun workstation with the right peripherals can act as a network resource for services such as printing, electronic mail forwarding, network-wide accounting and error logging, and network disk storage. Depending on activity load and performance needs, one server may provide all services or particular servers can be dedicated to providing each service. Sometimes more than one server may provide certain high-demand services.

4.1. Calculating Disk Space

To determine how much disk space you need on a server, you should examine what types of work the clients are doing. Minimally you should calculate:

- 60 megabytes for /, swap, /pub and /usr on the server
- 17 - 21 megabytes for / and swap for each client
- 20 or less megabytes in /usr/*servername* for each user's home directory

If you want to set up a server that serves both Sun-2 workstations and Sun-3 workstations, you need to add another 40 to 60 megabytes for another copy of /pub and /usr.

4.2. Clients per Server

Deciding the right mix of diskful and diskless clients on one network disk server can be one of the most difficult tasks. The decision depends on many configuration variables, especially, the network activity generated by your applications.

SunOS permits a range of from 1 to 20 client workstations per network disk server, depending on the network configuration. These clients may be completely diskless or they may have their own local disk as well as sharing the network disk server.

The network disk configuration utility limits the number of clients based on the amount of disk storage:

- One 130-megabyte disk, 1 to 2 clients
- One 280-megabyte disk, 1 to 4 clients
- One 380-megabyte disk, 1 to 8 clients.
- One 575-megabyte disk, 1 to 10 clients

4.3. Improving Server Performance

Other than the applications running on each workstation, the most important variables for selecting configurations are:

- the server disk configuration
- the amount of main memory on each client
- whether each client has a local disk or not

Adding a second disk drive to a controller increases on-line capacity and may increase performance slightly. Adding a second disk drive with its own controller increases performance if data is shared evenly across both disks. This arrangement would mean that swap space for some of the clients would be on the first disk; some on the second. Turning off certain programs that are not vital to your application(s), such as accounting, can improves performance.

An overly heavy load on a server can degrade performance. For example, if one of your servers is the yellow pages master server and is building updated yellow pages databases, your clients may get slow response time. If certain applications use large virtual address spaces in ways that cause extensive paging, the most effective performance boost for the entire network comes from adding main memory to the workstation(s) running those applications. If other applications process large amounts of disk data serially, the network benefits more from adding a local disk drive to the appropriate workstation(s).

4.4. Saving Disk Space with NFS

Sun workstations with their own disk can be made into clients of an NFS server, freeing up about 15 or 20 megabytes of disk space. To do this, mount `/usr` from a fileserver on the network and remove `/usr` files, freeing up all that disk space for your use. This process transforms a diskful *workstation* into a diskful *client*. Before doing this, you should note:

- The client and server must run the same version of SunOS.
- If the client is a Sun-3, it is not advisable to use a Sun-2 as a server.
- If you are converting a system that has already been in use, be sure to back up any files you want to keep.

4.5. Sun Network vs. a Timeshared Minicomputer

A cluster of Sun workstations is often evaluated against a timeshared superminicomputer system performing the same application set. The workstation approach copies the pieces of the environment most critical to predictability and responsiveness: the processor, main memory, and bit-mapped graphics display. Both approaches centralize mass storage; the difference is which "bus" (backplane or Ethernet) accesses mass storage.

If your application set is slowed down by competition for disk access under timesharing, the workstation approach may improve that problem. Disk caching occurs in *each* workstation, providing a much larger effective disk cache and at the same time a much higher cache hit rate.

Other approaches for improving performance (adding additional disks or controllers, or both, and spreading data properly among them) apply to both workstations and timesharing systems. The workstation approach offers more choices not possible or cost-effective for timesharing systems. Each workstation can be

customized to suit the requirements of the particular application set running on it.

The Sun-3/180S and the Sun-3/280S work well as timesharing servers and can handle different numbers of terminals depending on the activities running on each. For instance, the Sun-3/180S can handle 16 terminals with heavy users (doing troff, compiles, etc.) well. If the terminals have little use, the Sun-3/180S can handle up to 50 terminals. In general, however, you should not have both diskless nodes and terminals on the same server. One disk (380-MB or more) should be adequate for a timesharing server, depending on what users are doing. Memory size should be from 8 to 16 MB. The Sun-3/280 can handle twice as many terminals (doing the same applications) and about 1.5 times as many diskless clients as the Sun-3/180.

4.6. Network Q and A

Q 1. Is local disk/tape necessary for each workstation? Since I am the system manager, I would like to see my users be responsible for their own backups, but is it worth the cost? Either in performance or convenience?

A. We do not recommend local disk/tape in this situation. We suggest that you have all your user accounts on an SMD 380 MB (or larger) disk on a server, whether or not the client machine has a disk so that administration is centralized.

Users often do not do backups even if they have a tape drive. With the home directories on a server, you have to do backups on the system parts only of the client machines occasionally; only a few files matter.

Q 2. How many workstations should I put on one server?

A. If the local machines are diskless and the server is the Sun-3/180, then it should support six workstations with heavy loads; eight with average loads; and ten with light loads. If the server is the Sun-3/280, you can increase these amounts by about 20%. If the local machines are diskful and only home directories are on the server, you can increase the estimates by two or more.

Q 3. Are servers useful as workstations as well? Should I buy monitors and keyboards for these stations or does network serving take up all the CPU cycles?

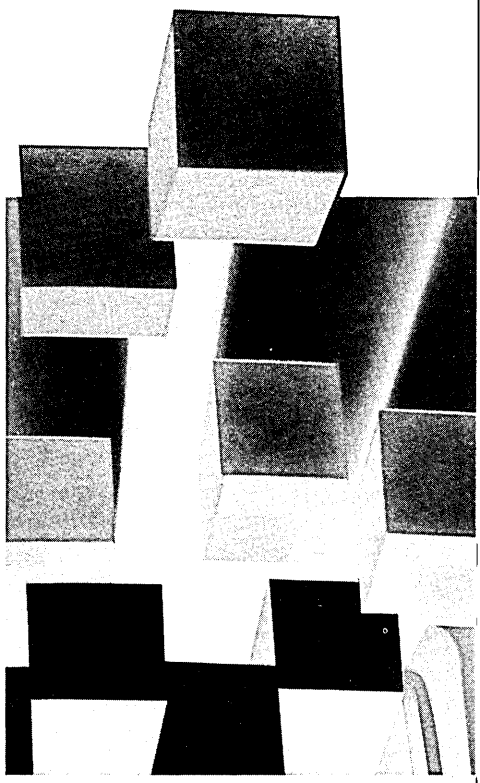
A. For some applications, servers can be used as workstations, but you should expect a slow down in performance when compared to a "pure" server.

Q 4. Should the Ethernet be divided into sub-nets by putting two controllers on each server?

A. Workstation-client clusters can be interconnected via a second "backbone" network. For large networks, this will significantly improve performance. For smaller networks (less than 40 workstations), adding a second network may not improve performance.

5

Hardware Configuration



5

Hardware Configuration

This chapter gives an overview of several hardware features of the Sun-3 products, such as the VMEbus and backplane, serial ports, and the Ethernet.

5.1. 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 in two ways:

- Mechanically
- Functionally

The mechanical specification describes the dimensions of subracks, backplanes, front panels, plug-in boards, etc. The functional specification tells how the bus works, what functional modules are 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 the Sun-3 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. In the Sun-3 models that are placed horizontally on a desktop (Sun-3/50, Sun-3/75, Sun-3/110), these 96-pin connectors are aligned left to right (starting with P1) or top to bottom.

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:

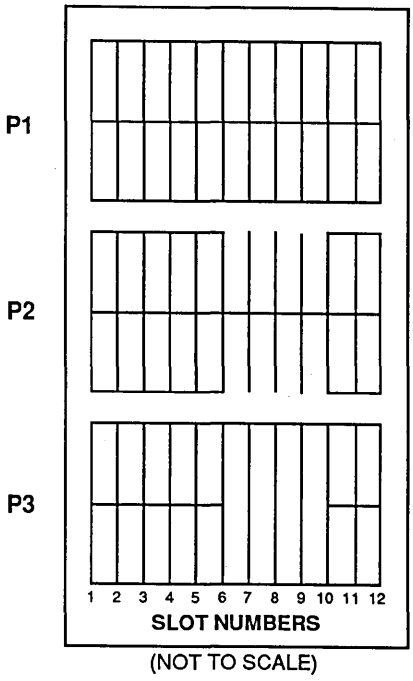
- VMEbus
- P2 bus
- Power bus

A VMEbus includes the backplane itself, its collection of electronic components, and its 96 pin connectors that can be plugged into the VMEbus backplane connectors.

The figure below shows a board with the three P Connectors that plug into the backplane.

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

Figure 5-1 *P Connectors*



If all this seems a little confusing, 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 5-1 shows with which bus the pins on each connector are associated.

Table 5-1 *Sun-3 Backplane and Buses*

Conn.	*Col*	*Pins*	*Function*	*12-slot Bus Group*	*3-slot Bus Group*
P1	A	1-32	VME	1 to 12	1 to 3
	B	33-64	VME	1 to 12	1 to 3
	C	65-96	VME	1 to 12	1 to 3
P2	A	1-32	"P2" Address	1 to 6, 7, 8, 9, 10 to 12	1 to 3
	B	33-64	VME	1 to 12	1 to 3
	C	65-96	"P2" Signals	1 to 6, 7, 8, 9, 10 to 12	
P3	A	1-32	Power (VCC, +12V, -5.2V)	1 to 12	1 to 3
	B	33-64	"P2" Data	1 to 6, 7, 8, 9, 1o to 12	1 to 3
	C	65-96	Power (Gnd, +12V, -5.2V)	1 to 12	1 to 3

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, part of the 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 devices that request interruption of normal bus activity to be serviced by an interrupt handler. These interrupt requests can be 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 has these features:

- 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
- the top 64 kilobytes for 16-bit addressing.

Interrupt Handler

The Interrupt handler option tells which interrupt request line a given Interrupt handler responds to. 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. The lowest numbered request line is 1 and the highest numbered request line is 7.

Requester Options

There are two requester options for the VMEbus. 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 in which 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 granting control of the VMEbus to the CPU 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 has:

- 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 have these features:

- 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 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-3 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 involves adding non-Sun boards to a Sun system, its location in address space may be critical.

