Part Number 800-1314-01
Revision: 50 of 15 October 1985
Class: 3

Hardware Installation Manual

for the

Sun-3/160 SunStation

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Preface

Welcome to the Sun Workstation®. This manual is meant to help you get the Sun-3/160 up and running. It gives unpacking and set-up directions for the workstation and presents basic information about the hardware configuration of the workstation.

Summary of Contents

This manual consists of six chapters and an appendix. Contents are:

Chapter 1 — *Unpacking and Setting Up the Sun-3/160* — is a guide to getting your Sun-3/160 out of its shipping cartons and setting it up ready to run.

Chapter 2 — *Basic Component Set-up* — describes how to set the voltage selectors; how to connect the Sun-3/160 to its keyboard, mouse, video monitor, and Ethernet; what the power-up self-test procedures mean; and connecting a modem, terminal or printer to the serial ports.

Chapter 3 — *Basic Hardware Configuration, and Options* — describes the basic configuration of the Sun-3/160, and the options available.

Chapter 4 — *How to Configure Your Sun-3/160* — describes how to add and remove the CPU board, Expansion board, and various options.

Chapter 5 — *Subsystem Set-up* — covers unpacking, mounting, and cabling for the disk and tape subsystems which may be supplied with your Sun-3/160.

Chapter 6 — *Environmental and Electrical Specifications* — describes the physical environment and electrical specifications.

Appendix A — Lists pinouts of various connectors and a signal description of the serial ports.

Finally, to help us maintain the currency and accuracy of this material we have supplied a reader comment sheet at the end of this guide. Please use the comment sheet to list errors and omissions. Your responses will help a great deal in our efforts to keep our documentation up to date.

Applicable Documents

We emphasize that this manual outlines rather than exhausts many of the topics contained within. References to applicable documents supplied with your system are given throughout, however, and we urge you to read these documents should

you need further information.

Part Number	Description
800-1029	M2321/M2322 Micro-Disk Drives Engineering Specifications
800-1133	Complete Set of Sun User's Manuals
800-1158	Installing Unix on a Sun Workstation — *(included in 800-1133)*
800-1207	M224XAS Disk Drives Engineering Specifications

1

Unpacking and Setting up the Sun-3/160

Unpacking and Setting up the Sun-3/160

This chapter describes how to unpack and set up your Sun-3/160. The "basic" Sun-3/160 consists of a monitor, single-board CPU, keyboard, and mouse.

Optional components of the Sun-3/160 include the Expansion board, color monitor (in place of the monochrome monitor), Sun-3 Color Video board, Multibus†-to-VME Adapter board, VME-to-VME Adapter board, Graphics Processor and Graphics Buffer boards, SCSI disk(s) and ¼-inch tape, SMD disk(s), and ½-inch streamer tape.

1.1. Safety Precautions

CAUTION **To avoid electric shock and/or a fire hazard, DO NOT REMOVE COVERS. Refer all servicing to qualified service personnel.**

1.2. Unpacking Instructions

The basic components of the Sun-3/160 are shipped in 3 separate cartons:

- the largest contains the pedestal;
- the smallest contains this and other manuals (as you have already discovered), the mouse, pad, and various cables;
- the remaining box contains the monitor and keyboard.

When you receive your shipment, inspect all shipping cartons *immediately* for evidence of damage. If any shipping carton is severely damaged, request that the carrier's agent be present when the carton is opened. If the carrier's agent is not present when a carton is opened and the contents are found to be damaged, keep all contents and packing materials for the agent's inspection.

1.3. Unpacking the Pedestal

NOTE

- *The shipping weight of the pedestal is about 100 pounds, so two people will be needed to unpack and set up the pedestal.*

†Multibus is a trademark of Intel Corporation.

- *Inside the large oblong carton is the pedestal and its four wheels, packed between two blocks (one block at each end) of styrofoam. These two blocks of styrofoam fit snugly into the Sun shipping carton, so it may be difficult to remove them.*

1. Place a pad or a cushion down upon a flat surface in an open working area (to protect the pedestal from being scratched while you unpack it). Give yourself plenty of space to move around.
2. Place the carton right-side up. Cut the shipping tape with a knife or scissors, taking care not to damage the contents within. Open the four top flaps.
3. The pedestal is encased in two styrofoam packing blocks (one block at each end) inside the shipping carton. Using care, roll the carton first on one side, then upside down, keeping the flaps open.
4. The open top of the carton is now facing down. Gently tug the cardboard carton up and off of the pedestal and packing blocks.
5. When you have removed the carton from the packing blocks, lift one end of the pedestal and remove the packing block.
6. If the wheels have not been attached to the pedestal, place this packing block beneath the pedestal. Lift the opposite end of the pedestal and remove the remaining block and place it under this opposite end of the pedestal.
7. Remove the plastic bag from the pedestal.
8. Complete this step only if the wheels are not already attached to the pedestal.

   With the pedestal still raised up on the two styrofoam blocks, use an open end wrench to screw the four rollers (one roller at each corner) into the base of the pedestal. You can identify the base of the pedestal by its four threaded holes — one at each corner.
9. Set the pedestal upright on its roller wheels.

1.4. Unpacking the Keyboard and (Color or Monochrome) Monitor

NOTE

- *Although the shipping weight of the keyboard and monitor is about 120 pounds, the packaging has been designed so that one person can unpack it alone. After unpacking the keyboard and monitor, you may need help moving the monitor to the place you finally want to set it up.*
- *Inside the large square carton are the keyboard and monitor, packed between two big blocks of styrofoam. The two halves of this styrofoam fit snugly into the Sun shipping carton, so it may be difficult to remove them.*

- *The keyboard is shipped with both types of monitor (color or monochrome). The monochrome monitor has a base; the color monitor does not (see figures following).*

1. Place a pad or a cushion down upon a flat surface in an open working area (to protect the monitor from being scratched while you unpack it). Give yourself plenty of space to move around.
2. Place the carton right-side up. Cut the shipping tape with a knife or scissors, taking care not to damage the contents within. Open the four top flaps.
3. The monitor and keyboard are encased in two styrofoam packing blocks inside the shipping carton. Using care, roll the carton first on one side, then upside down, keeping the flaps open.
4. The open top of the carton is now facing down. Gently tug the cardboard carton up and off of the styrofoam packing blocks.
5. When you have removed the carton from the packing blocks, roll the entire assembly over on its side so that the split between the two blocks of styrofoam is running horizontally. The monitor and keyboard are packed like this:

Figure 1-1 *Unpacking the Monochrome Monitor*

Key	*Description*
1	Monitor Base
2	Monitor
3	Keyboard (goes here)
4	Foam Packing Blocks

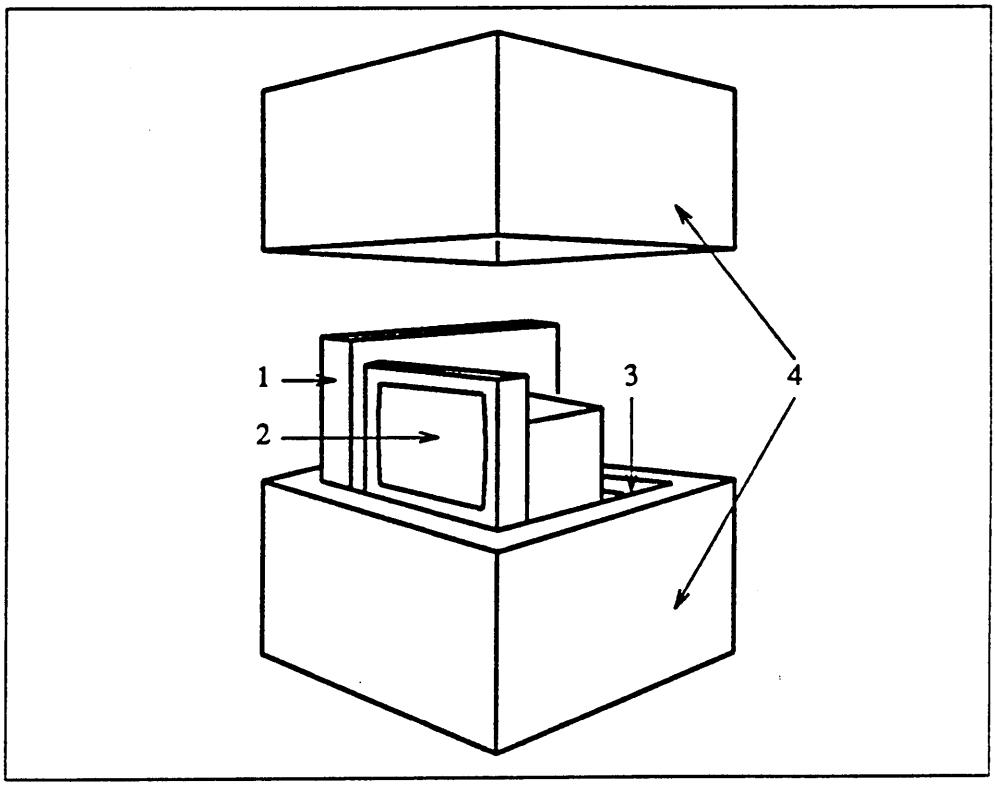
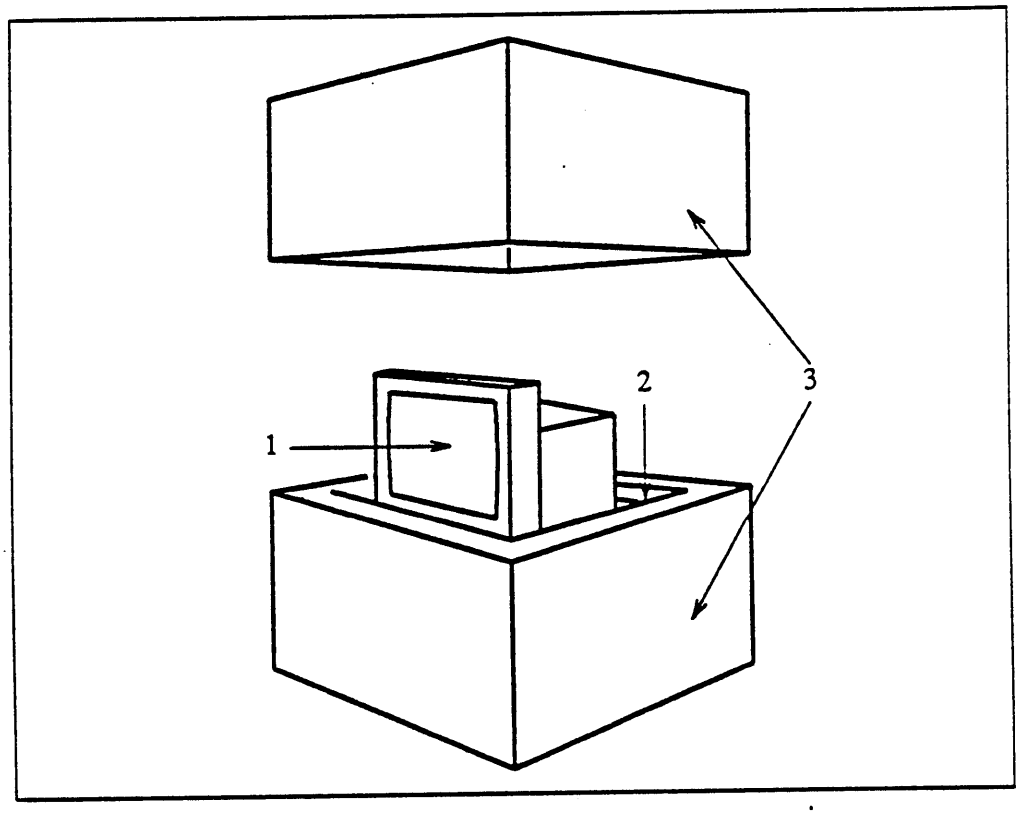


Figure 1-2 *Unpacking the Color Monitor*

Key	*Description*
1	Monitor
2	Keyboard (goes here)
3	Foam Packing Blocks



6. Remove the top piece of styrofoam packing. Remove the keyboard from the styrofoam, and set it aside.
7. Carefully turn the monitor upright and remove the remaining styrofoam block. Remove the plastic bag from around the monitor.
8. The monitor should now be sitting upright and facing you in your working area, with all packing material removed from it.

We recommend that you save the shipping carton and packing material for future use in case the product must be reshipped; any products shipped back to Sun must be repacked in their original Sun shipping cartons.

1.5. Unpacking the Mouse, Pad, Cables, Tapes, etc.

The final (and smallest) box contains the mouse and its pad, Ethernet cable (if ordered), software tapes, and various connecting cables. Open this box and take this equipment out, as needed.

2

Basic Component Set-up

Basic Component Set-up

CAUTION **Follow these safety precautions:**

- **Before plugging in the power cord of any component of your Sun system, be sure that the line power supply voltage and frequency are as required by the label on the back panel of your Sun-3/160 pedestal and monitor. (There is a table in Chapter 6, "Power Supply Specifications," which lists possible options. Refer to it if necessary.) You can reset these voltage selectors yourself, if necessary (see the instructions below, "Resetting the Voltage Selectors").**
- **Use only three-prong (grounded) outlets.**
- **Make certain that all servicing is performed by qualified personnel.**
- **Finally, DO NOT plug in the power cord until explicitly instructed to do so!**

2.1. Resetting the Voltage Selectors

The pedestal and monitor arrive from the factory set for 115 VAC operation. If you do not need to change the pedestal or monitor's voltage selection, go on to the next section, which describes connection of the keyboard, mouse, Ethernet, and video.

If you *do* need to change the pedestal or monitor's voltage selection, continue with this section.

Voltage select mechanisms are located in several places:

1. a switch on the power supply inside the front of the Sun-3/160 pedestal,
2. a connector on the right side (when facing the front of the monitor) of the color monitor chassis,
3. either a switch or a printed circuit board (depending upon the brand of monitor you receive) on the rear of the monochrome monitor.

2.2. Setting the Voltage in the Pedestal

The pedestal arrives from the factory already set for 115 VAC operation. If you do not need to change the pedestal's voltage selection, go on to the next section.