Sun has 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 5-2 *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 5-3 *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-3/160
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 they were 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 5-4 *Sun-3 16-bit VMEbus Address Space Devices*

VME 16-Bit Space		
Device	***Address***	***Size***
tm0	0xa0	0x2
tm1	0xa2	0x2
vpc0	0x480	0x20
vpc1	0x500	0x20
mti0	0x620	0x8
mti1	0x640	0x8
mti2	0x660	0x8
mti3	0x680	0x8
xyc0	0xee40	0x6
xyc1	0xee48	0x6
xtc0	0xee60	0x6
xtc1	0xee68	0x6

Table 5-5 *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, never both.*
@The ie1 board uses two separate pieces of the address space, thus two addresses are shown.

Table 5-6 *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 processor gives Direct Memory Access (DMA) devices, which communicate over the P1 bus, direct access through the MMU to main memory. This feature is known as Direct Virtual Memory Access since DMA devices deal with *virtual* memory addresses that are translated and protected by the MMU, in the same way as ordinary program accesses to memory.

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 card cage. The slot with the highest rank in the card cage 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:

- data transfer rate of the device
- amount of board buffering
- the characteristics and usage of other devices in the system

The Sun-3 68020 processor is always installed in slot one, making it the highest priority board. If you add non-Sun DMA boards, you need to analyze and test the system to select the right slot.

5.2. Serial Port Configuration and Speed

A Sun-3 processor board has two asynchronous serial ports (RS-423), compatible with RS-232 devices. These serial ports are configured as DTEs (Data Terminal Equipment) with modem control signals. The ports are used for driving output devices such as printers or plotters, or connecting lower-speed 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 Sun ALM is a highly-buffered DMA controller and is fully supported by SunOS.

5.3. External Cable Connections

The external connectors on the Sun-3 workstations are mounted directly on the printed circuit boards. Cabling is needed only for external options such as a 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).

SunOS release 3.2 allows you to define the number of drives per controller and the number of controllers per system. However, Sun designs limit the numbers of each to two. If your configuration exceeds these numbers, you are responsible for all system engineering issues related to the FCC, UL, and CSA. Separate SMD data cables run from each disk drive to the Sun-3 workstation system enclosure.

Table 5-7 shows the number of slots required for some of the options.

Table 5-7 *Sun Workstation VME Board Rear Panel Requirements*

VME Board	*External Connectors*	*Slots*
Sun-3 CPU	(2) Serial Ports Video, Keyboard/Mouse Ethernet connectors	1
Sun-3/50 CPU Sun-3/110 CPU	Thin Ethernet BNC Coaxial Cable (4)	
System Options		
Second Ethernet	1	1
Memory Expansion, GP+, GB,FPA	0	1
SMD Disk Ctl-Xylogics 450/451	SMD Command (2), Data (2)	1
½" Tape Controller	Tape Control (2)	1
Color Display Controller(RGB and Sync)	BNC Coaxial Cable (5*)	1
16-Channel ALM	(16) Serial Ports	2‡
SunLink	RS-449(2),RS-423(2)	1
SunIPC	Printer port, floppy port	1

NOTE *‡ Even though the ALM for the Sun-3/160/260 connects to only slot 12 on the backplane, the assembly requires additional mechanical space in slot 11. The Sun-3/180/280 version does not have the slot 11 restriction. Sun-3/180/280*

mechanically accepts three 16-channel ALMs.
** Four of the five connectors are used; one is reserved.*

5.4. Ethernet

For small or localized Ethernet installations, you may purchase 15-meter lengths of Ethernet 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 3 transceiver types:

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

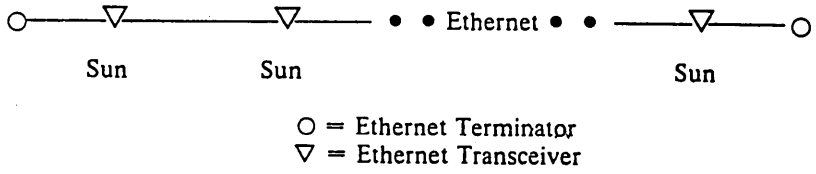
Sun workstations may serve as gateways between physically separate Ethernets. When a gateway is in place, users see a single logical network and have transparent access to all the systems on both physical networks. For performance reasons, SunOS places two limits on this transparency:

- First, a fileserver node and its clients **must be on the same physical network.**
- Second, a fileserver will serve 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 need to 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 5-2 *General Structure of Installed Ethernet Cable*



Thin Ethernet

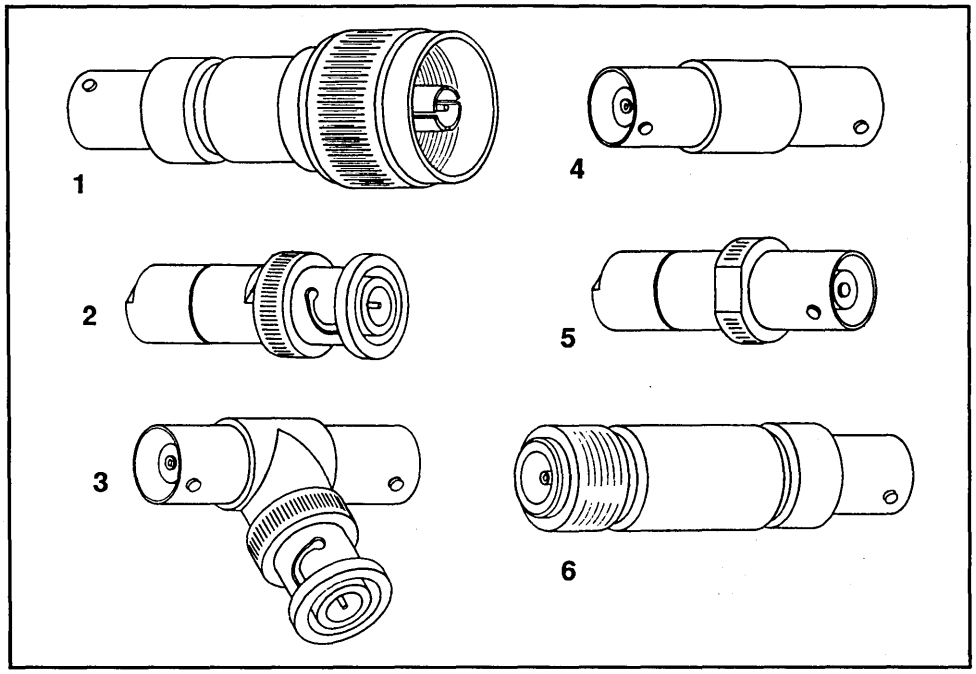
The Sun-3/50 series has a built-in Thin Ethernet transceiver with a BNC-type T connector that links other nodes with a 50 ohm, ¼-inch diameter, RG58 coaxial cable. You can connect to a standard Ethernet by using "fat" coaxial cable and external transceivers with a "barrel" connector that has a BNC female connector on one end and a Type N female connector on the other end. 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, 2, or 1 and 2's mixed. You must set the station for the type of transceiver it is going to be talking through. 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.*

Figure 5-3 *Thin Ethernet Connector Types*



Key	*Sun Order Number*	*Qty*	*Description*	*Purpose*
1	TA-M	10	Adapter, BNC female to type "N" male	connect thin cable to transceiver port
2	TT-M	10	50 ohm terminator, BNC male	to terminate a "T"
3	TTC	10	BNC "T" (F,M,F)	to daisy-chain workstations on thin cable
4	TBC	10	barrel,BNC female to BNC female	to extend/connect thin cables
5	TT-F	10	50 ohm terminator, BNC female	to terminate a thin cable
6	TA-F	10	Adapter, Type "N" female to BNC female	to connect fat Ethernet cable to thin cable

Ethernet Q and A

Q 1. 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.

Q 2. 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.

Q 3. Should I ground the system?

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

Q 4. What are the proper lengths for adding transceivers?

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

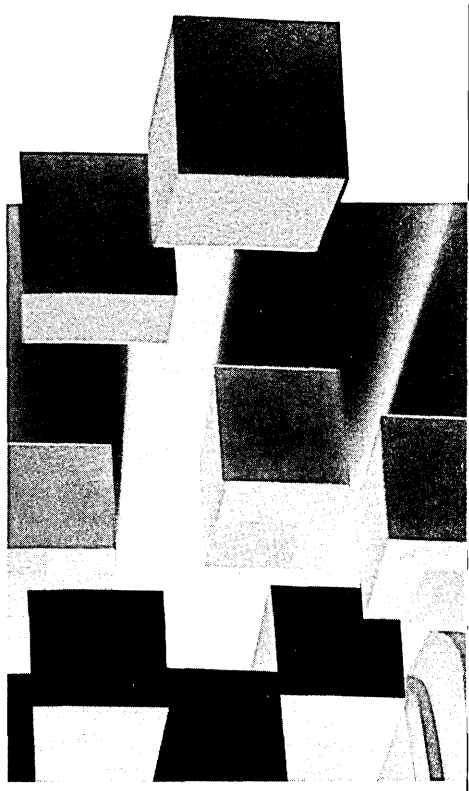
5.5. Printers

Sun workstations can be used with any serial printer (or any parallel printer with a VPC board), but you should be aware of these factors:

- If the printer needs H/W flow control (that is, it does not support XON/XOFF), then you need the H/W flow control patch available for a fee from Sun's Technical Support.
- Because PostScript may become a standard for printers, future products may assume a PostScript output device.

6

Power Requirements



6

Power Requirements

This chapter discusses the power requirements for the Sun-3 workstations and servers. See Appendix A and B for more site requirement information on:

- *Appendix A: Environmental Requirements*
- *Appendix B: Physical Space Requirements*

All electrical values are root mean square (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
- BTU's per hour to find your cooling requirements

Each of the major power formats is explained below.

6.1. 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 find the number of AC outlets you will need, count the number of AC power plugs for your system and peripherals. Note that the Sun desktop products, the Sun-3/50M, Sun-3/75M, and the Sun-3/110, 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, 115, 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 115 VAC installation.

```
Typical VA = 196 (Sun-3/50M) + 114   (MSS)
Typical VA = 310
Typical Amps = 310 / 115 = 2.7 Amps
```

We show volt-amps in both typical and worst-case categories. The typical values

shown are calculated from multiplying a measured rms AC current value by 115 VAC (the line voltage when the measurement as made). Worst-case values shown are calculated from multiplying the worst-case watts by the reciprocal power factor, 1.54.

6.2. 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 = 14.3 (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.

6.3. 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 given from your configuration. BTUs/hour are calculated from multiplying watts by a BTUs conversion constant of 3.412.

6.4. Power Calculations

Because the Sun-3 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)

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

Where P_{true} = true AC power in watts from above. All Sun products have the

same power supply efficiency.

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-3/75/110/160/180 = 0.65.

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

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, 115, 200, 220, 240)

6.5. AC Branch Circuit Limitations

This section helps you find if any changes must be made to your facility to use Sun-3 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. You are responsible to make sure that you do not exceed the local electrical code's limitations when configuring these Sun products.

The U.S. National Electric Code (section 210-22[c] and 210-23) 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 115 volts AC (VAC). The following table presents all of the different 115 VAC branch circuits that may be used by Sun equipment and their maximum permissible current loads in the U.S.

Table 6-1 *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, please contact the agency responsible for local electrical codes about specific information on local AC branch circuit limitations. You are responsibile to 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:

- 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 1.54 to be on the safe side. 1.54 is the reciprocal of a 0.65 power factor (usually the worst-case rating any product would have).

Sun Product Limits at 115 VAC

Because all Sun 3-slot and 12-slot products are rated to work without failing to voltages as low as 90 VAC on a 115 VAC branch circuit, Underwriters Laboratories (UL) requires that the AC line fuse be rated at the lowest working voltage. 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 115 VAC, a 15 amp line fuse is used for these products.

For each type of U.S. AC branch circuit, the table below presents what maximum DC loads in watts that are for each Sun product when the AC line voltage is approximately a stable 115 VAC **and** 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) or an application's current limitations (for instance, Sun-3/180 vs. Sun-3/180R1*).

* Units designated "R1" are mounted in a Data Center Cabinet.

Table 6-2 *Maximum Power Load of Sun-3 Products at 115 VAC*

Sun Product in DC Watts at 115 VAC†	*Maximum Load Breaker Rating*	*AC Branch Circuit*
Sun-3/110	314 *	15 A or 20 A
Sun-3/160	628	15 A
Sun-3/180	628	15 A
Sun-3/160	785	20 A
Sun-3/180	785	20 A
Sun-3/180R1	785	30 A
Sun-3/260	690	15 A
Sun-3/260	850	20 A
Sun-3/280	690	15 A
Sun-3/280	850	20 A
Sun-3/280R1	850	30 A

NOTE *† These figures represent the sum of the combined loads in watts for all of the power supply's DC voltage outputs when drawing the maximum allowed current (80%) for the AC branch circuit.*

** The 501-1193 3-slot fan tray uses 11 watts from the 18 vdc output of the power supply. Since all 3-slot products include this fan tray and the +18V output is not available for any other purposes, the power used by the fan tray has been removed from the stated power available at the power supply outputs.*

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 have been exceeded when configuring your system. To calculate your needs, use the values for each option in Table 6-13.

Table 6-3 *DC Output Current Ratings*

DC Output	*Sun-3/110*	*Sun-3/160/180/260/280*
+ 5.0	60 amps	120 amps
- 5.2	8 amps	10 amps
+12.0	3 amps	15 amps
-12.0	1.5 amps	5 amps

If the stable line voltage is going to be lower or higher than 115 VAC, you may calculate the maximum allowed DC load for one of the three above branch circuits using one of the following product's formulas:

Sun-3/110

This product will only draw 11.2 amps at 90 VAC. It will not exceed the 12 amp limit at 115 VAC.

Sun-3/160/180

(line voltage) x (maximum allowed current) x (.65) x (0.7)
where: 0.65 is power factor and 0.7 is power supply efficiency.

Sun-3/260/280

(line voltage) x (maximum allowed current) x (0.715) X (0.7)

where: 0.715 = power factor; 0.7 = Power Supply Efficiency.

If you have a color display and a Sun-3/160C/260C logic enclosure configured such that their combined AC power exceeds 12 amps, you must connect these Sun products to a common 20 amp branch circuit. We do not recommend placing the color display and the logic enclosure on separate branch circuits because third-wire ground currents could degrade video quality. If you need a second branch circuit, you can place all other Sun options except the color display on the second branch circuit.

Sun Products' Limits at 230 VAC

For Sun-3/110/160/180/260/280 products configured for 230 VAC operation, The maximum AC line fuse rating allowed is 6 amps. The table below presents what maximum DC loads in watts are allowed for each Sun product when the AC line voltage is approximately a stable 230 VAC. Variations between the products are the result of power supply design differences (for example, the Sun-3/160/180 vs. Sun-3/260/280).

Table 6-4 *Maximum Load in DC Watts*

Sun Product	*Maximum Load in DC Watts at 230 VAC †*
Sun-3/110	314 @ 6A *
Sun-3/160	523 @ 5A
Sun-3/160	628 @ 6A
Sun-3/180	523 @ 5A
Sun-3/180	628 @ 6A
Sun-3/260	690 @ 6A
Sun-3/280	690 @ 6A

NOTE *† These figures represent the sum of the combined loads in watts for all of the power supply's DC voltage outputs.*
** The 501-1193 3-slot fan tray consumes 11 watts from the 18 vdc output of the power supply. Since all 3-slot products include this fan tray and the +18V output is not available for any other purposes. The power consumed by the fan tray has been removed from the stated power available at the power supply outputs.*

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 have been exceeded when configuring your system. To calculate your individual needs refer to the values for each option in the tables in this chapter.

Table 6-5 *DC Output Current Ratings at 230 VAC*

DC Output	*Sun-3/110*	*Sun-3/160/180/260/280*
+ 5.0	60 amps	120 amps
- 5.2	8 amps	10 amps
+12.0	3 amps	15 amps
-12.0	1.5 amps	5 amps

If the stable line voltage is going to be lower or higher than 230 VAC, you may calculate the maximum allowed DC load for the AC branch circuit using one of the following formulas:

Sun-3/110

This product will only draw 5.6 amps at 180 VAC and will not exceed the 12 amp limit at 115 VAC.

Sun-3/160/180

(line voltage) x (see note) x (0.65) x (0.7)

where: 0.65 = power factor; 0.7 = power supply efficiency.

Sun-3/260/280

(line voltage) x (6 amps) x (0.715) x (0.7)

where: 0.715 = power factor; 0.7 = power supply efficiency.

NOTE *Sun-3/160 and Sun-3/180 products have been shipped with either a 5 or 6 amp 250 VAC line fuse. If your unit has a 5 amp fuse and more DC power is required, a 6 amp fuse may be installed to allow for an additional 105 DC watts capability. Contact your local Sun Sales Office for information on the fuse.*

6.6. 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 115 VAC operating range. TUV GS approval covers only the 230 VAC operating range. All other products are approved for both ranges.

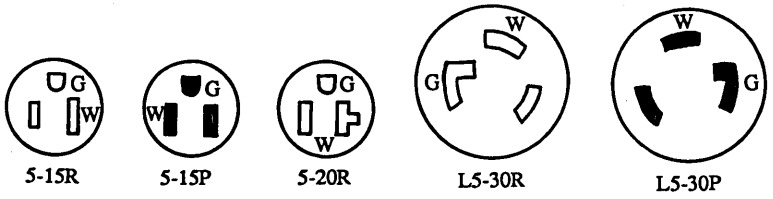
6.7. Power Connections

In the U.S. your configuration may need a 15, 20, or 30 amp branch circuit. Table 6-6 and Figure 6-1 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.

Table 6-6 *NEMA Power Connections*

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

Figure 6-1 *NEMA Receptacles and Plugs*



6.8. Sun-3/50 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 6-7 *Sun-3/50M Desktop Workstation Power Requirements*

Sun-3/50M Desktop Workstation 115 VAC operation			
	VA	***Watts***	***BTUs/hr***
Surge/typical	196	143	488
Worst-case	366	238	812
Fuse 115 and 230 VAC		4 amps, 250 V slow-blow	

6.9. Sun-3/100 and Sun-3/200 Series

The next two charts show the power needs for the Sun-3/75. Since the power needs of the Sun-3/100 and Sun-3/200 series depends on your configurations, you will see the abbreviation U/C (user calculated) in some of the tables.

Sun-3/75 Power Consumption

Table 6-8 *Sun-3/75M Desktop Workstation*

Sun-3/75M Desktop Workstation 115 VAC operation	*VA*	*Watts*	*BTUs/hr*
Typical monitor	96	66	225
Typical logic enclosure	U/C	U/C	U/C
Worst-case (monitor & logic encl.)	477	310	1058
DC output ratings			
Maximum watts available		150 watts	
Output voltage		**Max. Current Available**	
+5.0 VDC		25.0 amps	
-5.2 VDC		1.5 amps	
+12.0 VDC		1.5 amps	
Fuse			
115 and 230 VAC		4 amps, 250 V slow-blow	

3-slot and 12-slot Worst-case Power Consumption

For the 3-slot products' worst-case power consumption, use the following values for the logic enclosure for both the 115 and 230 vac ranges. These values must also be added to the worst-case values for whatever device is plugged into the enclosure's AC Convenience Outlet.

3-slot

- VA – 716
- Watts – 465
- BTUs/hr – 1587

12-slot

The following chart defines the 12-slot Products' (Sun-3/160/180/260/280) worst-case power consumption for both 115 vac and 230 vac ranges.

Table 6-9 *12-slot Worst-Cast Power Consumption*

12-slot Worst-Cast Power Consumption				
Product	*Line Current/Voltage*	*VA*	*Watts*	BTUs/hr
Sun-3/160/180	12A/115 (15A branch)	1380	898	3064
Sun-3/160/180	6A/230 (6A branch)	1380	898	3064
Sun-3/160/180	15A/115 (20A branch)	1725	1123	3832
Sun-3/180R1	15A/115 (30A branch)	1725	1123	3832
Sun-3/260/280	12A/115 (15A branch)	1380	987	3368
Sun-3/260/280	15A/115 (20A branch)	1725	1216	4149
Sun-3/280R1	15A/115 (30A branch)	1725	1216	4149

Calculating Typical Power Consumption for the Sun-3/75

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 would be calculated for a standalone Sun-3/75-4 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 be running at 115 VAC.

1. Make a table listing the individual DC voltage ampere values and the total watts values for each option in your configuration. See Tables 6-10 and 6-13.