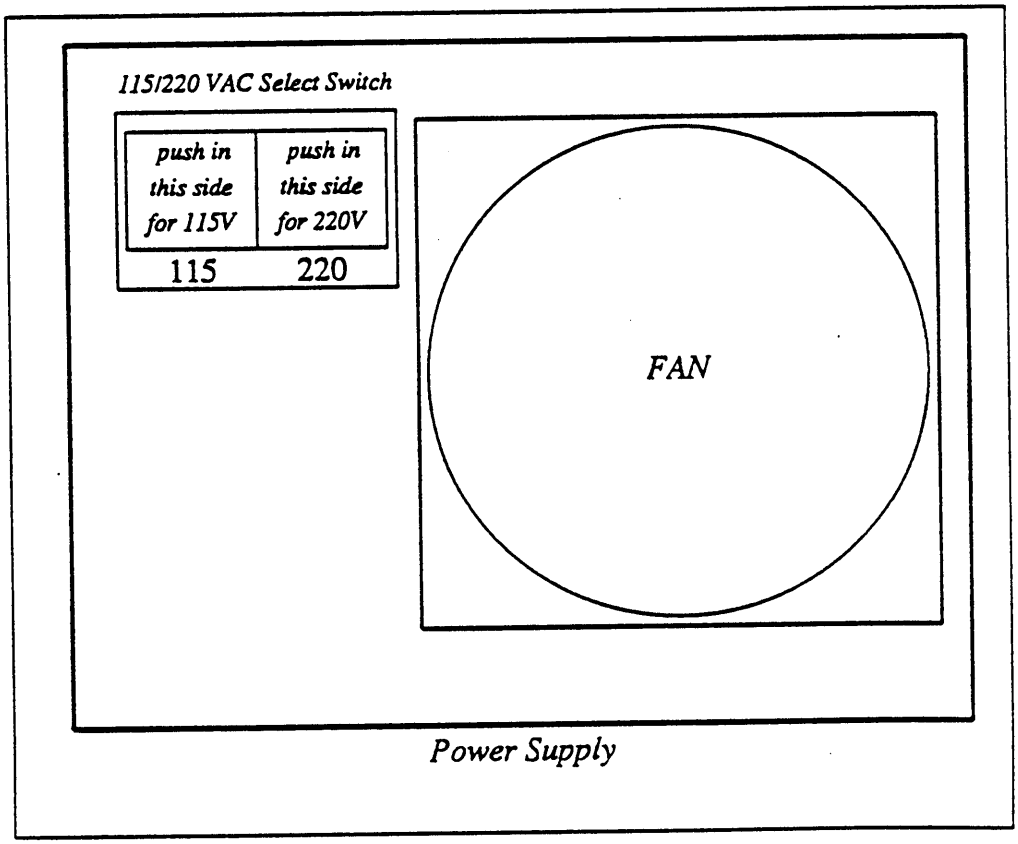
CAUTION **Before attempting to reset the pedestal's voltage selection, make certain that:**

- **the ON/OFF switch on the front of the pedestal is OFF (side next to the 0 is pressed in and the switch is unlit), and**
- **the AC power cord is unplugged from the wall receptacle.**

There are two different types of power supply being used in the Sun-3/160: ETA, and Pioneer. Each has a different way of setting the AC input selection switch.

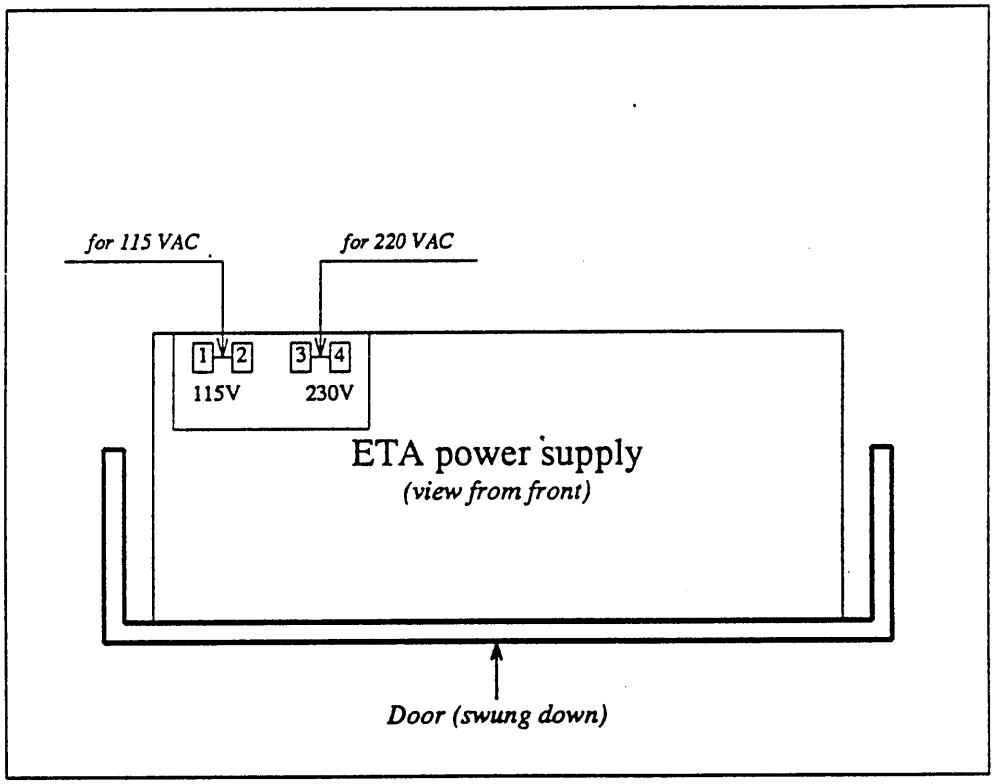
1. Remove the plastic bezel from the front of the pedestal by gripping it around the edges and pulling straight out. It should pop right off.
2. Remove the four screws holding the hinged front cover closed. The front cover is hinged at the bottom and swings down; when the cover is open you will see it is supported by a pair of metal cables.
3. Open the hinged front of the pedestal. The power supply is now exposed — it is inside the metal box attached to the hinged front of the pedestal.
4. The Pioneer power supply sets its input AC requirements by a switch on the rear of the supply, next to the fan. The two options — 110 VAC and 220 VAC — are labelled on the case below the switch. Check this switch to make certain it is set properly for your requirements.

Figure 2-1 *115/220 VAC Select Switch on Pioneer Power Supply*



5. The ETA power supply uses jumpers for its 115/230 VAC selection. These jumpers are visible on the front of the power supply — the side facing you when the pedestal door has been swung down. The two pins closest to the left side of the case (labelled "115") are jumpered together to select 115 VAC input; the inner two pins (labelled "230") are jumpered together to select 230 VAC input. See the figure below for the location of these jumpers. The power supply arrives from the factory with the two leftmost pins — 115 VAC — jumpered together.

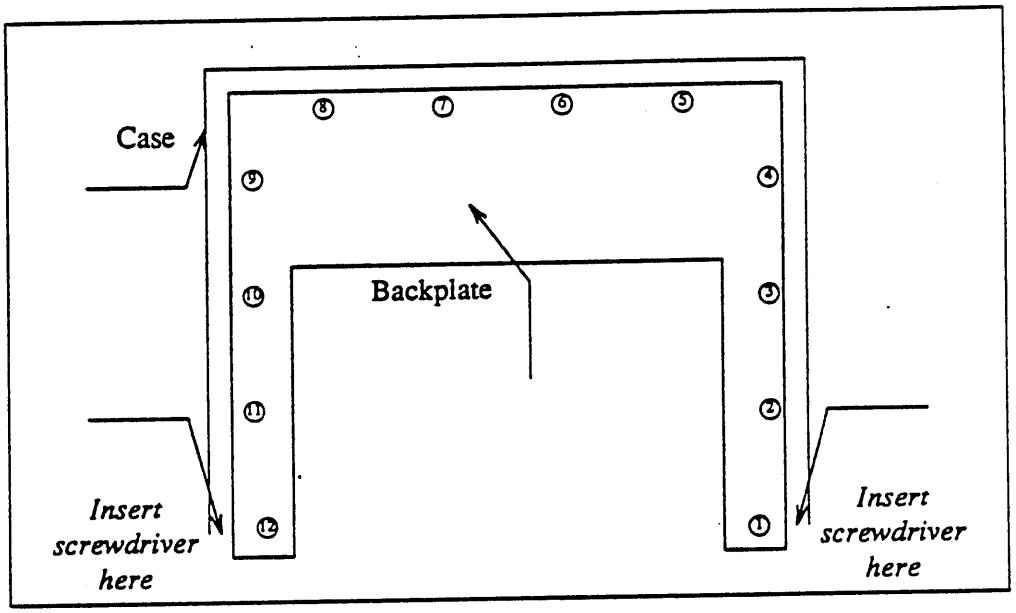
Figure 2-2 *115/220 VAC Select Switch on ETA Power Supply*



2.3. Voltage Selection on the Sun-3/160 Color Monitor

The color monitor arrives from the factory set for 115 VAC operation. Go on to the next section if you do not need to change the monitor's voltage selection.

Figure 2-3 *View of the Back of the Color Monitor*



CAUTION **Before attempting to reset the color monitor's voltage selection, make certain that:**

1. **the OFF/ON switch on the rear of the monitor chassis is OFF (side with the "0" is pushed in), and**
2. **the AC power cord is unplugged from the rear of the monitor.**

To change the voltage selection in the color monitor

1. remove screws 1 through 12 shown in the figure above, and
2. insert a blade screwdriver where it says "Insert screwdriver here" (in the figure above) between the case and backplate. Pop the cover up on both sides of the monitor. After loosening both sides you should be able to lift the cover off.
3. When facing the rear of the monitor, the 115/230 VAC jumper will be on the left side of the chassis.

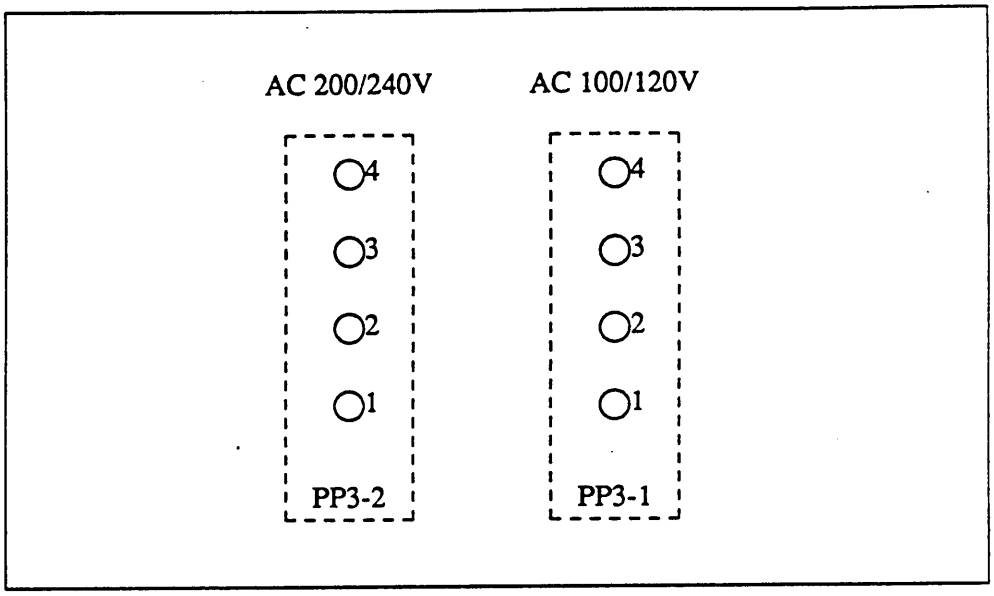
115 VAC Operation

For 115 VAC operation, set the connector marked "PP3" over the three jumpers to the right marked "PP3-1," (also marked "AC 100/120V").

230 VAC Operation

For 230 VAC operation, set the connector marked "PP3" over the three jumpers to the left marked "PP3-2," (also marked "AC 200/240V").

Figure 2-4 *Setting the Voltage Select Connector on the Color Monitor*



2.4. Voltage Selection on the Sun-3/160 Monochrome Monitor

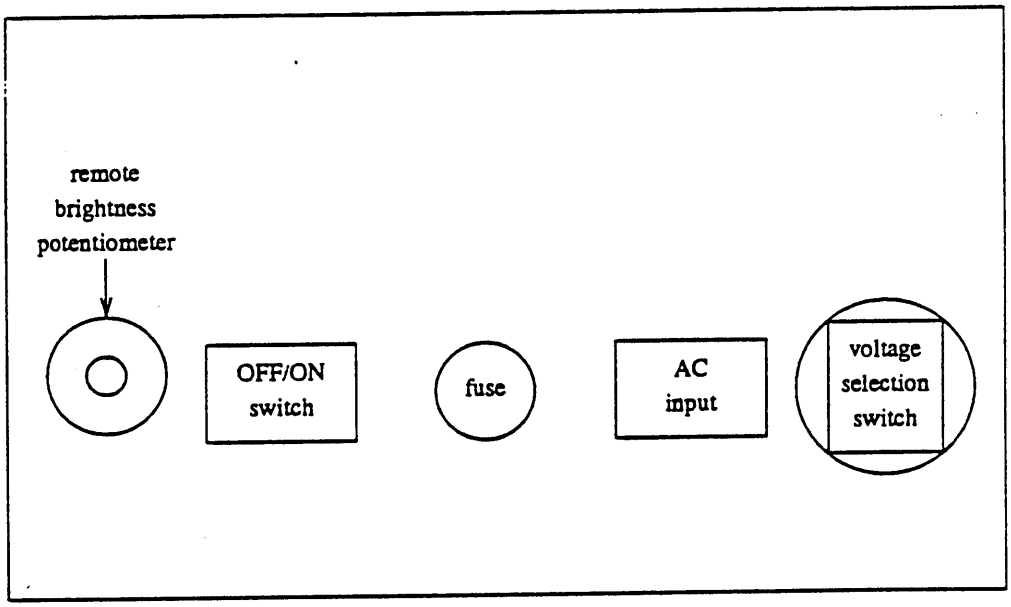
There are two models of monochrome (black and white) monitors available with the Sun-3/160. Although essentially the same, and each has a different method of voltage selection. The two types of voltage selection are:

1. PC card
2. switch

If the type monitor you have sets its voltage selection by switch, you will see a (possibly red) switch to the right rear side of the monitor chassis (when facing from the rear). One setting of the switch will display "115 V," the other "230 V." Use a blade screwdriver to push the switch either up (so the "115 V" is displayed, for 115 VAC operation) or down (so the "230 V" is displayed, for 230 VAC operation).

The diagram below shows the relative location of the voltage selection switch.