Component	+5A	-5.2A	+12A	Total Watts
2-slot backplane	1.3	-	-	6.5
Keyboard	0.4	-	-	2.0
Mouse	0.2	-	-	1.0
CPU (4 MB)	14.0	0.9	-	74.7
Memory (4 MB)	2.6	-	-	13.0
Sun-2 SCSI	3.2	-	-	16.0
TOTAL	21.7	0.9	-	113.2

2. Add up the "total" value for each column of values in your table. See example above.

3. 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 1-13.

4. To calculate "AC Watts" for projecting your power bills, insert the total DC watts value calculated in Step 2 into Formula A in Section 6.4. Total DC watts value is P_{dc} in Formula A.

$P_{DC} = 113.2\ watts\ (from\ Step\ 2)$

$P_{true} = (113.2\ watts) x\ 1.43$

$P_{true} = 162\ watts$

5. To calculate BTUs/hr for projecting your cooling requirements, insert the P_{true} calculated in Step 4 into Formula B in Section 6.4.

$$\frac{BTU}{hour} = P_{true}\ x 3.412$$

$$\frac{BTU}{hour} = 162 x 3.412$$

$$\frac{BTU}{hour} = 553$$

6. To calculate Volt-Amps, insert the P_{true} value calculated in Step 4 into Formula C in Section 6.4.

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

$$VA = 162x\,1.54$$

$$VA = 249$$

7. 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
3/75	249	162	553
MSS	114	80	273
TOTAL	459	308	1051

8. 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:

$$I_{nom} = \frac{Volt-Amps}{VAC_{nom}}$$

$$I_{nom} = \frac{459}{115}$$

$$I_{nom} = 4.0\,Amps$$

Table 6-10 *Sun-3/75M Subassembly Power Consumption*

Sun-3/75M Subassembly Power Consumption				
Component Description	***Amps @+5V***	***Amps @-5.2V***	***Amps @+12V***	***Total Watts***
501-1093 2-slot backplane	1.3	-	-	6.5
370-1063 Keyboard	0.4	-	-	2.0
370-1058 Mouse	0.2	-	-	1.0
501-1164 CPU (4 MB)	14.0	0.9	-	74.7
501-1164 CPU (2 MB)	13.0	0.9	-	69.7
501-1111 2 MB expansion	2.0	-	-	10.0
501-1122 4 MB expansion	2.6	-	-	13.0
501-1045 Sun-2 SCSI	3.2	-	-	16.0
501-1152 Blank Mem with Sun-2 SCSI	3.2	-	-	16.0
Level 1 or 2 Eth. transceiver	-	-	0.4	4.8

6.10. Power Consumption for the 3-slot and 12-slot Products

This section provides fuse and power consumption ratings for the Sun-3/110 (3-slot) and the Sun-3/160/180/180R1/260/280/280R1 (12-slot).

The fuse ratings are shown in the next table:

Table 6-11 *Fuse Ratings*

Fuse Ratings		
Product	***Nominal AC Volts***	***Fuse Rating***
Sun-3/110	115	15 amps, 250 V slow-blow
Sun-3/110	230	6 amps, 250 V slow-blow
Sun-3/160	115	15 amps, 250 V slow-blow
Sun-3/160	230	6 amps, 250 V slow-blow*
Sun-3/180	115	15 amps, 250 V slow-blow
Sun-3/180	230	6 amps, 250 V slow-blow*
Sun-3/180R1	115	15 amps, 250 V slow-blow
Sun-3/260	115	15 amps, 250 V slow-blow
Sun-3/260	230	6 amps, 250 V slow-blow
Sun-3/280	115	15 amps, 250 V slow-blow
Sun-3/280	230	6 amps, 250 V slow-blow
Sun-3/280R1	115	15 amps, 250 V slow-blow
Sun-3/280R1	230	6 amps, 250 V slow-blow

NOTE * *Sun-3/160 and Sun-3/180 products that were ordered with Option 910A have been shipped with either a 5 or 6 Amp 250 V AC line fuse. If your unit has a 5 Amp fuse and you want to install a 6 Amp line fuse, contact your local Sun Sales Office for information regarding the fuse.*

Calculating Typical Power Consumption for 3-slot and 12-slot Products

For these products' enclosure, 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 6-13.

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 watt's value is greater than the overall rating of the supply.

Table 6-12 *Maximum Allowed Value*

Product	Maximum Allowed Value						
	+5 vdc amps	*-5.2 vdc amps*	*+12 vdc amps*	*-12 vdc amps*	*Total watts(DC)*	*Allowed/Rated AC Branch*	*Nominal AC Volts*
Sun-3/110	60	8	3	1.5	314+	any	115/230
Sun-3/160	120	10	15	5	628	12A/15A	115
Sun-3/180	120	10	15	5	628	12A/15A	115
Sun-3/160	120	10	15	5	785	15A/20A*	115
Sun-3/180	120	10	15	5	785	15A/20A*	115
Sun-3/180R1	120	10	15	5	785	15A/30A*	115
Sun-3/260	120	10	15	5	690	12A/15A	115
Sun-3/280	120	10	15	5	690	12A/15A	115
Sun-3/260	120	10	15	5	850	15A/20A*	115
Sun-3/280	120	10	15	5	850	15A/20A*	115
Sun-3/280R1	120	10	15	5	850	15A/30A*	115
Sun-3/160	120	10	15	5	523	5A/6A*	230
Sun-3/180	120	10	15	5	523	5A/6A*	230
Sun-3/160	120	10	15	5	628	6A/6A	230
Sun-3/180	120	10	15	5	628	6A/6A	230
Sun-3/260	120	10	15	5	690	6A/6A	230
Sun-3/280	120	10	15	5	690	6A/6A	230

NOTE *+ The product's power supply is rated at 325 watts. However, 11 watts are used by a separate cooling system voltage that is unaccessible to the user.*

** The "rated" limit is determined by the product's fuse rather than by the local electrical codes or local electrical codes and the fuse.*

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 6.4. 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 6.4.

6. To calculate Volt-Amps for determining the AC Branch Circuit requirements, P_{true} value calculated in Step 4 into Formula C in Section 6.4.

7. Now that you have 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 6-13 *Card Cage Subassembly Power Consumption*

Card Cage Subassembly Power Consumption						
Approved Product	*Component Description*	*Amps @+5V*	*Amps @–5.2V*	*Amps @+12V*	*Amps @–12V*	*Total Watts*
160,260	540-1252 Fans:					
	each:	-	-	(0.3)	-	
	6 per unit:	-	-	1.8	-	21.6
180,280	540-1129 Fans:					
	each:	-	-	(0.4)	-	
	4 per unit:	-	-	1.6	-	19.2
110	501-1193 3-slot Fan Tray	-	-			10.8††
110	501-1127 3-Slot Backplane	1.3	-	-	-	6.5
160,260,180,280	501-1092 12-Slot Backplane	1.3	-	-	-	6.5
110	501-1134 CPU (4MB)	16.0	4.3	0.15	-	104.0
160,180	501-1163 CPU (2MB)	12.5	0.9	-	-	67.2
160,180	501-1164 CPU (4MB)	13.5	0.9	-	-	72.2
160,180	501-1131 2MB Exp Mem	1.9	-	-	-	9.5
110,160,180	501-1132 4MB Exp Mem	2.5	-	-	-	12.5
260,280	501-1100 CPU	22.5	0.6	-	-	115.6
260,280	501-1102 8MB Exp Mem:					
	Standby:	9.8	-	-	-	49.0
	Active:	12.0	-	-	-	60.0
110,180,280	501-1138 Sun-2 SCSI Ctlr*	3.0	-	-	-	15.0
160,260,180,280	501-1149 Sun-2 SCSI Ctlr*	3.0	-	-	-	15.0
160	370-1010 Adaptec SCSI Disk Ctlr	1.5	-	0.1	-	8.7
160	370-1034 5-¼" 85 MB Disk	2.0@	-	4.8P/3.1A	-	67.6/47.2
160,260	370-1011 Sysgen ¼" Tape Cntr	2.0#	-	-	-	10.0
160,260	370-1037 ¼" Tape Drive w. fmtr	3.0@#	-	4.2/1.9	-	65.4/37.8
180,280	370-1061 MT-02 1/4" Tape Ctlr	1.5#	-	0.04	-	8.0
180,280	370-1076 ¼" Tape Drive wo. fmtr	1.0@#	-	4.2/1.9	-	55.4/27.8
160,180,260,280	501-1139 GP+	20.0	-	-	-	100.0
160,180,260,280	501-1055 GP	17.5	-	-	-	87.5
160,180,260,280	501-1058 GB	2.3	-	-	-	15.0
160,180,260,280	501-1153 2nd Ethernet Ctlr	5.6	-	0.4	-	32.8
160,180,260,280	501-1014 Sun-2 Color	15.9	5.7	-	0.2	111.5
160,180,260,280	501-1116 Sun-3 Color	12.5	2.9	0.1	0.2	81.2
160,260	501-1157 Sun VME ALM	6.7+	-	0.7	0.4	46.7
180,280	501-1165 Sun VME ALM	6.7+	-	0.7	0.4	46.7
160,180,260,280	501-1154 Xylogics 450 SMD Ctlr	8.8+	1.0	-	-	49.2
160,180,260,280	501-1166 Xylogics 451 SMD Ctlr	8.2+	1.0	-	-	46.2
160,180,260,280	501-1156 CPC ½" Tape Ctlr	5.1	-	-	-	25.5
160,180,260,280	501-1155 Xylogics 472 ½" Tape Ctlr	7.0+	-	-	-	35.0
160,180	501-1125 SunIPC	7.0	-	-	-	35.0

Table 6-13 *Card Cage Subassembly Power Consumption— Continued*

Card Cage Subassembly Power Consumption						
Approved Product	*Component Description*	*Amps @+5V*	*Amps @–5.2V*	*Amps @+12V*	*Amps @–12V*	*Total Watts*
All	370-1095 Sun-3 Keyboard	0.4	-	-	-	2.0
All	370-1058 Sun-3 Mouse	0.2	-	-	-	1.0
All	501-1105 FPA	13.0	-	0.3	-	68.5
All	501-1158 Sun SCP	6.1+	-	0.2	0.1	34.1
All	501-1191 VME 3x2 Adptr	-	-	-	-	-
All	501-1054-04A VME/Multi. Adptr	2.0	-	-	-	10.0
All	Level 1 or 2 Ethernet Transcvr	-	-	0.4	-	4.8

NOTE *@ The host system's power supply is designed to handle the temporary peak current draw of the disk and tape devices. Peak current values should not be used to calculate power budget.*

 # The Sysgen and ¼" Tape Drive plus formatter are a matched set. The MT-02 and ¼" Tape Drive less formatter are a matched set. The MT-02 set is the later of the product technology used. The Sysgen and the MT-02 tape controllers and their respective tape drives are not interchangeable.

+ The table values are comprised of (1) the vendor's specified worst-case values and (2) 2.0 Amps for the +5 vdc (consumed by Sun's VME-to-Multibus Adapter Assembly (501-1054).

** The 501-1149 Sun-2 SCSI controller was replaced by the 501-1138 Sun-2 SCSI controller in later versions of the Sun-3/180 and Sun-2/180 products.*

†† The 501-1193 3-slot fan tray uses 11 watts from the 18 vdc output of the power supply. Since all 3-slot products include this fan tray and the !18vdc output is not available for any other purposes, the power consumed by the fan tray has been removed from the stated power available at the power supply outputs. See Table 6-2 and 6-4.

6.11. Displays

This section describes the power requirements for the monochrome, color, and grayscale displays. The letter (M, G, C, LC, HM) following the model number of a product is the monitor type. For instance, the Sun-3/160C has a color monitor.

- M - Monochrome display for the 50, 75, 160,
- C - Color display for the 110, 160, 260
- G - Grayscale display for the 110, 160, 260
- LC - 15-inch color display for the 110
- HM - High resolution monochrome display for the 260

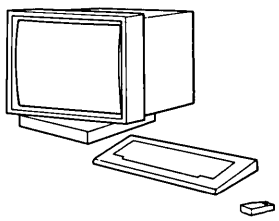
NOTE *The Sun-3/180 and Sun-3/280 are servers (S). Monitors are add-on options.*

Table 6-14 *M Display Power Standards*

	M display		
	VA	*Watts*	*BTUs/hr*
Surge	105	83	283
Typical†	96	66	225
Worst-case	146	95	324
Fuse		1.5 amps, 250 V slow-blow	

NOTE *† This is the typical current draw for a white screen. This amount is considerably less for reverse video.*

Table 6-15 *C Display Power Standards*



	C display		
	VA	*Watts*	*BTUs/hr*
Surge	230	140	478
Typical*	292	205	700
Degauss	351	228	778
Worst-case	385	250	853
Fuse (Hitachi)			
115 VAC		5 amps, 250 V slow-blow	
230 VAC		3 amps, 250 V slow-blow	
Fuse (Ikegami)			
115 VAC		4 amps, 250 V normal	
230 VAC		2 amps, 250 V normal	

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

Table 6-16 *G Display Power Standards*

	G display		
	VA	*Watts*	*BTUs/hr*
Surge/typical*	138	90	307
Worst-case	147	95	324
Fuse		1.5 amps, 250 V slow-blow	

Table 6-17 *LC Display Power Standards*

	LC display		
	VA	*Watts*	*BTUs/hr*
Surge/typical*	180	122	416
Degauss/Worst-case	214	154	526
Fuse			
115 VAC		3 amps, 250 V medium-blow	
230 VAC		2 amps, 250 V medium-blow	

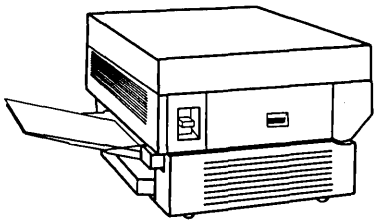
Table 6-18 *HM Display Power Standards*

	HM display		
	VA	*Watts*	*BTUs/hr*
Surge/typical†	102	97	331
Worst-case	186	121	413
Fuse		3 amps, 250 V slow-blow	

6.12. Desktop and Deskside Options

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

Table 6-19 *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
200-240 VAC	2696 BTUs/hr
Any line voltage	410 BTUs/hr
Fuse	
115 and 230 VAC	3 amps 250V slow-blow

† This is the typical current draw for a white screen. This amount is considerably 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 mix or gray shading.

Table 6-20 *Desktop Mass Storage Subsystem Requirements*

NOTE *This is also called the Shoebox.*

Desktop MSS Power Requirements 115 VAC operation	*VA*	*Watts*	*BTUs/hr*
Worst-case (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
Fuse			
115/230 VAC		3 amps, 250 V slow-blow	

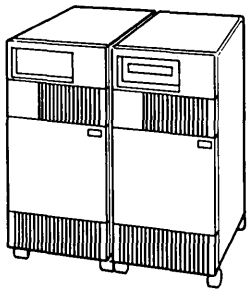
Table 6-21 *Single Disk Deskside Expansion Pedestal Power Requirements*

NOTE *This is the same for both 130 and 280 MB disks.*

Single Disk Deskside Expansion Pedestal Power 115 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 6-22 *Double Disk Deskside Expansion Pedestal Power*

NOTE *The Double Disk Deskside Expansion Pedestal houses two 130-MB disks for 260 megabytes of total storage or two 280-MB disks for 560 megabytes of total storage.*



Double Disk Deskside Expansion Pedestal Power 115 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	

6.13. System-level Configuration Issues

For the system-level options in this section, the volt amp (VA), watts and BTU/hr figures show what the option would use if it were the only device accessed. Because the hardware and software design of Sun products does not allow all of the 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" 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 where 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 configuration, 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 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.

6.14. Cabinets and Cabinet-Mounted Options

This section has power information on cabinets and cabinet-mounted options. Please note that the cabinet-mounted options can be bought **without** the cabinet. Two cabinets, a Data Center cabinet and a meter high cabinet, are available for the Sun-3/160 and the Sun-3/260. The Sun-3/180 and the Sun-3/280 use the Data Center cabinet only. Both cabinets have 19-inch RETMA spacing. The Data Center cabinet is available in a 115 volt version only. The meter high cabinet is available in both 115 volt and 220 volt versions.

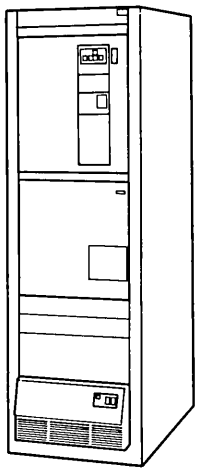
Data Center Cabinet

The Data Center cabinet can accommodate any subset of the following:

- one ½-inch tape and two 10 ½-inch disks (for use with the Sun-3/160)
- one Sun-3/180S or one 3/280S, one ½-inch tape, and two 10 ½-inch disks

In either case, you can have no more than two Data Center cabinets per Sun system-level configuration. The Data Center cabinet also has a power sequencer with 3 outlet sections, unswitched, switched 1, and switched 2. The Sun-3/180S and the second 10 ½-inch disk are on switched outlet 2. The ½-inch tape, first 10 ½-inch disk and fan assembly are on switched outlet 1. The Data Center cabinet also has a remote power-on key switch.

Table 6-23 *Data Center Cabinet Requirements*



	Data Center Cabinet
Power rating	
Worst-case	2880 watts (24 amps @ 115 VAC), 30 amps @ 90 VAC 16 amps per circuit with 3 circuits
Typical	user-calculated
Thermal dissipation	user-calculated
Circuit breakers	
115 VAC range	16 amps, 3 each

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 this chapter.
2. Add up the values for all the peripherals installed in the Data Center Cabinet.
3. Add values from Steps 1 and 2 to values for the cabinet's blower assembly.

Bottom-mounted blower:

Volt-Amps - 64

Watts - 42

BTU/hr - 143

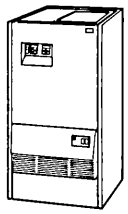
Top-mounted blower:

Volt-Amps - 17

Watts - 11

BTU/hr - 38

Meter-High Cabinet



The meter-high cabinet has three possible configurations:

- One 1600 bpi ½-inch tape
- One 1600 bpi ½-inch tape, and a 380-MB 10 ½-inch disk
- One 10 ½-inch disk (380 MB)

NOTE *The 575 MB disk is too long to fit in the meter high cabinet.*

You can have no more than two meter-high cabinets for a deskside system-level configuration. The power for the 115 volt version of the meter high cabinet is distributed through an internal 15 amp, 115 volt power strip. In the 230 volt version, the meter high cabinet does not have an internal power strip; the cabinet-mounted peripherals plug directly into the wall outlet.

Table 6-24 *Meter-High Cabinet*

Meter-High Cabinet	
Power rating	
typical	user-calculated
worst-case	1725 watts (15 amps at 115 VAC)
Thermal dissipation	user-calculated
Circuit breaker	
115 VAC range	15 amp
230 VAC range	not applicable

380-MB Disk

Table 6-25 *380-MB Disk Power Requirements*

380 MB Disk Power	
Operating line voltage	90-264 VAC
Operating line frequency	48-52 Hz, 58-62 Hz

Table 6-26 *380-MB Disk Power Rating and Thermal Dissipation*

380 MB Disk Drive				
Line Voltage VAC ±10%	**Line Frequency Hertz ±2 Hz**	**VA**	**Watts**	**BTUs/hr**
100	50/60	570/540	528/469	1800/1600
120	50/60	552	498	1700
220	50/60	616	586	2000
240	50/60	624	586	2000
Circuit breaker				
115 and 230 VAC		10 amps		

NOTE *For all line voltages and frequencies, a worst-case transient with a maximum of 40 amps for less than ½ cycle of input AC power will occur followed by a start-up current draw of 5.3 amps at 100/120 VAC or 2.7 for 220/240 VAC for 40 seconds.*

575-MB Disk

Table 6-27 *575-MB Disk Power Requirements*

575-MB Disk Power Requirements					
Line Voltage VAC ± 10%	*Line Frequency* Hz ± 2 Hz	*Volt-Amps* Start-up*	Running	*Watts*	*BTU/hr*
100	50/60	780/730	600/570	528/498	1800/1700
120	50/60	780/756	576/552	498/469	1700/1600
220	50/60	902/792	638/616	586/557	2000/1900
240	50/60	960/840	624/600	557/528	1900/1800