Figure 2-5 *Location of the Voltage Selection Switch on Sun-3/160 Monochrome Monitor*

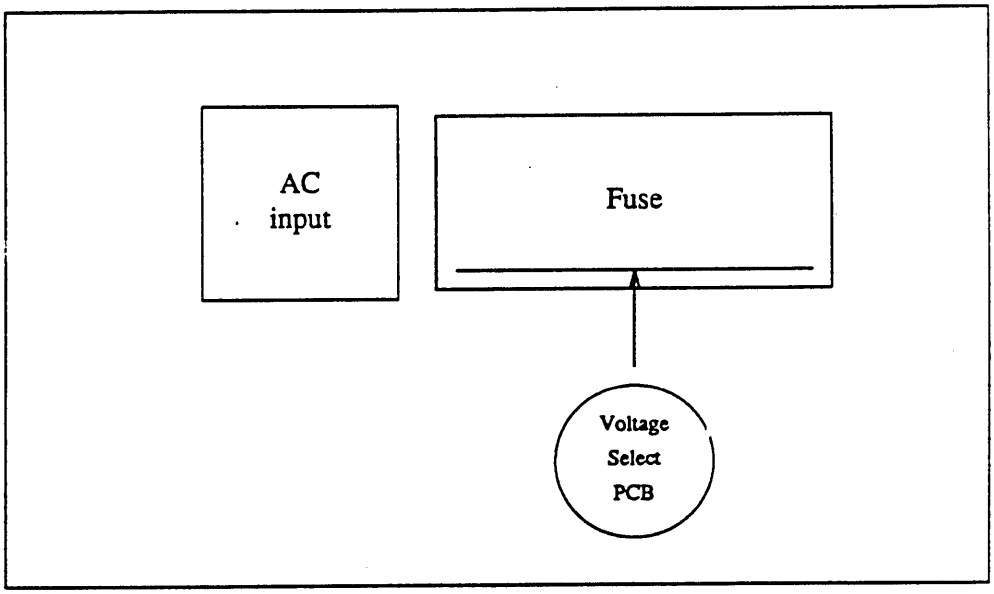


If the type of black and white monitor you have sets its voltage selection by PC card, things are a little more complicated. To set the voltage selection, you change the position of a PC card inside the fuse case. There are four voltages that can be selected, two from each side of the PC card, and they are:

1. 120 or 240 VAC, and
2. 100 or 230 (referred to as "220" on the voltage select PCB) VAC.

The diagram below shows the location of the voltage select PCB.

Figure 2-6 *AC Power, Voltage Select, and Fuse on Sun-3/160 Monochrome Monitor*



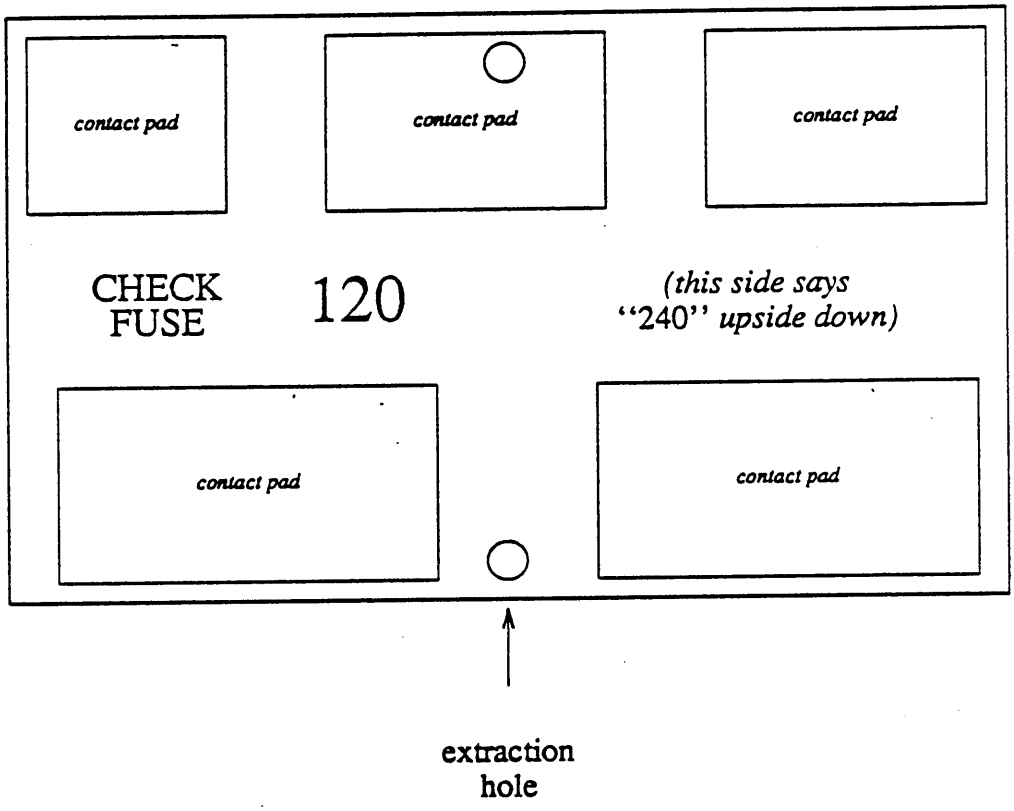
To access the voltage select PCB, you will have to

1. turn the power off to the base unit (by pressing the OFF/ON switch so the "0" side is pushed in);
2. pull the AC power cord from the AC input receptacle on the rear panel;
3. slide the clear plastic panel, which covers the fuse case, to the left. The fuse and voltage select PCB will now be accessible.
4. Pull the voltage select PCB out.

120/240 VAC Operation

Below is a diagram of the 120/240 VAC side of the voltage select PCB. For 120 VAC operation, slide the voltage select PCB into the fuse case with this side up (with the legend CHECK FUSE 120 on the left-hand side and facing out towards you).

Figure 2-7 *120/240 VAC Select on Sun-3/160 Monochrome Monitor*

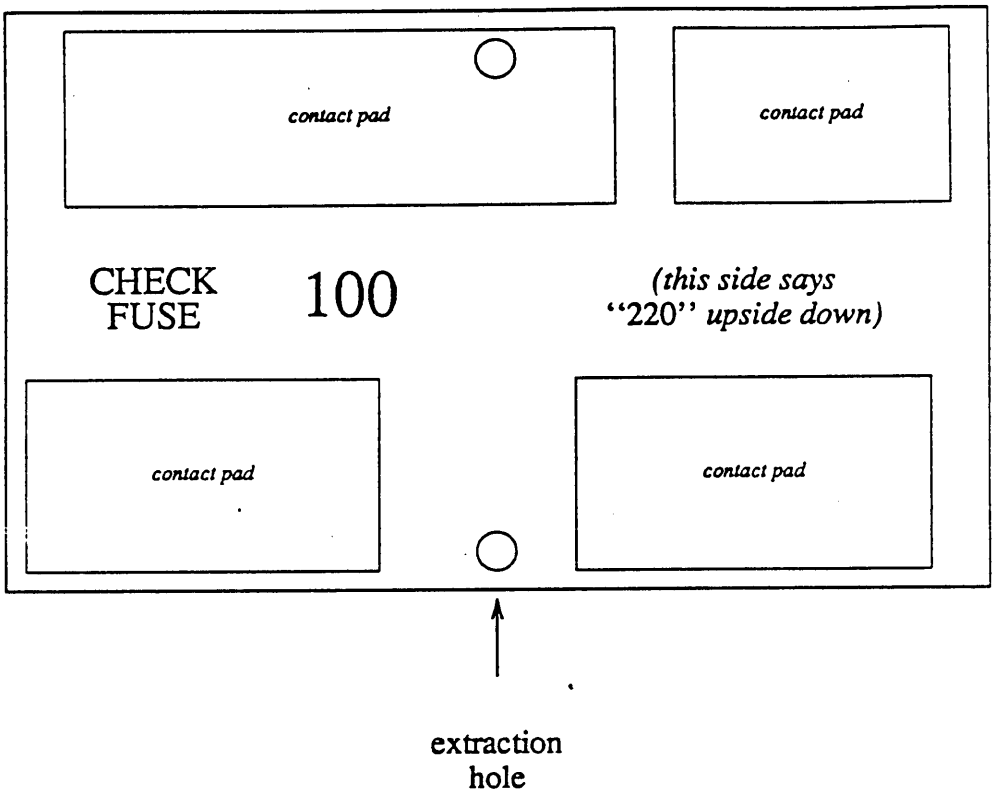


For 240 VAC operation, keep this side up and rotate the PCB 180 degrees, so that the legend "240" is on the left-hand side and faces out towards you. Slide the PCB into the fuse case in this position.

100/230 VAC Operation

For 100/230 VAC operation, flip the card over. It looks something like this:

Figure 2-8 *100/230 VAC Select on Sun-3/160 Monochrome Monitor*



2.5. Connecting the Keyboard, Mouse, Ethernet, and Video

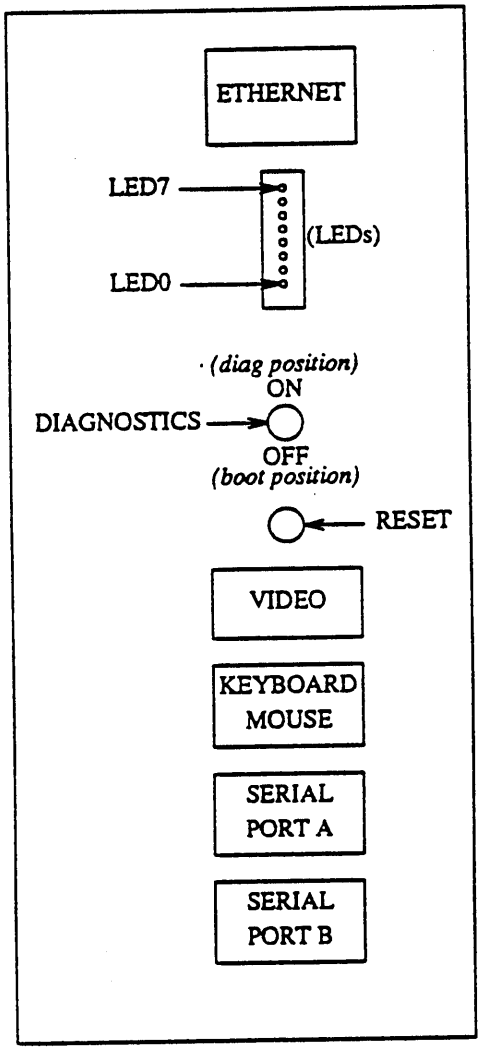
CAUTION **Before attempting any of the following connections, make certain that:**

1. **the OFF/ON switch on the front of the pedestal is OFF (side with the "0" is pushed in), and**
2. **the AC power cord is unplugged from the rear of the pedestal.**

The Sun-3/160 comes with its boards already installed in the pedestal. (Should you want to add more boards, please see the chapter titled "Hardware Configuration and Options.") The CPU board, to which the keyboard, mouse, and Ethernet will be connected, is in slot one, the slot to the furthest left when facing the rear of the machine. The Color board, to which RGB color will be connected, may be placed in any free slot — although it is recommended to go in slot 8.

The keyboard, mouse, Ethernet, serial I/O, and video connectors are arranged on the backpanel of the CPU board as shown below. The CPU board will be in slot 1; you can identify it by its vertical row of D connectors, and the small bank of 8 diagnostic LEDs by these connectors.

Figure 2-9 *Sun-3/160 Connectors on the 2060 CPU Board*



This section describes how cables will be connected from the backpanel of the CPU board to each of the following items:

- keyboard,
- mouse,
- Ethernet,
- monitor,

- DIAGNOSTICS switch,
- RESET switch.

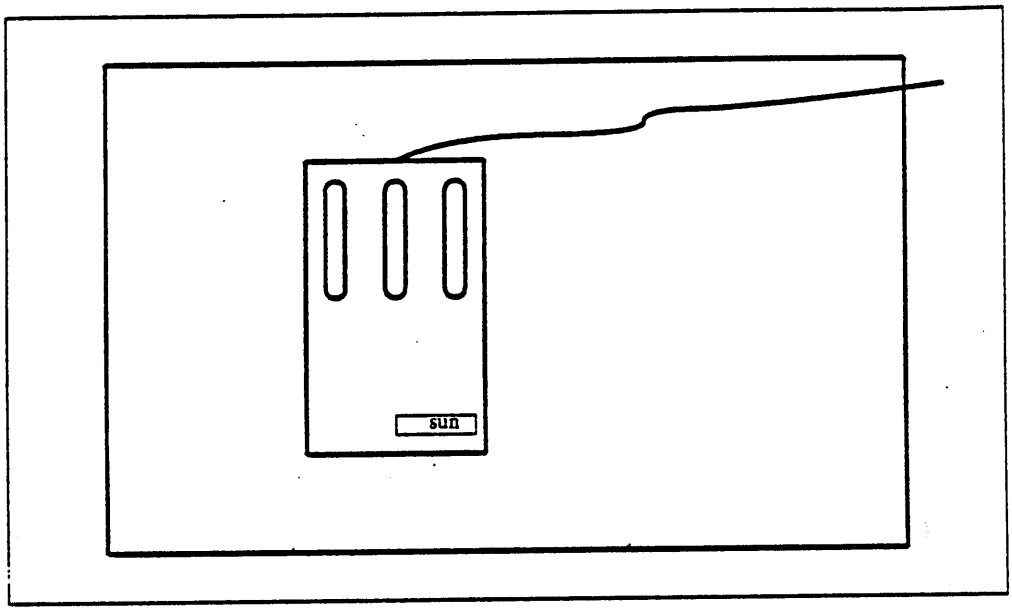
The two remaining connectors, marked SERIAL PORT A and SERIAL PORT B are serial I/O ports to which can be connected peripherals such as modems, printers, and other terminals.

After removing the manuals and cables from the smallest carton, attach the keyboard, mouse, and Ethernet to the pedestal's CPU board in the following ways:

Keyboard and Mouse Connections

1. The keyboard cable is permanently connected to the keyboard; the other end plugs into the DB-15 (15-pin D connector) at the backpanel of the CPU board. Find your keyboard cable and plug it in now to the KEYBOARD connector on the backpanel.
2. Find the mouse and its cable. The mouse is a little rectangular box with three long buttons which is permanently attached to its connecting cable.
   - The mouse plugs directly into the keyboard itself; there is a phone connector for the mouse in the top middle area of the keyboard. Find the mouse and its cable and plug this cable into the phone connector on the keyboard now.
   - Take out the mouse pad, a hard shiny metallic plate about 9 inches by 11 inches. The mouse sits on the side of the pad which has the Sun logo, and the pad must be oriented so that its length is **horizontal** in relation to the mouse (see the figure below, "Orienting the Mouse on its Pad"). After setting your system up and logging into SunWindows™, moving the mouse across the face of the pad will cause the cursor to move across the display.