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

1600 bpi Tape

Table 6-28 *½-inch 1600 bpi Tape Drive Power Rating*

1600 bpi Tape Drive Power Rating		
Nominal AC Input Voltage	*Line Voltage*	*Range Line Frequency*
115 VAC	104-128	60 Hz
220 VAC	191-256	50 Hz
240 VAC	191-256	50 Hz

Table 6-29 *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
Worst-case	not avail.	not avail.	not avail.
Fuse			
115 VAC		5 amp	
220-240 VAC		2.5 amp	

6250 bpi Tape

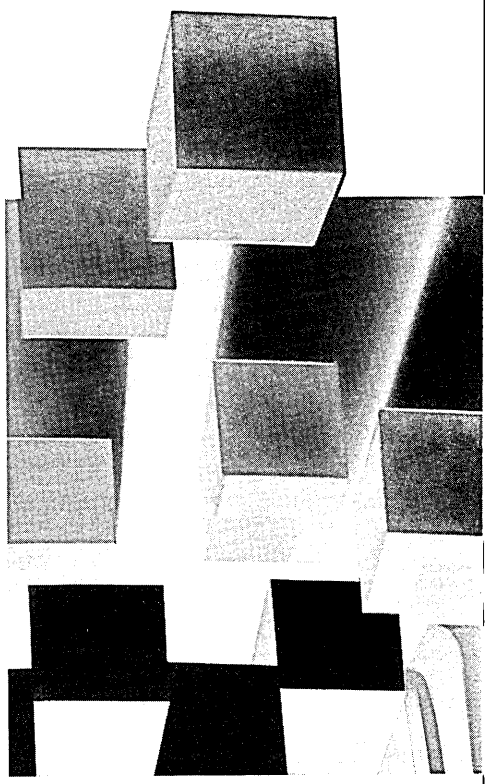
Table 6-30 *½-inch 6250 bpi Streaming Tape Power Requirements*

Streaming Tape Drive Power Requirements 115 VAC operation	*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 115/230 VAC		15 amps	

NOTE *For 180 to 264 VAC, typical values are 125% of 115 VAC range values.*

7

A Note on Software Products



7

A Note on Software Products

Sun's unbundled software products have special configuration requirements. The memory and disk space needs for these software products are discussed here:

- Sun CommonLisp
- GKS
- SunLink Products
- SunINGRES ™
- SunUNIFY ™ Relational-Database System
- SunAlis Office Automation System

7.1. Sun CommonLisp

Sun CommonLisp (SCLISP) brings artificial intelligence (AI) capabilities to the Sun Workstation families. CommonLisp gives software developers the tools to integrate software written in a symbolic programming language with the conventional computing tools of Sun's complete UNIX programming environment. CommonLisp is a full implementation as defined by the CommonLisp Committee and published in the book *Common Lisp: The Language* by Guy L. Steele, Jr.

Memory and Disk Requirements

Sun CommonLisp requires at least four megabytes of main memory. Eight megabytes is reasonable for development. The working set of the compiler is bigger than four megabytes. Thus, with eight megabytes you can compile programs without excessive swapping. Large knowledge-based applications may need from 12 to 16 megabytes.

Because CommonLisp is a memory-intensive system, a fast-swapping disk is best. CommonLisp keeps data in virtual memory rather than data files. Running a Lisp application requires a fair amount of swapping. A lightly loaded server with a 380-megabyte disk is better than a local SCSI disk. The address space for a knowledge-based system is big so you should plan on 40 to 50 megabytes of swapping space on the disk subsystem for a large application. A good configuration for a system with four to five users is a Sun-3 server with eight megabytes memory and a 380 megabyte disk with each user's workstation having eight megabytes of memory.

7.2. GKS

SunGKS is a complete level 2C version of the Graphical Kernel System (GKS), the most internationally accepted 2-D graphics standard. GKS is completely integrated with SunView.

SunGKS requires four megabytes of main memory and 350 kilobytes of disk space.

7.3. SunLink Products

SunLink is a group of data communications products that allow Sun workstations to work with systems of other vendors. You can use the SunLink Communication Processor (SCP) board with several SunLink products to improve performance.

You need one synchronous modem eliminator or two synchronous modems for BSC RJE, Internetwork Router, SNA 3270, and BSC 3270.

BSC RJE

SunLink BSC RJE software allows Sun workstations to exchange files and execute remote programs within a Binary Synchronous Communications (BSC) Remote Job Entry (RJE) environment. Workstations running with this software can appear as IBM 2780, 3780, or HASP remote job entry stations to remote mainframes and minicomputers.

The SunLink RJE BSC software is about 600 kilobytes. You will need more disk space on the gateway to hold any input files waiting for transfer to the host and any job output received from the remote host.

The gateway portion of SunLink BSC RJE increases the kernel by 25 kilobytes. The executables are 250 kilobytes. A gateway that makes heavy use of RJE BSC will use 200 kilobytes of main memory and 250 kilobytes of swap space.

The gateway software has a real-time requirement of three seconds to respond to the host to prevent timeouts. While the gateway will normally recover from a host timeout, data throughput will suffer. If several timeouts happen, the host will terminate connection. The gateway should run on a machine whose loading and memory size allow it to meet these real-time requirements.

The following table can be used to estimate gateway loading. It gives the maximum loading (percent of CPU used for a Sun-3 processor) assuming continuous data traffic. Loading during idle periods (when no jobs are being sent or received) is minimal. To estimate loading for a Sun-2, multiply the loading figure by 2.5.

Table 7-1 *BSC RJE Gateway Loading*

BSC RJE Gateway Loading	
Baud rate	***Loading (% of CPU)***
4800	5%
9600	10%
19,200	20%

BSC 3270

SunLink BSC 3270 gives Sun workstations interactive access to applications on an IBM mainframe by emulating a BSC 3270 terminal. SunLink software is 1300 kilobytes. The gateway portion of SunLink BSC 3270 increases the kernel size by 100 kilobytes. A gateway that makes heavy use of BSC 3270 will use 100 kilobytes of main memory and 150 kilobytes of swap space.

The following table can be used to estimate gateway loading. It gives the maximum loading (percent of CPU used for a Sun-3 processor) assuming continuous data traffic. Loading during idle periods (polling) will depend on the host polling frequency. To estimate loading for a Sun-2, multiply the loading figure by 2.5.

Table 7-2 *BSC 3270 Gateway Loading*

BSC 3270 Gateway Loading	
Baud rate	***Loading (% of CPU)***
4800	5%
9600	10%
19,200	20%

Internetwork Router (IR)

The SunLink Internetwork Router (IR) extends the communications capabilities of Sun workstations beyond a single Ethernet local area network. The SunLink IR creates a transparent link across wide-area transmission facilities between high-performance Ethernets. The Internetwork Router physically connects the Ethernets with a variety of transmission techniques that establish an *internetwork*. You can access applications, databases, printers, and files on remote Ethernets as if they were operating on a local Ethernet.

SunLink IR software is about 150 kilobytes. SunLink IR increases the kernel size by about four kilobytes. The maximum number of Internetwork Routers per system is four.

SNA 3270

SunLink SNA 3270 is a powerful software tool linking Sun workstations to mainframe computers conforming to IBM's Systems Network Architecture (SNA). SunLink SNA 3270 gives interactive access to any application running on an IBM mainframe without modification of the host hardware or software. SNA 3270 can maintain up to 24 simultaneous connections and emulates the IBM 3274, 3278, and the 3287.

SunLink SNA 3270 software is 900 kilobytes. The gateway portion of SunLink SNA 3270 increases the kernel by 15 kilobytes. The executables are 150 kilobytes. A gateway that makes heavy use of SNA 3270 will use 100 kilobytes of main memory and 150 kilobytes of swap space.

X.25

SunLink X.25 delivers packet-switched communications to Sun workstations. It adheres to the international standard X.25 recommendation, providing a communication link with public and private networks located throughout the world. SunLink X.25 also provides virtual terminal capabilities through support of the international X.29/X.3 standards. Using SunLink X.25, Sun workstations can

exchange information with other Sun networks or with computers from other manufacturers in local, national, or international configurations.

SunLink X.25 software is 1200 kilobytes. SunLink X.25 increases the kernel size by 35 kilobytes. You must add enough disk space for any X.25 applications that you want to create.

DDN

SunLink DDN includes the host-PSN protocol layers below IP, allowing Suns to provide DDN host services to a multivendor Ethernet network or internetwork which supports the TCP/IP protocol suite. Sun Link DDN includes the three major interfaces defined by the Dept. of Defense:

- DDN Standard X.25
- DDN Basic X.25
- 1822 HDH/HDLC

The software runs on any Sun processor with an available local port or on a Sun equipped with the SCP board for higher speeds. SunLink DDN software is 1200 kilobytes. SunLink DDN increases the kernel size by 35 kilobytes. You must add enough disk space for any DDN applications that you want to create.

OSI

Sunlink OSI allows Sun workstations to communicate with systems from other vendors using the Open Systems Interconnection (OSI) protocol standards defined by the International Standards Organization (ISO). Release X.0 of Sun-Link OSI allows open communications with vendors conforming to the Technical and Office Protocol (TOP) and the Manufacturing Automation Protocol (MAP) specifications. Sun's approach has been to design a core implementation of these protocols that can serve as the platform for building networks based on these protocols. Because of the consistency between Sun's layered software architecture for networking and the OSI seven-layered model, Sun can easily add new OSI protocols as they mature.

SunLink OSI has these features:

- IEEE 802.4/802.2 Type 1 Data Link layer
- ISO connectionless Network layer
- ISO Class 4 Transport layer
- ISO Session layer using the Basic Combined Subset (BCS)
- File Transfer, Access, and Management (FTAM) application layer
- MAP Common Application Service Element (CASE)
- MAP Directory Service
- MAP Network Management

SunLink OSI software is 3000 kilobytes. SunLink OSI increases the kernel by 100 kilobytes. To install SunLink OSI, you need about 5 megabytes of disk space.

The SunLink OSI session/transport process has certain real-time requirements. Although the ISO transport will normally recover from host timeouts, data throughput will suffer. If several timeouts happen, one of the end-systems will terminate the connection. SunLink OSI should run on a machine whose loading and memory size allow it to meet these demands. Four or more megabytes of main memory is recommended for systems running SunLink OSI.