Figure 2-10 *Orienting the Mouse on its Pad*



Connecting the Ethernet Cable to the Sun-3/160

NOTE *This section is optional, and is only for those who need to connect their Sun-3/160 to an Ethernet.*

Find the Ethernet cable. It is a thick cable with 15-pin D connectors at both ends.

CAUTION **Before going on, make certain that J2503 on the CPU board is properly jumpered. If you are using a Level 1 Ethernet transceiver, the jumper must be IN. If you are using a Level 2 Ethernet transceiver, then the jumper must be OUT. If J2503 is incorrectly jumpered, you could damage your Ethernet transceiver.**

1. The male end of the Ethernet cable has a pair of metal studs that fit into the slide lock assembly attached to the CPU board's "ETHERNET" jack. Plug this male end into the "ETHERNET" jack. Push the slide lock over the studs to fasten the D connector securely in place.
2. The female end of the cable has the slide lock assembly attached to *it*; plug this end into the Ethernet transceiver and lock it securely also.

NOTE *After completing the above connections, you may refer to "Connecting the Sun-3/160 to the Ethernet," below, for further instructions regarding Ethernet installation.*

Connecting RGB Video to the Sun-3/160

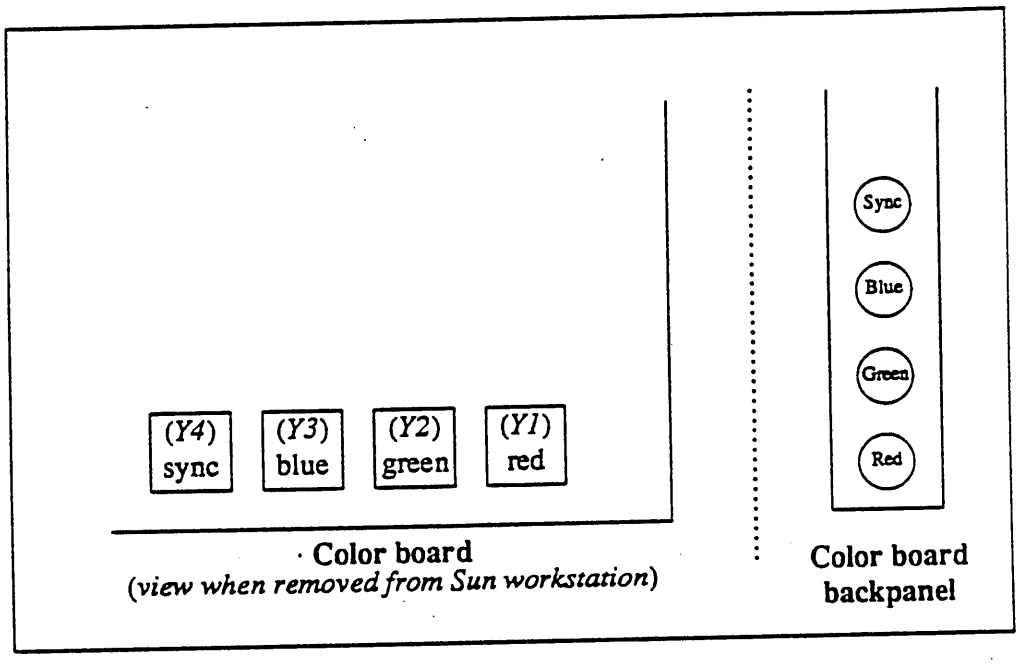
If you have a Sun-3/160C, then your machine comes with a color monitor and a Sun Color Video board. Four RGB-Sync cables (bundled together as one) connect the Color Video board to the color monitor.

The Color board can go in any free slot (although it is recommended to go in slot 8), and RGB-Sync cable connections are made from it to the back of the color monitor.

Find the RGB video cable. The video cable is a single bundle of four 15-foot lengths of coaxial cable with male BNC connectors at each end. Refer to the figure titled "Color and Sync Connections on the Color Board," for the following Color board connections.

1. Plug one cable into the female BNC connector marked "Y1" (red signal) on the Color board; connect the other end of this cable into the similar connector marked "R" on the rear of the color monitor.
2. Plug another cable into the female BNC connector marked "Y2" (green signal) on the Color board; connect the other end of this cable into the similar connector marked "G" on the rear of the color monitor.
3. Plug another cable into the female BNC connector marked "Y3" (blue signal) on the Color board; connect the other end of this cable into the similar connector marked "B" on the rear of the color monitor.
4. Plug the remaining cable into the female BNC connector marked "Y4" (composite sync signals) on the Color board; connect the other end of this cable into the similar connector marked "Ext Sync" on the rear of the color monitor.
5. Finally, make certain all the impedance switches on the back of the color monitor ("75Ω/High") are set to the "75Ω" position.

Figure 2-11 *Color and Sync Connections on the Color Board*



Connecting the Black and White Monitor to the Sun-3/160

CAUTION **Make certain that the AC power switches of the base unit AND the monitor are OFF. The OFF position of the AC power switch is with the side marked "0" pushed in.**

If you have a Sun-3/160M workstation, you have a monochrome monitor. You will connect the monochrome monitor to the video connector on the CPU board.

Find the monochrome monitor's video cable. The monitor's video cable has a 9-pin D connector at each end.

1. Plug the male D connector of the video cable into the "VIDEO" jack on the rear of the pedestal, and tighten the screws.
2. Plug the female D connector of the video cable into the "VIDEO" input of the monitor and tighten the screws on it.

Find the monitor power cable; it is a standard three-prong cable.

1. Plug the male end into the wall.
2. Plug the female end into the video power receptacle on the rear of the monitor.

Diagnostic and User Reset Switches

There are two switches on the back of the 2060 CPU board, labelled DIAGNOSTICS and RESET.

- If you *do* want to run diagnostics when you power the system up, turn this switch UP.

NOTE *If you place the DIAGNOSTICS switch in the UP or on position, all messages are sent to serial port A — so you must have a terminal connected to port A in order to see them.*

- If you do *not* want to run diagnostics when you power up, turn this switch DOWN. Normally you place the DIAGNOSTICS switch in the DOWN or off position when booting or running the system.
- To force a reset of the system after you have powered it up, press the RESET switch. This places you in a program called the "monitor." To exit the monitor, you must reboot the system.

  Reboot the system by typing "b" (for "boot") "vmunix," and press the return key.

```
>b vmunix <return>†
```

  The system will now begin to automatically reboot.

2.6. Powering Up the Sun-3/160

CAUTION **Before going on, make certain that the power switches to the monitor and pedestal are OFF (the side with the "0" is pushed in).**

So far you have made certain that

1. the monitor and pedestal have been set correctly for available AC power,
2. both the pedestal and monitor are plugged into AC power at a convenient wall outlet, and
3. the DIAGNOSTICS switch is down — in the BOOT position.

Next, turn the power switch on the front of the Sun-3/160 pedestal ON (side with the "1" is pushed in), and also turn the power switch on the back of the monitor ON. You should see (or hear) three things happen:

- the fans inside the pedestal will come on, and
- the eight diagnostic LEDs on the CPU board will begin blinking on and off (see below, "Power-On Self Test Procedures" and the table following, "Diagnostic LEDs"), and

†This is true for software releases prior to 3.0. For software releases 3.0 and later, merely type "b"

```
>b <return>
```

The system will now begin to reboot.

- the CRT screen will slowly come on.

The blinking LEDs indicate that the Sun-3/160 is going through a self-test; when this self-test is successfully completed, the following message will come onto your screen:

```
Self Test completed successfully

Sun Workstation, Model Sun-3/160, Sun-3 Keyboard
ROM Rev --, _MB Memory installed, Serial # - - - -
Ethernet address --:--:--:--:--:--
```

For further information describing how to bring up UNIX,† log on, and choose your password, please see *Installing UNIX on the Sun Workstation*, part number 800-1158.

2.7. Power-On Self Test Procedures

The central processor board (CPU) of the Sun-3/160 has a set of PROMs which contain a program generally known as the "monitor." The monitor controls the operation of the system before the UNIX kernel takes control.

When system power is first turned on, the monitor runs a quick self-test procedure, a running commentary of which is carried by the eight LEDs on the CPU board. Results of this self-test are contained in the table below; a solid circle means the light is on; a hollow circle means the light is off. Also, left to right in the table is equivalent to reading the LEDs from top to bottom when the CPU board is in its slot.

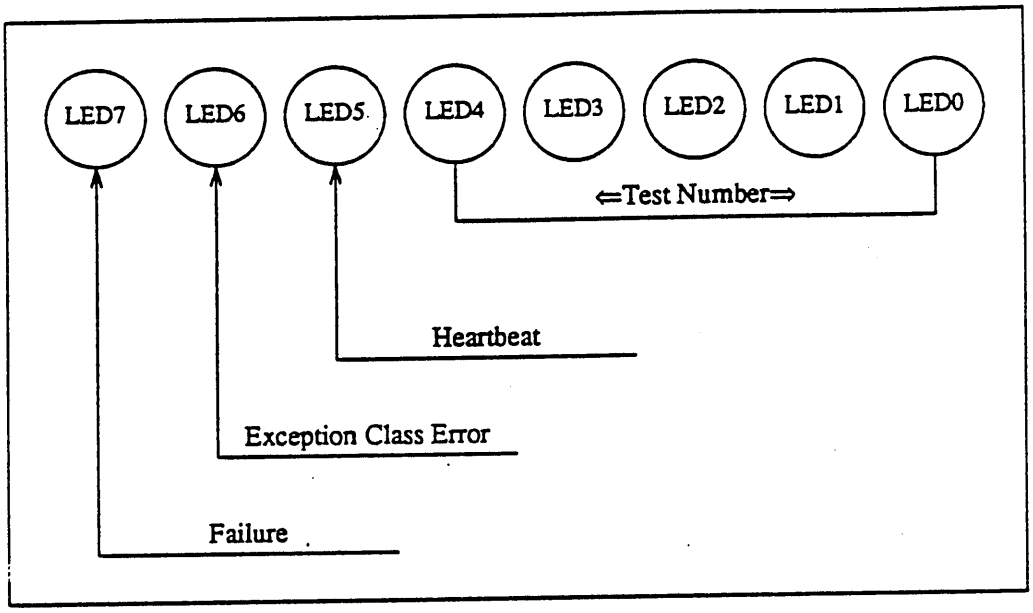
If at some point in the above sequence, the LEDs freeze (keep the same pattern for more than a couple minutes), or the sequence restarts from the beginning, there is a critical hardware problem with the workstation. The appropriate thing to do in this case is to contact Sun Microsystems Field Service or your local Field Service organization. Copy down the pattern of lights (as well as you can, if it is repeating over and over); they contain important diagnostic information for Field Service.

† UNIX is a trademark of AT&T Bell Laboratories.

Table 2-1 *Diagnostic LEDs*

LEDs ● = ON, ○ = OFF 7 0	*What the System is Doing When These LEDs Are Cycling*	*What Might Be Bad If This Indication Stays On And the top LED (bit 7) Lights*
● ● ● ● ● ● ● ●	A reset sets LEDs to this state	CPU or PROMs bad
○ ○ ○ ○ ○ ○ ○ ●	Test 1 checking the boot PROM	Boot PROM
○ ○ ○ ○ ○ ○ ● ○	Test 2 checking DVMA Register	CPU Board
○ ○ ○ ○ ○ ○ ● ●	Test 3 checking the Context Register	CPU Board (MMU)
○ ○ ○ ○ ○ ● ○ ○	Test 4 Segment Map RAM Rd/Wr Test	CPU Board (MMU)
○ ○ ○ ○ ○ ● ○ ●	Test 5 checking Segment Map RAM	CPU Board (MMU)
○ ○ ○ ○ ○ ● ● ○	Test 6 checking Page Map RAM	CPU Board (MMU)
○ ○ ○ ○ ○ ● ● ●	Test 7 checks memory data path	CPU or Exp. Board
○ ○ ○ ○ ● ○ ○ ○	Test 8 checks bus error detection	CPU Board
○ ○ ○ ○ ● ○ ○ ●	Test 9 checks interrupt capabilities	CPU Board
○ ○ ○ ○ ● ○ ● ○	Test 10 checking MMU read access	CPU Board
○ ○ ○ ○ ● ○ ● ●	Test 11 checking MMU write access	CPU Board
○ ○ ○ ○ ● ● ○ ○	Test 12 writing to invalid page	CPU Board
○ ○ ○ ○ ● ● ○ ●	Test 13 tries to write to protected page	CPU Board
○ ○ ○ ○ ● ● ● ○	Test 14 performs parity error check	CPU Board
○ ○ ○ ○ ● ● ● ●	Test 15 performs parity error check	CPU Board
○ ○ ○ ● ○ ○ ○ ○	Test 16 performs memory tests	CPU or Memory Exp. Board
● ○ ○ ○ ○ ○ ○ ○	Self-Tests have found an error	CPU or Memory Exp. Board
○ ● ○ ○ ○ ○ ○ ○	An Exception Class error was found	CPU Board
○ ○ ● ○ ○ ○ ○ ○	Self-Test done, UNIX in boot-state (LED is blinking)	CPU Board
○ ○ ○ ○ ○ ○ ○ ○	"Walking Ones" pattern	UNIX running okay

Figure 2-12 *What the Diagnostic LEDs Mean*



1. If the LED in bit position 7 lights up during self-test, it indicates a failure. The exact test that failed is indicated by LEDs 0 through 4, which can be decoded by the "Diagnostic LEDs" table above.
2. If the LED in bit position 6 lights up during the self-test, it indicates the failure is an exception class failure — bus error trap, address error trap, unexpected interrupt, etc.
3. LED 5 is the heartbeat LED. It will start blinking after the conclusion of self-test and before the execution of UNIX to indicate that the CPU is actually executing code and not hung somewhere.
4. LEDs 0-4 indicate the exact test being undertaken during self-test. If LED 7 is not lit, then the tests are proceeding without error; if LED 7 lights up, then LEDs 0-4 will freeze, indicating which test failed. Refer to the table above, if necessary.

If all 8 LEDs are lighting up in sequence from 0 to 7 then back to 0 again, it means that you have exited self-test and UNIX is running successfully.