SunLink DNA*-Type Protocols

SunLink DNA*-Type Protocols software links Sun workstations to machines supporting DEC's native network architecture, DECnet. Sun users can share network resources with DEC machines running DECnet Phase IV or any other machines supporting an Ethernet based implementation of the DECnet Phase IV protocols. Remote login, file transfer, and distributed applications are typical uses of the DNA product. Sun workstations running the DNA software and DEC computers running DECnet Phase IV (for example, VAX/VMS with DECnet-VMS) can co-exist on the same network and share resources. SunLink DNA and the Sun TCP/IP networking software co-exist on the Sun and the protocols co-exist on the same Ethernet.

SunLink DNA*-Type Protocols software is 1150 kilobytes. SunLink DNA increases the kernel by 70 kilobytes. The executables are 768 kilobytes.

VT100*-Type Terminal Emulator (SunLink Terminal Emulator)

The SunLink Terminal Emulator is a window-based software package that runs in the Sun Visual/Integrated Environment for Workstations (SunView) on any Sun processor. The SunLink Terminal Emulator provides a Sun window emulating a VT100 display terminal.

You need about 1.5 megabytes of disk space to install the SunLink Terminal Emulator. No kernel modifications are needed to run the product. The emulator uses approximately the same resources as a standard shelltool.

7.4. SunINGRES

SunINGRES gives software designers easy-to-use programming tools to create interactive and batch database applications. These tools include the data manipulation language QUEL and forms-based visual interfaces to this language. SunINGRES uses a simple, uniform data model, *tables*, that lets complicated database systems be structured and maintained with ease. It also gives database networking through INGNET.

SunINGRES requires 1.25 megabytes of main memory and 8 megabytes of disk. You must add a sufficient amount of disk space for the programs and database you create in SunINGRES also.

7.5. SunUNIFY

SunUNIFY provides a complete spectrum of fourth-generation applications development facilities for interactive and networked applications. The SunUNIFY database system allows more sophisticated user interfaces and logical data integrity checking. It was designed with an emphasis on performance, making it attractive for interactive applications that need split-second response time.

*Digital Network Architecture (DNA) and VT are trademarks of Digital Equipment Corporation.

SunUNIFY requires 300 kilobytes of main memory and 12 megabytes of disk space plus additional disk space for the programs and database that you create.

7.6. SunAlis

SunAlis is a multi-faceted, fully integrated office software system. It provides professionals and administrative personnel with the document preparation tools and management tools needed to analyze data and communicate with other people. SunAlis features include:

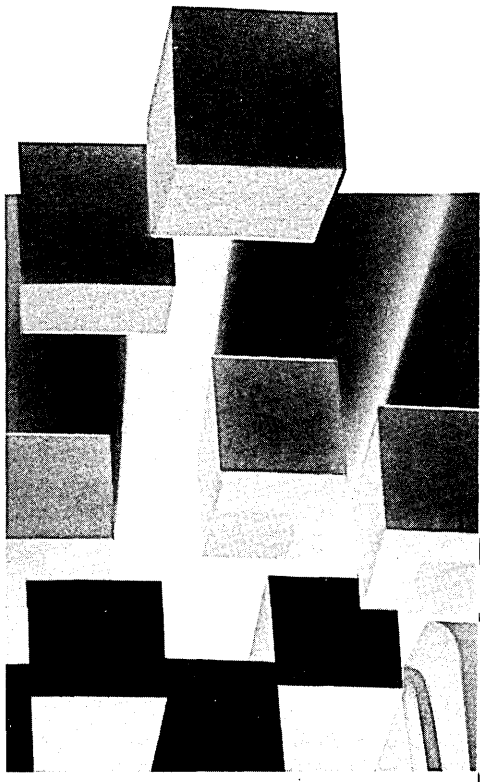
- Document composer
- Graphics editor
- Business graphics
- Spreadsheet
- Personal and office database

SunAlis requires 16 megabytes for the executable directory. Each user needs a minimum of two megabytes of memory, but three megabytes of memory provides better performance. You must also have at least eight megabytes of swap space to run SunAlis without SunTools. If you plan to have users run SunAlis at the same time, you should add one additional megabyte of swap space per user.

To run SunAlis with SunTools, you need at least 12 megabytes of swap space. You need an additional megabyte per user of swap space if multiple users run SunAlis at the same time.

8

Ordering Tips



8

Ordering Tips

This chapter describes the Sun Price List and its conventions. The price list is divided into seven sections:

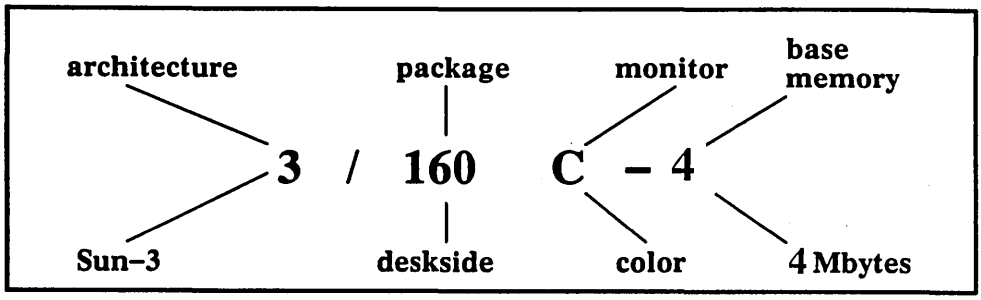
- Sun-3 Hardware
- System Software Distribution (operating systems)
- Software Products (such as SunINGRES, Sun Common Lisp, GKS)
- PC Compatibility Products
- Printers
- Accessories
- Sun-2 MC68020 Upgrades

Each page of the price list has four columns called, **Order Number, Description, List Price,** and **Discount Category.**

8.1. Hardware Order Numbers

Sun has developed a logical system of order numbers for the Sun-3 hardware.

Each *system* order number describes the architecture of the system, the type of package and the type of monitor. The following diagram shows what the order number *3/160C-4* means.



The architecture number is 3. With the Sun-3 product family, three package types are available:

- Desktop (50, 52, 75, 110)
- Deskside (110, 160, 260)
- Cabinet-mountable (180, 280)

The Sun-3 family has five monitor types and one server (no monitor option):

- Monochrome (M)
- High Resolution Monochrome (HM)
- Color (C)
- Grayscale (G)
- 15-inch monitor (LC)
- Server, no monitor (S)

The last component in the ***system*** order is the base memory. Thus, a 3/75M-4 comes with four megabytes of memory, but a 3/75-8 comes with eight megabytes of memory.

8.2. Option Numbers

Option numbers for Sun-3 hardware are always three digits. They are organized according to this table:

Table 8-1 *Option Number Categories*

Option Numbers	*Type of Option*
100-199	P2 bus boards - Memory expansion, FPA
200-299	Monitors, frame buffers, graphics accelerators
300-399	reserved
400-499	Communications options
500-599	Small Disks
600-649	Large Disks
650-699	Tape Drives
700-799	reserved
800-899	reserved
900-949	Power options
950-999	Cabinet options

Option Numbers Affixes

Besides the three-digit option number, there are letters that can be added as prefix or suffix to signify certain information.

Standalone Orders

An X **before** the three-digit option means the option is ordered without a system, as a **standalone.** These options are customer installable.

- X###

For example, an X620A is an order number for the 380-megabyte disk by itself.

Version Letters

A letter, such as A, B, or C, **after** the 3-digit option means this is a different version of the same functionality that is installed with a different CPU or package.

- ###A

For example, X620A is a 380-MB disk with controller that is ordered without a system. The A means that this option is the first version of this option. If there were a 620B option, it would be the same functionally as 620A, but it might have a different connector or cable for a different package.

Packaging Letters

The suffixes ***R1 and R2*** are added to the end of the order number when you want equipment to be installed in a cabinet. R1 stands for a Data Center cabinet; R2 for a meter-high cabinet.

For example, to order a 380-megabyte disk subsystem mounted in a a Data Center cabinet, you would write:

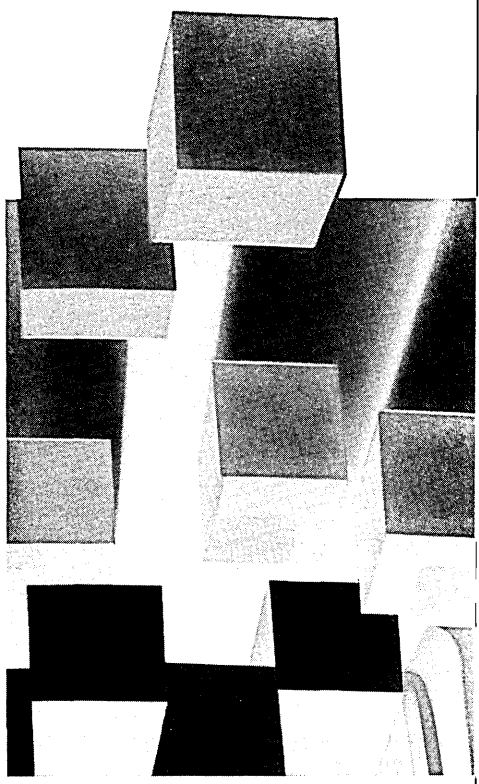
620AR1 or X620AR1

You would also have to order the cabinet itself (960A or X960A).

For a 1600 bpi ½" tape drive, option 670, ***R1*** means horizontal mounting. If you are adding a ½" inch tape drive to an existing meter-high cabinet, X670AR2 may be ordered without the cabinet (950A) to make sure proper mounting hardware is received.