2.8. Accessing the EEPROM

The 2060 CPU board has an EEPROM that can be accessed through the boot PROM monitor. You must first enter the monitor program by pressing the L1 key (upper left-hand corner of the keyboard) and the A simultaneously. This will abort your present session and put you in the monitor program. The monitor displays as its characteristic prompt the "greater than" symbol:

```
>
```

To access the EEPROM now, type the letter Q, followed by the EEPROM address which you want to examine or modify. Thus, if the location you want to access is hexadecimal address B8 (0xB8), you would type:

```
>Q B8
```

and press the return key. The system will then display the contents (a single byte) of address B8 in the EEPROM, which is part of the the data test pattern for the EEPROM data lines.

```
>EEPROM 0B8: AA
```

To update the contents of this location, merely enter the new information followed by a carriage return. This will write the new value to address 0xB8 — and then automatically allow you to access the next address.

Let's say you want to replace the value 0xAA with the value 0x66:

```
>EEPROM 0B8: AA 66 <return>
```

The address counter will now automatically increment and you will now be in the next location. If you want to terminate this process press the space bar (or any non-hexadecimal character), followed by a carriage return.

```
>EEPROM 0B8: <space> <return>
```

Setting Your Primary Terminal

You can use different terminals with your Sun-3/160:

- a monochrome terminal, hooked to the video output of the CPU board;
- a color terminal, hooked to the video output of the Color board;
- either one or two ASCII terminals, connected to the serial port(s) — port A and port B — of the CPU board.

You must let the processor know which terminal you consider to be your "primary" terminal — the terminal over which you and the processor will communicate.

You set a byte in the EEPROM to select your primary terminal: either serial port A, serial port B, color monitor, or monochrome monitor.

Location of the byte which sets your primary terminal is 0x00001F. Terminal values are:

```
0x00 = monochrome monitor
0x10 = serial port A
0x11 = serial port B
0x12 = color monitor

Also, any other value selects the monochrome monitor.
```

Let's say you want to set your primary terminal to be the color monitor. You would access EEPROM location 0x00001F, and then enter the value which

identifies the color monitor — 0x12.

First, access location 0x00001F.

```
>Q 1F <return>
```

This puts you at EEPROM location 0x00001F. The value presently at this location will be displayed (we'll say it's 0x10, for serial port A).

```
>EEPROM 01F:  10
```

Enter the value for the color monitor — 0x12 — and then press the space and return keys, to escape.

```
>EEPROM 01F:  12 <space> <return>
```

Setting Your Screen Size

The default (standard) screen size is 1152 by 900 pixels. Location 0x16 in the EEPROM handles special screen sizes, such as 1000 by 1000 (1Kx1K). Screen size values are:

```
0x12 = 1Kx1K
0x00 = 1152x900
```

However before you can complete your screen size change, you must replace the PROMs you are using with new vertical and horizontal timing PROMs. This must be done by Sun field service.

2.9. Asynchronous Serial Ports

You may attach modems, printers, plotters, or other serial devices which use the RS-232-C or RS-423 interface, to the serial port connectors labeled SERIAL PORT A, and SERIAL PORT B, on the enclosure backpanel.

Each Sun-3/160 serial port provides a 25-pin connector (DB-25) compatible with RS-232-C equipment. All signals in our connector are semantically the same as their RS-232-C counterparts. However the Sun-3/160 uses improved electrical circuits which, while working with RS-232-C devices, are also compatible with the newer RS-423 standard.

The serial ports on the Sun-3/160 were designed for connecting to peripherals such as printers and plotters, and can drive these output lines at speeds up to 19.2 kilobaud; input lines may be driven to 9.6 kilobaud.

All ports provide DTR, RTS, and clock signals, and receive DSR, CTS, and DCD signals. All ports are wired as Data Terminal Equipment (DTE) ports (which means Transmit Data from the workstation is on pin 2 and Receive Data from the peripheral is on pin 3), and thus allow direct connection of Data Communications Equipment (DCE) such as modems. Computers, terminals, printers, and other DTE devices can also be connected directly to the serial ports by using the null modem cable available from Sun, part number 530-1056. For further information refer to *System Interface Manual for the Sun Workstation*, part number 800-1173, section ZS(4S), which discusses the Zilog serial interface.

Signals carried on the SERIAL PORT A, and SERIAL PORT B, connectors are listed in the appendix.

NOTE *The following sections — which describe connecting modems, terminals, and printers to the serial ports — are guidelines only, and specific devices may require more detailed information such as that contained in the System Interface manual.*

Connecting a Modem to the Sun-3/160

The serial ports are wired as DTEs, and most modems are wired as DCEs. The cable connecting your modem to the Sun-3/160 should be "straight through" — the signals on pins 2, 3, 4, 5, 6, 7, 8, and 20 at the output of the cable should be the same as those signals on corresponding pins of the serial port. Do *not* use a null modem cable to connect the serial port to your modem. It does not matter which serial port you connect to; both are identical.

Refer to the manual which comes with your modem to see which signals you will need for proper operation of your modem. Refer also to *System Administration for the Sun Workstation*, part number 800-1150, and *Installing UNIX on the Sun Workstation*, part number 800-1158, which detail connecting to a modem.

Connecting a Terminal to the Sun-3/160

The serial ports are wired as DTEs. Most terminals are wired as DTEs too. To connect a terminal to a serial port you must first make certain that the terminal you are using accepts the RS-232-C or RS-423 protocol. If it does, you may then connect the terminal to either serial port with a null modem cable, Sun part number 530-1056. In the null modem cable, pins

2 and 3 are crossed

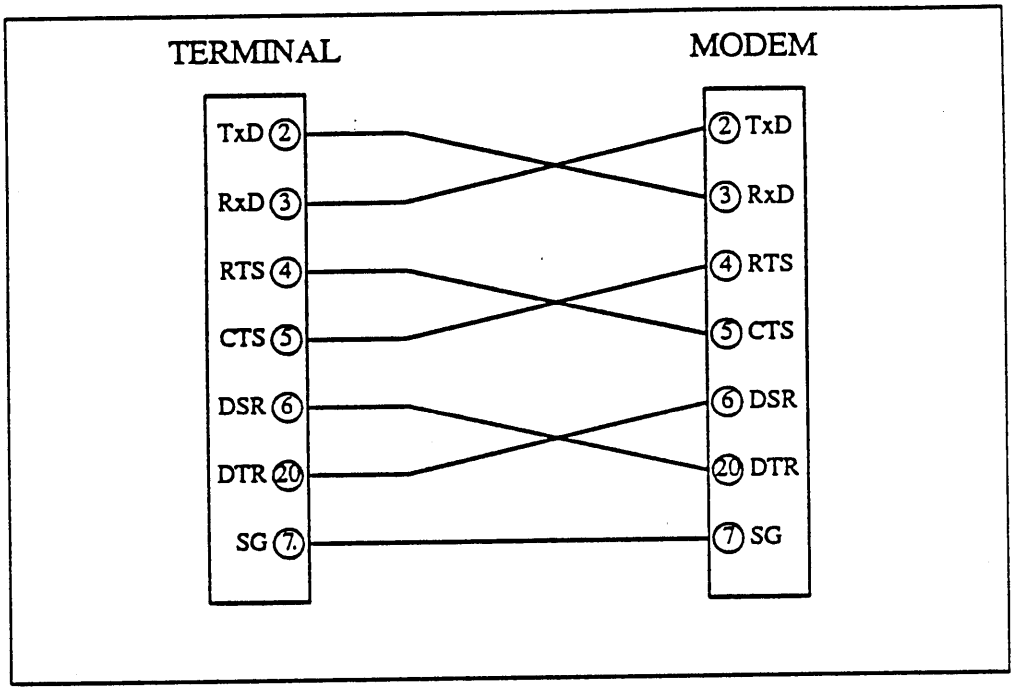
4 and 5 are crossed

6 and 20 are crossed

and pin 7 is wired straight through.

"Pins 2 and 3 crossed" means that the signal entering the cable on pin 2 emerges on pin 3, and vice versa (see the figure below). The connector on the left is the Serial I/O Port on the CPU board; the connector on the right is the terminal (DTE).

Figure 2-13 *Null Modem Cable Pin Arrangement*



Refer to the manual that comes with your terminal to make certain that the signals needed to operate the terminal are provided at the correct pins of the serial port. Refer also to *System Administration for the Sun Workstation*, part number 800-1150, and *Installing UNIX on the Sun Workstation*, part number 800-1158, which detail connecting to a terminal.

Connecting a Printer to the Sun-3/160

The serial ports are wired as DTEs. Most printers are wired as DTEs too. To connect a printer to a serial port you must first make certain that the printer you are using has a DB-25 connector and uses the RS-232-C standard. Most serial printers do. However it should be noted that you **can not** connect a parallel interface printer to a Sun-3/160 unless you also use a serial-to-parallel converter. After determining that you have a serial interface printer (or a parallel interface printer with a serial-to-parallel converter), connect the printer to either serial port with a null modem cable, Sun part number 530-1056. In the null modem cable, pins

2 and 3 are crossed

4 and 5 are crossed

6 and 20 are crossed

and pin 7 is wired straight through.

"Pins 2 and 3 crossed" means that the signal entering the cable on pin 2 emerges on pin 3, and vice versa (see the figure above).

Refer to the manual that comes with your printer to make certain that the signals needed to operate the printer are provided at the correct pins of the serial port. Refer also to *System Administration for the Sun Workstation*, part number 800-1150, and *Installing UNIX on the Sun Workstation*, part number 800-1158, which detail connecting to a printer.

2.10. Connecting the Sun-3/160 to the Ethernet

If you ordered the Ethernet kit, you will find included in the box with the manuals and cables the Ethernet transceiver and transceiver cable (see the following figure, "Linking Up to an Ethernet"). The coaxial cable and terminators necessary to connect multiple machines to a network may be purchased separately from Sun.

CAUTION **Before going on, make certain that J2503 on the CPU board is properly jumpered. If you are using a Level 1 Ethernet transceiver, the jumper must be IN. If you are using a Level 2 Ethernet transceiver, then the jumper must be OUT. If J2503 is incorrectly jumpered, you could damage your Ethernet transceiver (more information on J2503 is contained below).**

Setting up an Ethernet with all Sun-supplied components is fairly straightforward:

1. Screw the 50 ohm coaxial cable into one of the transceiver N connectors (an N connector is a round, screw-on connector).
2. Each end of the coaxial cable must have a 50 ohm terminator attached. This may be done either by attaching the 50 ohm terminator
   - to the transceiver's vacant N connector, or to
   - the end of the coaxial cable, using a barrel connector. (A barrel connector is a double N connector.)

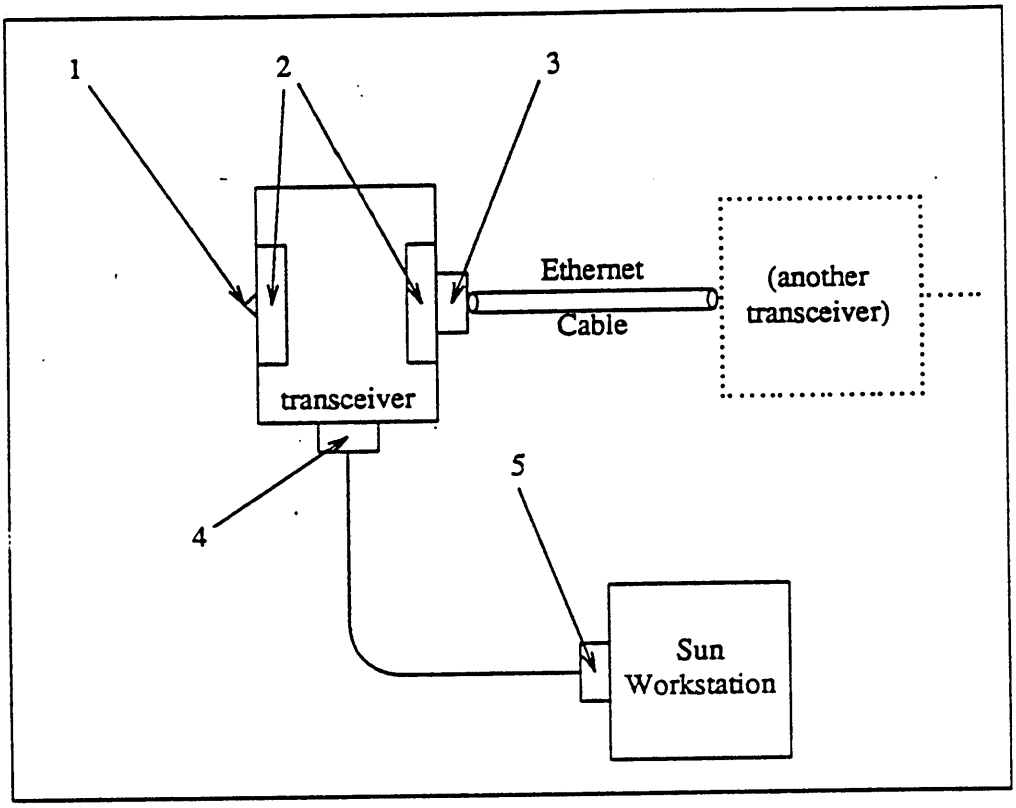
CAUTION **Handle the coaxial cable with some care, as it is fragile; don't install it in an area where it may be run over or stepped on.**

3. For each workstation, plug the female end of the workstation's transceiver cable into the 15-pin D connector on the transceiver, and the male end of the workstation's transceiver cable into the "ETHERNET" connector on the workstation's backpanel.
4. Finally, J2503 on the 2060 CPU board must be set for either a Level 1 or Level 2 Ethernet transceiver. For Level 1 transceiver (which is the way the board arrives from the factory) J2503 will have its jumper in. Examples of Level 1 transceivers are the TCL 2010E, 3COM 3C100, and the Interlan NT10. If you are using a Level 2 Ethernet transceiver, J2503 must not have a jumper. Examples of a Level 2 transceiver are the TCL 2010I, 3COM 3C101, 3C102, BICC 1110, and multiplexer boxes such as Digital Equipment Corporation's DELNI.

NOTE *While these transceivers are compatible with Sun equipment, it should be understood that Sun does not guarantee the performance of any component not purchased from Sun.*

Figure 2-14 *Linking Up to an Ethernet*

Key	*Description*
1	Terminator
2	Female N connector to transceiver
3	Male N connector to transceiver
4	Ethernet transceiver D connector
5	Sun-2 to Ethernet D connector



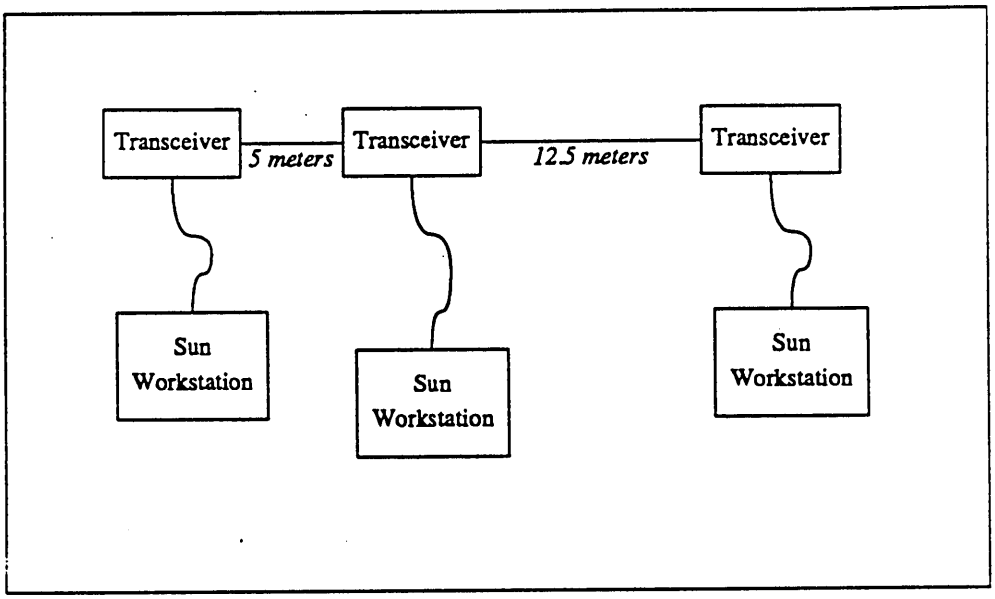
Please note that there are certain cabling limitations which must be observed for proper Ethernet implementation:

Table 2-2 *Ethernet Cabling Limitations*

MAXIMUM contiguous length of coaxial cable segments	500.0 meters
*Distance between transceivers**	2.5 meter multiples*
MAXIMUM length of transceiver cable	50.0 meters

*Transceivers must be placed at 2.5 meter intervals along the coaxial cable. That is, you could connect transceivers 2.5 meters apart, but not 2.0 meters; you could connect transceivers 7.5 meters apart, but not 7.0 meters (see figure below).

Figure 2-15 *Ethernet Cabling Lengths*



Transceivers are connected to the Ethernet by female N connector (on the transceiver) to male N connector (on the Ethernet cable).

If you buy Ethernet cable in bulk, the cable must be marked every 2.5 meters. Make certain you attach each transceiver on a mark, and also make certain to cut the cable ends on marks.

2.11. Degaussing the Color Monitor

During shipment, metal portions of the color monitor chassis can build up magnetic fields which interfere with the correct operation of the monitor. (A symptom of this interference is color distortion. Whenever this distortion cannot be corrected by adjusting controls, you should try degaussing.)

These magnetic fields can be neutralized by using both the external degaussing coil and the internal degaussing circuitry. The internal degaussing circuitry is inside the color monitor; the external degaussing coil comes shipped separately with the monitor. The area around the coil itself is what does the demagnetizing; the area in the center of the coil does not do anything. External degaussing is done with the monitor turned OFF, internal degaussing is done with the monitor ON.

CAUTION **The degaussing coil will demagnetize EVERYTHING. Before plugging the degaussing coil in, make certain that ALL TEST EQUIPMENT AND MAGNETIC MEDIA (tapes, disk drives) are at least five feet from the coil, otherwise you will erase your media!**

1. Remove the degaussing coil from its container. Before plugging it in make doubly certain that

- all magnetic peripherals and test equipment are AT LEAST FIVE FEET away from the coil, and
- the coil is AT LEAST SIX FEET from the monitor.

2. Remember, it is the coil itself which does the demagnetizing; the area in the center of the coil does not do anything. All available sides, the rear, and the front of the monitor will have to be degaussed.
3. Hold the coil perpendicular to the monitor. With the coil at least six feet from the monitor, plug the coil in and press the coil switch. Do not leave the coil on for more than ten minutes at a time.
4. With the power on, turn the coil parallel to the screen of the monitor. Then bring the coil to within three inches of the screen.
5. With the coil held parallel about three inches from the the surface of the screen, move the coil in short circular motions over the screen. Do this for one to two minutes. DO NOT RELEASE THE SWITCH OR PULL THE PLUG!
6. Move to the sides of the monitor. Move the coil in short circular motions over each surface — sides, top, and rear. Do this for one to two minutes per surface. Finally, degauss the screen of the monitor again.
7. When you have degaussed the monitor, keep the coil parallel to the screen and slowly move the coil away from the monitor. When you are six feet away, turn the coil perpendicular to the screen and release the switch or pull the plug.
8. If the color distortion persists, the monitor may need to be internally degaussed. There is a button on the back of the monitor which says "DEGAUSSING." Turn the power to the monitor ON and press the "DEGAUSSING" button. Hold it in for ten to fifteen seconds until the color distortion disappears.

If neither the external nor the internal degaussing corrects the color distortion, notify your Sun service representative.

3

Basic Hardware Configuration and Options

Basic Hardware Configuration and Options

This chapter describes the basic Sun-3/160, along with options available. For details on how to configure your system or add options, see the following chapter.

3.1. Basic Sun-3/160

The basic Sun-3/160 has

- Color or monochrome monitor — 19-inch, 66.6 Hz non-interlaced display with antiglare coating (standard on color and optional on monochrome display)
- Keyboard and mouse
- Pedestal — which will hold up to twelve Eurocard-format (triple-high VME) printed circuit boards
- CPU board
- Color Video board (with Sun-3/160C).

3.2. Standard Configuration

Sun-3/160 CPU Board

The 2060 CPU (Central Processing Unit) board is installed in the first slot of the Sun-3/160. The CPU board contains the 68020 CPU, a minimum of two megabytes of memory, I/O connections, monochrome display controller, and Ethernet controller. Three jacks connect the 2060 board to the backplane inside the Sun-3/160 pedestal, and five I/O connectors are at the opposite end of the board.

In sequence, as the I/O connectors are aligned on the board, they are:

Table 3-1 *I/O Connectors on the CPU Card*

Connector Name
Ethernet
Video
Keyboard (including Mouse)
Serial Port A
Serial Port B

Pinouts of all the connectors are listed in Appendix A.

3.3. Options for the Sun-3/160

The 2060 CPU board supplies a minimum of two megabytes and a maximum of four megabytes of main memory for the Sun-3/160; additional memory is provided by the 2061 Expansion card(s). Each Expansion card contains up to 144 memory chips, in several optional configurations:

Table 3-2 *System Memory — Basic and Optional Configurations*

Option Number	*Memory on Card*
Sun-3/160 - 2	2 Mbytes (on CPU board)
Sun-3/160 - 4	4 Mbytes (on CPU board)
Sun-3/160 - 102	2 Mbytes (on Expansion board)
Sun-3/160 - 104	4 Mbytes (on Expansion board)

A maximum of 16 Mbytes — three expansion cards of 4 Mbytes each and 4 Mbytes on the CPU card — are allowed.

Other options to the Sun-3/160 include:

- Option 160: VME-to-VME Adapter board — provides interface for standard (double-width, single height) VME boards to the Sun-3/160 backplane
- Option 170: Multibus-to-VME Adapter board
- Option 501: 85 Mbyte unformatted (71 Mbyte formatted) hard disk
- Option 502: 170 Mbyte unformatted (142 Mbyte formatted) disk subsystem
- Option 601: 168 Mbyte unformatted (130 Mbyte formatted) disk subsystem
- Option 602: 336 Mbyte unformatted (260 Mbyte formatted) disk subsystem
- Option 620: 474 Mbyte unformatted (380 Mbyte formatted) disk subsystem

- Option 650: ¼ inch cartridge tape subsystem — backup option for the 260 and 380 Mbyte hard disks
- Option 670: ½ inch tape drive subsystem — backup option for the disk subsystems.

Sun-3 Color Board

The Sun-3 Color Video board provides the capability of upgrading the monochrome Sun-3/160M into a color workstation — the Sun-3/160C Color SunStation™. The Color Video board goes in slot 8, although it can actually be placed in any unoccupied slot.

The Sun-3 Color board incorporates:

- 1152 by 900 pixel resolution bit-mapped color graphics
- 8 color planes, allowing 256 different colors to be displayed simultaneously from a palette of over 16 million
- Performance enhancement via 8 custom VLSI RasterOp processors.

2061 Expansion Board

The 2061 Expansion board (if used) resides in slot 2 of the Sun-3/160, next to the CPU board, because the two boards must share a common memory (P2) bus. Additional Expansion boards can be added to slots 3 and 4.

When used with the 2061 Expansion board, the 2060 CPU board supplies two or four megabytes of main memory for the Sun-3/160; additional memory must be provided by the Expansion card. Each Expansion card can contain up to 144 memory chips, in several optional configurations:

Table 3-3 *Expansion Memory — Basic and Optional Configurations*

Option Number	*Expansion Memory*
Option 102	2 Mbytes Expansion Memory
Option 104	4 Mbytes Expansion Memory

Graphics Processor and Graphics Buffer Boards

The Graphics Processor and optional Graphics Buffer board(s) can be used in the Sun-3/160C to increase graphics performance. The Graphics Processor normally goes in slot 10 of the Sun-3/160C, and the Graphics Buffer in slot 11.

Multibus-to-VME Adapter Board

A Multibus Adapter card is available to provide mechanical and electrical interface between the Sun-3/160 VME backplane and Multibus (IEEE-796) boards supplied by Sun. This adapter board can go in slot 7, 8, or 9 — whichever is free. The customer must perform integration and testing for any boards not supplied by Sun.

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

A VME-to-VME Adapter board is available to interface standard double-width single-height VME cards with the Sun-3/160 Eurocard-format (triple height) backplane. The VME(2)-to-VME(3) adapter board is used with the Sun-supplied SCSI board, which goes in slot 7.

SCSI Board

A SCSI controller board can be mounted on a VME(2)-VME(3) adapter board and plugged into slot 7 of the Sun-3/160 backplane. A cable running from the P2 jack of slot 7 connects the SCSI controller to the SCSI disk.

4

How to Configure Your Sun-3/160

How to Configure Your Sun-3/160

In general, the Sun-3/160 is shipped with its board(s) already installed. However, if you are upgrading a Sun-3/160, you can use this section to determine how to install the boards, how to set the switches for them, and what the correct jumper settings are.

CAUTION

- **Turn off the power and disconnect the power cord before inserting or removing any boards.**
- **Some of the devices on the Sun-3/160 boards are very sensitive to electro-static discharge. Extreme care must be used when handling any of the boards.**

4.1. VME System Backplane and P2 Connectors

The VME backplane is a single, large printed circuit board covering the P1, P2 and P3 buses. The backplane has three 96-pin connectors per slot which are aligned vertically and labeled P1, P2, and P3. Each connector has three rows of pins (A, B, and C) with each row of pins serving a different function. 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. The table below explains this.

Table 4-1 *Sun-3/160 Backplane and Buses*

Connector	Row	Function (Bus)
P1	A	VME
	B	VME
	C	VME
P2	A	"P2"
	B	VME
	C	"P2"
P3	A	Power
	B	"P2"
	C	Power

All boards are inserted or extracted from the back of the Sun-3/160. The CPU and Expansion boards must be in slots 1 to 4 (slots are numbered from left to right, when facing the rear of the pedestal). This is because the CPU and Expansion boards must share a common memory (P2) bus, available in the 1-4 slot arrangement.

NOTE *Slots 1 through 6 and slots 10, 11, and 12 share a common P2 bus; this means that you cannot plug a Multibus-to-VME adapter board (for instance) into one of these slots (1, 2, 3, 4, 5, 6, 10, 11, 12) because the CPU, Expansion boards, GP and GB boards are incompatible with the P2 signals on the Multibus-to-VME adapter board.†*

Bus priority is determined by the board's position in the card cage; a board in slot 4 has a higher bus priority than a card in slot 5. The recommended board arrangement is as follows:

Table 4-2 *Recommended Board Arrangement for the Sun-3/160*

Board name	Slot Position											
	1	2	3	4	5	6	7	8	9	10	11	12
SUN-3 CPU	A											
SUN 2nd 4 MB		A										
SUN 3rd 4 MB			A									
SUN 4th 4 MB				A								
SUN VME FPA					A							
VME SCSI Ctlr							A					
SUN GP										A		
SUN GB											A	
2nd Ethr Ctlr							A	B				
1/2-inch Tape Ctlr							A	B	C			
1st SMD Ctlr							A	B	C	D‡		
2nd SMD Ctlr								A	B	C‡	D‡	
SUN VME Color		B	C	D	E	F		A				
SUN ALM Ctlr											A‡	
SUN ALM USART												A‡
SUN SCP							A	B	C	D‡	E‡	F‡

In the table above, 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, you would move to the next recommended slot.

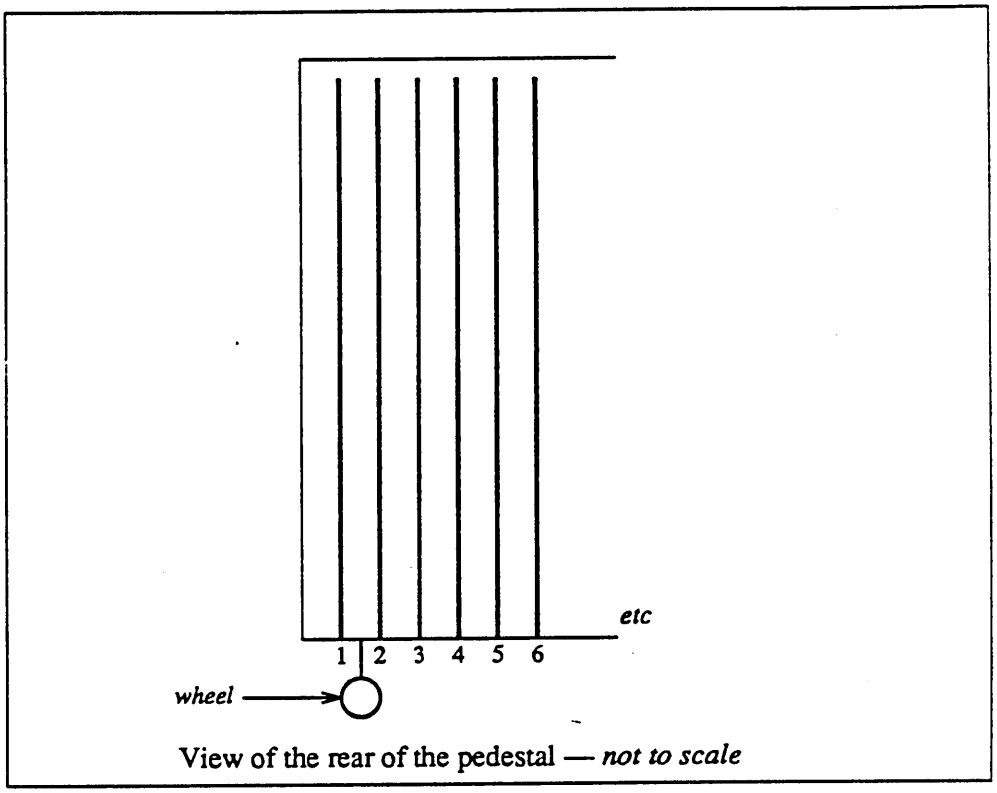
†Actually, if you use the latest rev. Multibus-to-VME adapter board (part number 501-1054-04, rev A — or later) you can plug a Multibus board into slots 10-12. 501-1054-04, rev A (or higher) adapter boards have their P2 bus disconnected, and so there are no problems with signal contention.