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-3 Environmental Requirements*

Sun-3 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:
115 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 @ 666 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
2) Product containing ¼" tape drives	
Non-Operating	-20 to +60 ° C
3) Product containing ½" tape drives	
Operating	+5 to +40 ° C
Non-Operating	0 to +50 ° C
4) Gradient (Op and Non-Op)	10 ° C per hour

Table A-1 *Sun-3 Environmental Requirements— Continued*

Sun-3 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	
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) at 10 and 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-3 Environmental Requirements— Continued*

Sun-3 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)
Bench Drop	Two rotational flat drops from 4 inches (102 mm) or from the point of equilibrium (whichever is less) on opposite ends of the bottom of the unit
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
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-3 Environmental Requirements— Continued*

Sun-3 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
Compression Rate	1/2 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 15 ° 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 *Electro-static Discharge*

Electrostatic discharge	
No operator-perceived errors	0 to 15 KV
Operator-perceived errors †	15 to 25 KV

NOTE *† No permanent damage to equipment but loss of data possible.*

A.1. Environmental Exceptions

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

Table A-3 *380-MB and 575-MB Disk Environmental Exceptions*

380-MB and 575-MB Disk Environmental Exceptions	
Operating vibration	0.2 G
Operating shock	2 G's (10 ms maximum)

Table A-4 *½-inch 1600 bpi Tape Drive Environmental Exceptions*

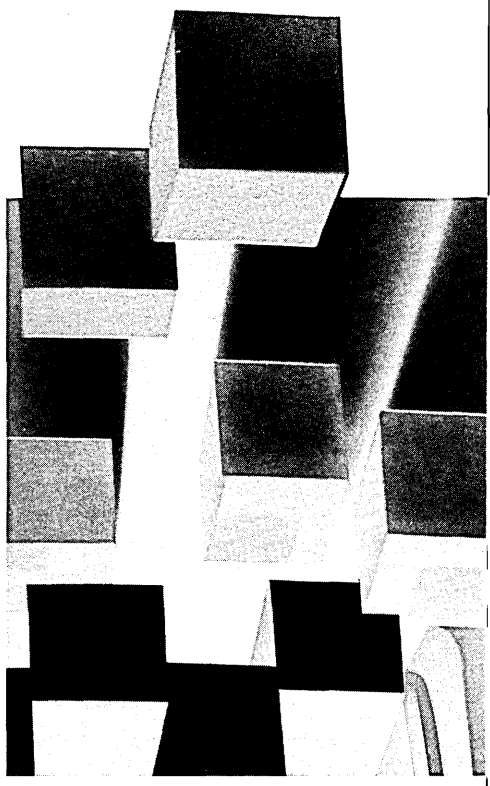
1600 bpi Tape Drive Environmental Exceptions	
Storage Altitude	12,192 meters (40,000 ft)

Table A-5 *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

Physical Space Requirements



B

Physical Space Requirements

This section lists the physical dimensions of the Sun-3 workstations, servers, and most options. When planning space for this equipment, make sure you leave room for cables in the back and for adequate ventilation around all sides of the equipment.

B.1. Displays

Table B-1 *M Display for the Sun-3/50 and Sun-3/75 Dimensions*

M Display	
Monitor	
Height	55.1 cm (21.7 inches)
Width	53.3 cm (21 inches)
Depth	43.7 cm (17.2 inches)
Weight	
Net	40 kg (88 pounds)
Shipping	42.5 kg (93.5 pounds)

NOTE *These dimension include the base of the monitor which contains the logic enclosure of the system.*

Table B-2 *Sun-3 Keyboard*

Keyboard	
Height	4.1 cm (1.6 inches)
Width	46 cm (18.1 inches)
Depth	19.8 cm (7.8 inches)

Table B-3 *Sun-3/110 Dimensions*

Sun-3/110	
LC Display	
Height	40.9 cm (16.1 inches)
Width	37.4 cm (14.7 inches)
Depth	45.4 cm (17.9 inches)
C Display	
Height	45.7 cm (18 inches)
Width	46.7 cm (18.4 inches)
Depth	51.4 cm (20.3 inches)
G Display	
Height	45.2 cm (17.8 inches)
Width	47 cm (18.5 inches)
Depth	39.4 cm (15.5 inches)
Desktop	
Height	113 cm (4.45 inches)
Width	616 cm (24.25 inches)
Depth	465 cm (18.32 inches)
Pedestal	
Height	616 cm (24.25 inches)
Width	287 cm (11.3 inches)
Depth	465 cm (18.32 inches)
Weight	
Sun-3/110	
Net	21.4 kg (47 pounds)
Shipping	27.3 kg (60 pounds)
LC Monitor	
Net	20.5 kg (45 pounds)
Shipping	30.5 kg (67 pounds)
C Monitor	
Net	46.3 kg (102 pounds)
Shipping	49.9 kg (110 pounds)
G Monitor	
Net	36.3 kg (80 pounds)
Shipping	38.6 kg (85 pounds)

Table B-4 *Sun-3/160/180/260/280 M and G Monitors Dimensions*

M and G Display	
Monitor	
Height	45.2 cm (17.8 inches)
Width	47 cm (18.5 inches)
Depth	39.4 cm (15.5 inches)
Weight	
Net	102.3 kg (225 pounds)
Shipping	129.5 kg (285 pounds)

Table B-5 *Sun-3/160/260 Color Monitor Dimensions*

C Display	
Monitor	
Height	45.7 cm (18 inches)
Width	46.7 cm (18.4 inches)
Depth	51.4 cm (20.3 inches)
Weight	
Net	113.6 kg (250 pounds)
Shipping	145.4 kg (320 pounds)

B.2. Deskside Systems

Table B-6 *Sun-3/180 and Sun-3/280 Dimensions*

Sun-3/180 and Sun-3/280	
Height	49.6 cm (19.53 inches)
Width	48.3 cm (19 inches)
Depth	50.8 cm (20 inches)
Weight	
Alone	54.6 kg (120 pounds)
Mounted	169.1 kg (372 pounds)

Table B-7 *Sun-3/160 and Sun-3/260 Pedestal Dimensions*

Sun-3/160 and Sun-3/260	
Height	71.1 cm (28 inches)
Width	32.5 cm (12.8 inches)
Depth	59.7 cm (23.5 inches)

B.3. Desktop and Deskside Options

Table B-8 *Desktop MSS Dimensions*

Desktop MSS	
Height	16.5 cm (6.5 inches)
Width	37.5 cm (14.8 inches)
Depth	37.5 cm (14.8 inches)
Weight	17 kg (37 pounds)

Table B-9 *Deskside Expansion Pedestal Dimensions*

Deskside Expansion Pedestal	
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 B-10 *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	87 kg (192 pounds)

B.4. Cabinets

The Data Center cabinet is approximately 25 inches wide by 77 inches high by 35 inches deep. When planning for space requirements for the Data Center cabinet, you should add 30 inches for rear clearance and 30 inches for front clearance.

Table B-11 *Data Center Cabinet External Dimensions*

Data Center Cabinet	
Height	194.3 cm (77.5 inches)
Width	64.7 cm (25.5 inches)
Depth	88 cm (35.0 inches)
Weight	320 kg (712 pounds)

Weight listed is the weight of the Data Center Cabinet when empty.

Meter-High Cabinet

The meter-high cabinet is approximately 22 inches wide by 42 inches high by 37 inches deep. When planning for space requirements for the meter high cabinet, you should add 30 inches for rear clearance, 30 inches for front clearance, and 24 inches for top clearance (since the tape drive is top-loading).

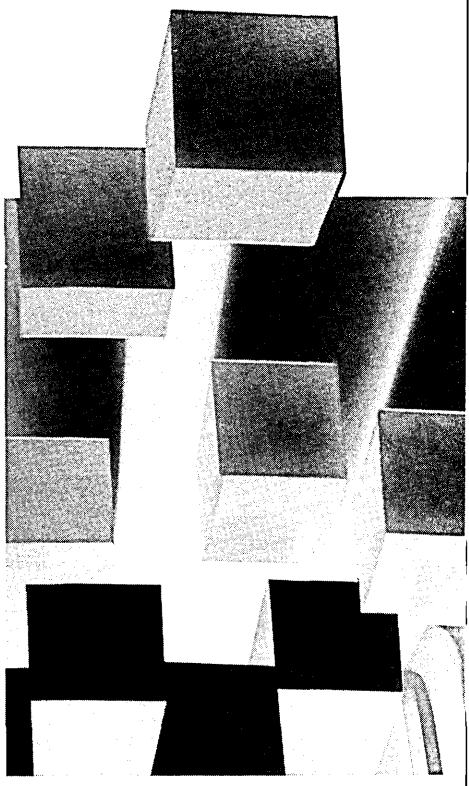
Table B-12 *Meter-High Cabinet Dimensions*

Meter-High Cabinet	
Height	106.6 cm (42.0 inches)
Width	54.6 cm (21.5 inches)
Depth	91.4 cm (36.0 inches)
Weight	198 kg (440 pounds)

Weight listed is the weight of the meter-high Cabinet when empty.

C

Glossary



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Glossary

68020
Microprocessor by Motorola that is the basis of the Sun-3 CPU. 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.

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), 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.

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

Bus
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 program that takes a source (symbolic) program and creates a 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 by passing on a signal. 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, flexible (floppy), Winchester (hard), and cartridge.

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
A type of 96-pin connector.

Diskful 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 Correcting Code corrects single bit errors and detects 2 bit errors in memory circuits, a feature of the Sun-3/200 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 first proposed by European computer scientists.

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

Floating Point Coprocessor
A special chip (also known as 68881 and the Floating Point Processor (FPP)) that does floating point calculations on the CPU board.

Formatted megabytes
The number of megabytes of space 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 a mass-storage media.

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. Since different computers accomplish varying amounts of processing in one instruction cycle, industry practice is to define one MIP as the integer performance of a VAX 11/780.

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 machines connected together so they can transmit information to one another. There are two kinds of networks, local and remote. A local network is a high speed network connecting machines at one site. A remote network contains machines that do not have a high speed connection to your machine.

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
A computer or terminal on a network; each node has a different name.

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

Page
1. A set 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
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. These interrupt requests can be 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. It is used with Sun 71-megabyte disk and the streaming tape drive.

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 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.

Shoebox
Sun's desktop mass storage subsystem.

SMD
(Storage Module Device) An industry standard interface used for large capacity, high-performance disks. An "enhanced" SMD (ESMD) standard is now available.

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

ST-506
An interface specification for hard disk drives.

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.

SunAlis
Sun's version of Alis, an office automation system produced by Applix.

SunINGRES
Sun's version of INGRES, a database system produced by RTI.

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
(SCLISP) 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 sub-routine 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
A method of allocating processor time and computer services among many users so that the computer looks like it can process a number of programs "simultaneously."

Utilities
The standard routines 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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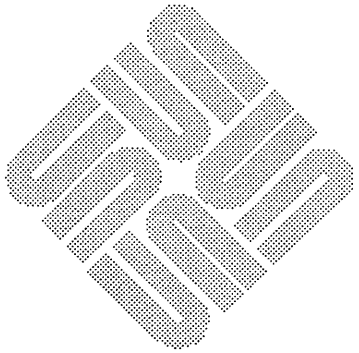

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