‡If you are using the GP and GB in slots 10, 11 or 12 and you want to use a Multibus-to-VME adapter board in one of these three slots, the adapter board MUST BE 501-1054-04, rev A (or higher), to avoid problems of signal incompatibility on the P2 bus.

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 would go in slot 8 — precedence "B."

Accordingly, if you wanted to add a 1/2-inch tape controller, and slots 7 and 8 were filled, you put the 1/2-inch tape controller in slot 9 — "C."

Figure 4-1 *How the Slots Are Numbered in the Sun-3/160 Pedestal*



View of the rear of the pedestal — *not to scale*

4.2. Unused Slots

Whenever you have a vacant slot between any two used slots, you must jumper certain pins of the vacant slot. For instance, if you have a CPU board in slot 1, an Expansion board in slot 2, and some other board in slot 4, you have to jumper certain pins in slot 3 to continue the electrical connections between slots 2 and 4. If there are two empty slots between any two used slots, **both** empty slots must be jumpered. And so on.

The signals that *always* come jumpered from the factory are:

```
P1_BG0IN to P1_BG0OUT
P1_BG1IN to P1_BG1OUT
P1_BG2IN to P1_BG2OUT
```

The signals that may or may not be jumpered are:

```
P1_IACKIN to P1_IACKOUT
P1_BG3IN to P1_BG3OUT
```

The following table tells you which jumpers must be in for which boards.

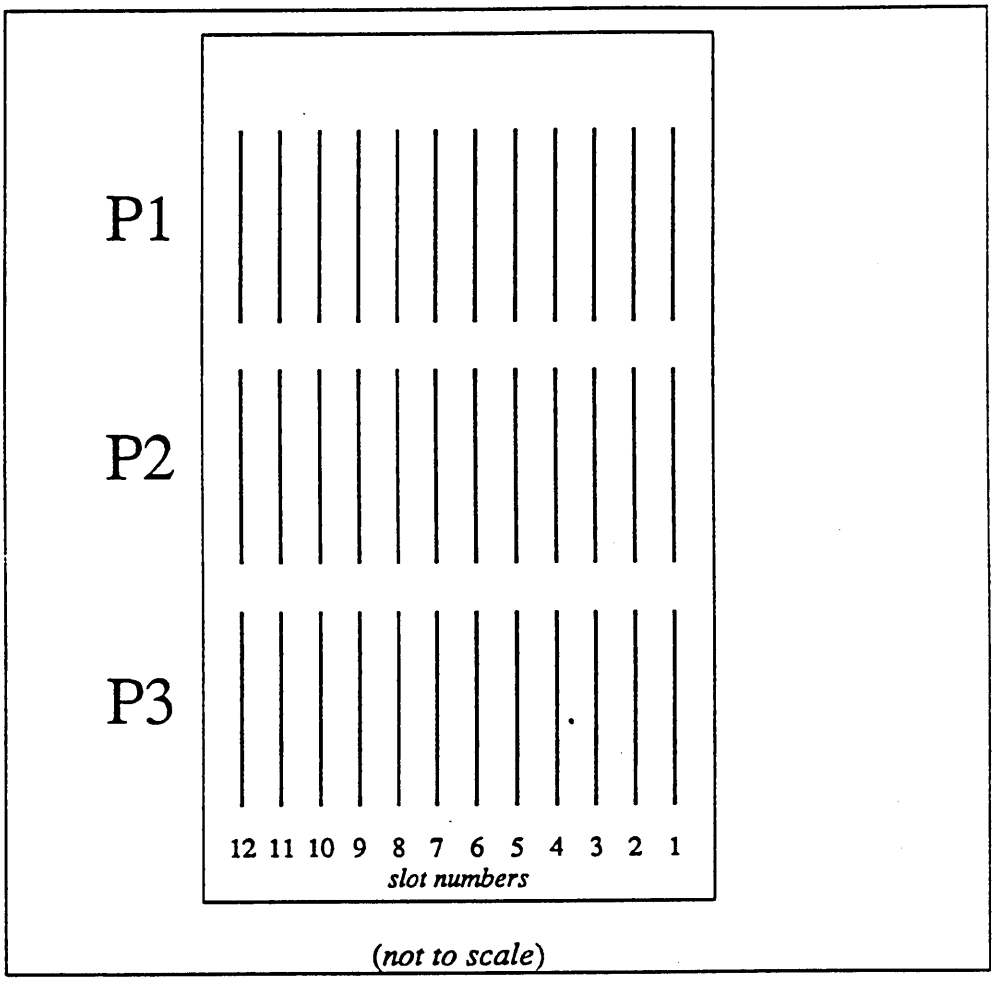
Table 4-3 *Jumpering for BUS GRANT and INTERRUPT ACKNOWLEDGE on the Backplane*

Jumper IN or OUT		
Jumper Jx03 Bus Grant	**Jumper Jx04 Interrupt Acknowdge**	**Board**
OUT	OUT	SUN-3 CPU
IN	IN	SUN 2nd 4 MB
IN	IN	SUN 3rd 4 MB
IN	IN	SUN 4th 4 MB
IN	IN	SUN VME FPA
OUT	OUT	VME SCSI Ctlr
OUT	OUT	SUN GP
IN	IN	SUN GB
OUT	OUT	2nd Ethr Ctlr
OUT	OUT	1/2" Tape Ctlr
OUT	OUT	1st SMD Ctlr
OUT	OUT	2nd SMD Ctlr
IN	OUT	SUN VME Color
OUT	OUT	SUN ALM Ctlr

To jumper these signals, you must:

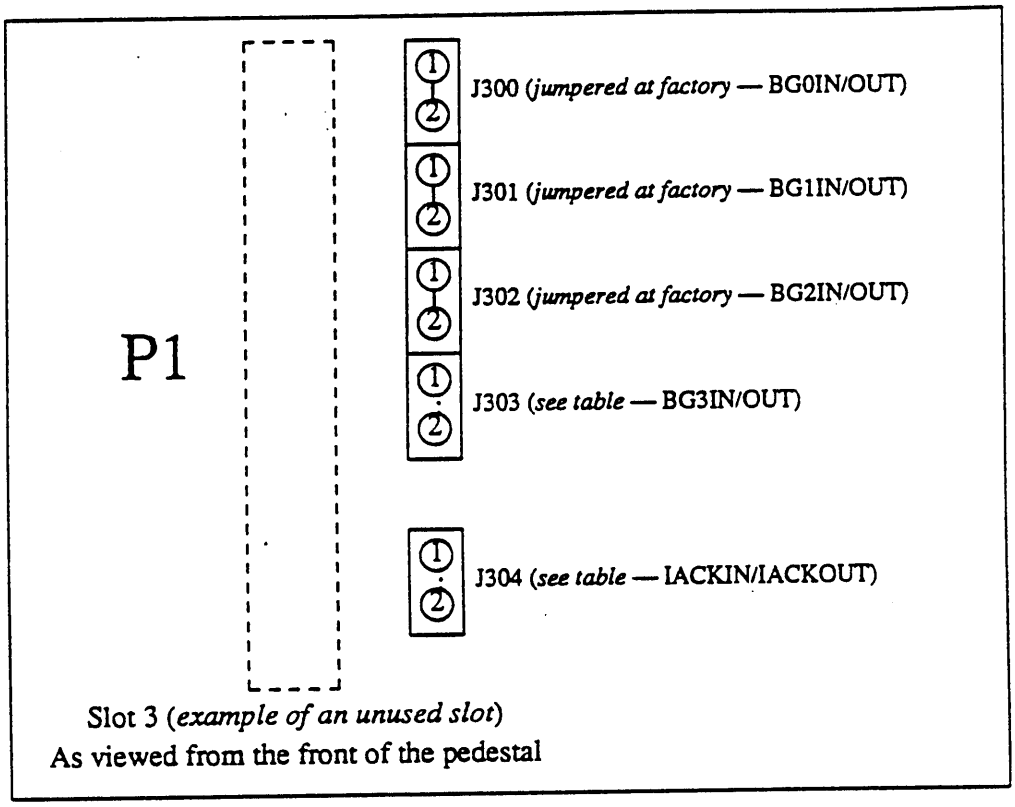
1. Open the front of the pedestal. Do this by removing the plastic bezel, (grab it around the edges and tug — it should pop right off), removing the four screws around the edges of the front cover, then swinging this front down until it is supported by the two cables.
2. Inside the pedestal will now be visible the back-side of the backplane — the side of the backplane opposite the P connectors.
3. The three P connectors are aligned vertically with P1 at the top and P3 at the bottom (see the figure below).

Figure 4-2 *Slot Numbering and P Connectors — As Seen From the Front of Pedestal*



4. From the front of the pedestal, the slot numbering flows from right to left; slot 1 is furthest to your right, slot 12 furthest to your left. Find the vacant slot which you are going to have to jumper (in our example, slot 3).

Figure 4-3 *Jumpering the Empty Slot Between Two Filled Slots*



5. Notice that all the P1 connectors have five two-pin jumper blocks coming out this side of the backplane. Each two-pin jumper block is labelled "J-" something, and represents a pair of signals. In our example, (using slot 3 as the empty slot), the jumper blocks would be numbered J300 through J304. As the backplane comes from the factory, Pin 1 is jumpered to pin 2 in the top three jumper blocks, J300, J301 and J302. The bottom two jumper blocks, J303 and J304, may or may not be jumpered (see the table above).†

   - J300 (BG0IN/OUT) — is jumpered as it comes from the factory.
   - J301 (BG1IN/OUT) — is jumpered as it comes from the factory.
   - J302 (BG2IN/OUT) — is jumpered as it comes from the factory.
   - J303 — may or may not be jumpered: pin 1 to pin 2 connects BG3IN to BG3OUT
   - J304 — may or may not be jumpered: pin 1 to pin 2 connects IACKIN to IACKOUT

†Of course, if the empty slot was slot 5, the jumper block numbers would be J500 through J504, and J503 and J504 would have to be jumpered.

As shipped from the factory, the BG3IN/BG3OUT and IACKIN/IACKOUT are normally jumpered for all unoccupied slots on the backplane.

4.3. 2060 CPU Board

The CPU board goes in slot 1 of the backplane.

The following table lists the way factory jumpers are set on the 2060 board when you receive it from Sun. For instance, this table says that the board arrives with a jumper connecting pin 3 to pin 4 on J300; but pin 1 is *not* jumpered to pin 2. Use this table as a reference to make certain that your board is correctly configured.

Table 4-4 *CPU Board Jumpers*

Jumper Block No.	*Pins*	*Location*	*Jumper In?*	*Purpose*
J2502	1-2	A-3	Yes	Enable VME Clock
J1200	1-2	A-3	No	For 27256 Boot PROM
J1201	1-2	A-3	Yes	For 27512 Boot PROM
J2501	1-2	B-6.5	Yes	Enable Ethernet Clock
J2301	1-2	B-21	Yes	Enable Video Clock
J1001	1-2	E-32	Yes	Enable SCC Clock
J3102	1-2	K-11	Yes, for ⇒	4 Mbyte CPU board
J3101	1-2	K-11	Yes, for ⇒	2 Mbyte CPU board
J100	1-2	K-11	No	Cache Disable
J2505	1-2	K-11	†No, for ⇒	Level 2 Etnernet
J400	1-2	N-11	Yes	Select 16.67MHz CPU Clock
J400	3-4	N-11	No	Select 12.5MHz CPU Clock
J400	5-6	N-11	Yes	Select Asynch. 12.5MHz FPP Clock
J400	7-8	N-11	No	Select Synch. 16.67MHz FPP Clock
J300	1-2	R-5	No	Null
J300	3-4	R-5	Yes	VME Interrupt Level 1
J300	5-6	R-5	Yes	VME Interrupt Level 2
J300	7-8	R-5	Yes	VME Interrupt Level 3
J300	9-10	R-5	Yes	VME Interrupt Level 4
J300	11-12	R-5	Yes	VME Interrupt Level 5
J300	13-14	R-5	Yes	VME Interrupt Level 6
J300	15-16	R-5	Yes	VME Interrupt Level 7
J2703	1-2	R-12	Yes	CPU is VME Reset Master
J2702	1-2	R-12	No	CPU is VME Reset Slave
J2701	1-2	R-12	Yes	CPU is VME Arbiter & Requester
J2700	1-2	R-12	No	CPU is VME Requester Only

† This jumper is IN for Type 1 Ethernet

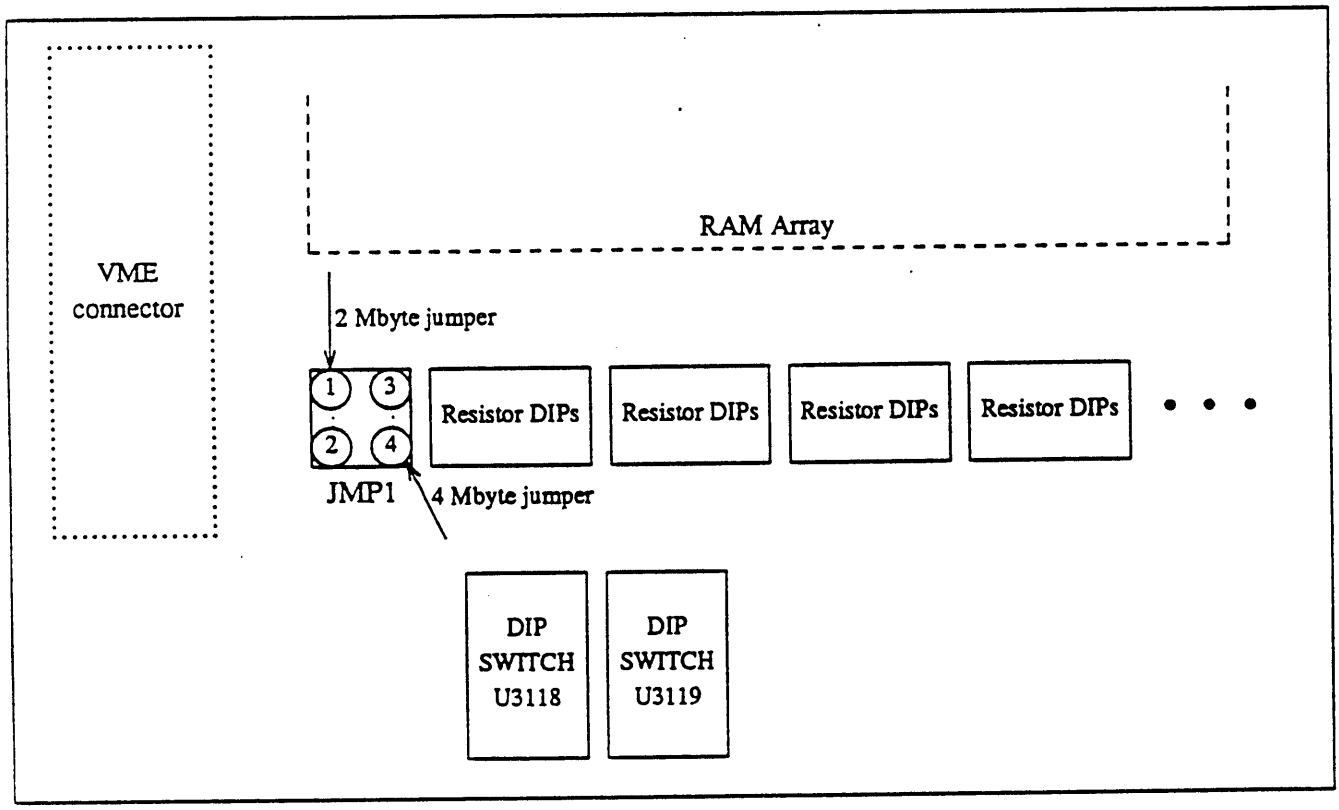
4.4. 2061 Expansion Board

Each 2061 Expansion board arrives from the factory with its jumper blocks correctly set for your particular configuration. If you are using a single 2061 Expansion board, it goes in slot 2.

If you are using more than one Expansion board, each successive board goes in the slot to the right of the last — for instance, the second Expansion board would go in slot 3, and the third in slot 4.

A jumper selects between 2 and 4 Mbytes on the expansion board. The figure below shows the location of the jumper for either configuration. Pins 1 and 2 are jumpered for 2 Mbyte Expansion board (and pins 3-4 remain unjumpered); pins 3 and 4 are jumpered for the 4 Mbyte Expansion board (with pins 1-2 remaining unjumpered).

Table 4-5 *Expansion Board Jumpers*



There are two DIP switches on the Expansion board, and either one or two PALs, depending on the amount of memory you have on the board.

- 2 Mbyte expansion memory has PAL U3100 stuffed, and
- 4 Mbyte expansion memory has PAL U3100 and U3102 stuffed.

The DIP switches are set at the factory, and their settings depend upon the amount of memory you have on your CPU board. The two DIP switches are located at U3118 and U3119, each one selects a 2 Mbyte address space. If you

have a 2 Mbyte Expansion board, then only U3118 is used. A 4 Mbyte Expansion board uses both U3118 and U3119. DIP switch settings for different Expansion board configurations are given in the two tables below.

Table 4-6 *Expansion Board DIP Switch Settings*

2 Mbyte Expansion Board	
Mbytes Selected	*DIP Switch U3118 Switch Position*
1 and 2	turn section 1 on†
3 and 4	turn section 2 on‡
5 and 6	turn section 3 on
7 and 8	turn section 4 on
9 and 10	turn section 4 on
11 and 12	turn section 4 on
13 and 14	turn section 4 on
15 and 16	turn section 4 on

4 Mbyte Expansion Board		
Mbytes Selected	*DIP Switch U3118 Switch Position*	*DIP Switch U3119 Switch Position*
1 to 4	turn section 1 on†	turn section 2 on‡
3 to 6	turn section 2 on	turn section 3 on
5 to 8	turn section 3 on	turn section 4 on
7 to 10	turn section 4 on	turn section 5 on
9 to 12	turn section 5 on	turn section 6 on
11 to 14	turn section 6 on	turn section 7 on
13 to 16	turn section 7 on	turn section 8 on

The size of memory on the Expansion board is decoded at boot time.

4.5. Color Video Board

The Color Video board goes in slot 8, although it can actually be placed in any unused slot. The Color board occupies a 4 Mbyte address space.

CAUTION **On the Color board is a 5.2V reference voltage potentiometer that is not user-adjustable. DO NOT ATTEMPT TO ADJUST IT!**

The Color Video board jumpers are described in the following table. Those jumpers placed IN at the factory are indicated by an asterisk (*). In our case, only the J1700 clock jumper is placed IN at the factory.

†Not used, first two Mbytes (at least) are resident on CPU board.
‡This setting is only used if the CPU board has two Mbytes.

Table 4-7 *Color Board Jumpers*

Jumper Block Number	*Pins*	*Description*
J100	1-2	Base Address Decode
J100	3-4	Base Address Decode
J200	1-2	Sense Bit 0
J200	3-4	Sense Bit 1
J200	5-6	Sense Bit 2
J200	7-8	Sense Bit 3
*J1700	1-2	Enable/Disable Clock

J100 comes from the factory set for base address of 0x400000, which means that all pins (pins 1-4) are unjumpered. Other possible base address settings are described in the table below:

Table 4-8 *Base Address Settings for the Color Board*

Base address you want	*Jumper setting*
0x000000	connect pin 1 to pin 2
0x400000	don't connect any pins
0x800000	connect pin 1 to pin 2 and cut the trace between pins 3 and 4
0xC00000	don't connect any pins cut the trace between pins 3 and 4

4.6. Installing the SCSI Board

The SCSI disk controller board goes in a VME(2)-to-VME(3) adapter board, and the adapter board goes into slot 7 of the Sun-3/160. On the opposite side of the backplane, the SCSI cable plugs into a P2 connector at slot 7, and runs from this P2 position up to the SCSI disk.

Following is a table outlining jumpers on the SCSI board and the way the jumpers are configured at the factory. Jumpers which have an asterisk by them are placed IN at the factory; all the rest are not jumpered.

Table 4-9 *SCSI Board Jumpers*

Jumper Block Number	*Pins*	*Description*
J500	1-2	P1 Bus Grant 0 In
J500	3-4	P1 Bus Grant 1 In
J500	5-6	P1 Bus Grant 2 In
*J500	7-8	P1 Bus Grant 3 In
J501	1-2	P1 Bus Req 0
J501	3-4	P1 Bus Req 1
J501	5-6	P1 Bus Req 2
*J501	7-8	P1 Bus Req 3
J502	1-2	P1 Bus Grant 0 Out
J502	3-4	P1 Bus Grant 1 Out
J502	5-6	P1 Bus Grant 2 Out
*J502	7-8	P1 Bus Grant 3 Out
J600	1-2	Respond Priority 0
J600	3-4	Respond Priority 1
*J600	5-6	Respond Priority 2
J600	7-8	Respond Priority 3
J600	9-10	Respond Priority 4
J600	11-12	Respond Priority 5
J600	13-14	Respond Priority 6
J600	15-16	Respond Priority 7
J601	1-2	P1 Int Req 0
J601	3-4	P1 Int Req 1
*J601	5-6	P1 Int Req 2
J601	7-8	P1 Int Req 3
J601	9-10	P1 Int Req 4
J601	11-12	P1 Int Req 5
J601	13-14	P1 Int Req 6
J601	15-16	P1 Int Req 7

4.7. How to Install the Graphics Processor/Graphics Buffer Boards

The Graphics Processor (GP) and Graphics Buffer (GB) boards only go into the Sun-3/160C:

- the GP normally goes in slot 10, although it can go in slots 11 or 12 if either are unoccupied.
- the GB normally goes in slot 11, although it can go in slot 12 if it is unoccupied.

There are two possible GP/GB configurations:

1. installing the GP only, and
2. installing both the GP and GB.

Before installing the GP and GB, each of these boards has jumpers which must be set. These jumpers can be located using the X-Y coordinate system (explained below) stencilled on the board(s).

Definition of PCB Grid Locations (X-Y Coordinate System)

Both the GP and the GB boards have grid markings which are used to define and locate components. This grid uses an X-Y coordinate system in which X is one axis and Y is orthogonal to it. Letters of the alphabet (A to Z) define the X coordinate and numbers (1 to 99) define the Y coordinate of this grid. These grid markings are clearly displayed on the perimeter of each board.

- For the GP, the X axis locations run from A to R, and the Y axis locations run from 1 to 34.
- For the GB, the X axis locations run from A to P, and the Y axis locations run from 1 to 19.

Therefore, a PCB grid location of J-4 would indicate an X location of J and a Y location of 4.

Definition of GP/GB Jumpers and DIP Switch

Jumper and DIP switch identifiers on both the GP and the GB are silkscreened on the component side of the PCB.

Graphics Processor— Jumpers and DIP Switch

The Graphics Processor has the following 18 jumpers (all are 2-pin jumpers). The test point jumpers do not need a shunt (in most cases there is a PCB trace which connects the two pins of the test point jumpers together).

Table 4-10 *Graphics Processor Jumpers—What They Mean*

Jumper	*PCB Grid Location*	*What Signal Is Present With Shunt In [Out]†*
J1	J-2	GP board ID bit 3 = 0 [1]
J2	J-2	GP board ID bit 4 = 0 [1]
J3	J-2	GP board ID bit 2 = 0 [1]
J4	J-2	GP board ID bit 5 = 0 [1]
J5	J-2	GP board ID bit 1 = 0 [1]
J6	J-2	GP board ID bit 6 = 0 [1]
J7	J-2	GP board ID bit 0 = 0 [1] (If 0 => GB is present)
J8	J-2	GP board ID bit 7 = 0 [1]
J9	P-4	Ground test point (both pins are ground)
J10	A-6	Ground test point (both pins are ground)
J11	N-10	PP halt test point (for test equipment interface)
J12	P-10	VP halt test point (for test equipment interface)
J13	N-13	Manual Reset test point
J14	N-14	Main clock connect [disconnect]
J15	N-15	VP free-running clock test point
J16	N-15	PP free-running clock test point
J17	P-30	Ground test point (both pins are ground)
J18	B-33	Ground test point (both pins are ground)

The Graphics Processor has an 8-position DIP switch which determines the base VME address to which the GP responds. In the following table,

†If the shunt is not IN (shunt is OUT), then the signal in square brackets is valid.

ON *is the same as* SHORTED, *and*

OFF *is the same as* OPEN

Table 4-11 *VME Base Address DIP Switch—What The Settings Mean*

Switch Number	*Description With Switch ON [OFF]†*
1	GP responds to VME address bit 17 = 0 [1]
2	GP responds to VME address bit 16 = 0 [1]
3	GP responds to VME address bit 23 = 0 [1]
4	GP responds to VME address bit 22 = 0 [1]
5	GP responds to VME address bit 21 = 0 [1]
6	GP responds to VME address bit 20 = 0 [1]
7	GP responds to VME address bit 19 = 0 [1]
8	GP responds to VME address bit 18 = 0 [1]

Graphics Buffer—Jumpers

The Graphics Buffer has 10 jumpers (five 3-pin jumpers, five 2-pin jumpers). The test point jumpers do not need a shunt (in most cases there is a PCB trace which connects the two pins of the test point jumpers together).

†If the switch is OFF, then the signal in square brackets is valid.

Table 4-12 *Graphics Processor Jumpers—What They Mean*

Jumper	*PCB Grid Location*	*Signal Description*
J1	N-2	Ground test point (both pins are ground)
J2	B-2	Ground test point (both pins are ground)
J3	E-5	Manual Reset test point
J4	E-5	Graphics Buffer is 2 Megabytes (shunt pins 2-3) Graphics Buffer is 4 Megabytes (shunt pins 1-2)
J5	B-15	Refresh Interval test point bit 0
J6	B-15	Refresh Interval test point bit 1
J7	B-15	Refresh Interval test point bit 2
J8	B-15	Refresh Interval test point bit 3
J9	P-18	Ground test point (both pins are ground)
J10	A-18	Ground test point (both pins are ground)

nstalling the Graphics 'rocessor Board Only

umper Settings—Installing the ;P Only

Configure the jumpers on the Graphics Processor like this:

1. at PCB grid location J-2,
   - install shunts J2 and J3,
   - remove shunts J1, J4, J5, J6, J7, and J8 (if present).

   This sets the GP board ID to 0xEB.
2. At PCB grid location N-14, install shunt J14.
3. It makes no difference whether or not any of the other shunts are installed.

)IP Switch Settings—Installing he GP Only

Configure the VME base address DIP switch on the Graphics Processor like this:

1. at PCB grid location R-11, flip
   - switches 1, 3, 4, 6, 7, and 8 ON, and
   - switches 2 and 5 OFF.

   This procedure sets the base address to 0x210000 which is, by convention, the base address of the GP.

3oard Location in the Sun-3/160C Backplane—Installing he GP Only

If you are just using a Graphics Processor board, it *can* be installed in any one of the slots from 10 to 12 on the Sun-3/160C. The recommended location, however, is slot 10. Were you to use a Graphics Buffer board with the GP then the pair should go in slots 10 and 11.

A point of information: the GP uses the P1-A, P1-B, P1-C, P2-A, P3-A, and P3-C connectors.

CAUTION

On the Sun-3/160 backplane, slots 1 through 6, and slots 10 through 12 have their P2 bus signals tied together. Since the GP drives and receives signals on P2-A connector in slot 10, any board installed in slots 11 or 12 must NOT use the P2-A connector.

Jumpering the Backplane for GP-Only Operation

1. Remove the BG3IN/BG3OUT shunt (J1003 if the GP is in slot 10) and the IACKIN/IACKOUT shunt (J1004 if the GP is in slot 10) from the slot which the Graphics Processor is in.†
2. Make sure that the BG3IN/BG3OUT and IACKIN/IACKOUT daisy chain is continuous between the CPU and the GP. You do this by checking to see that any board installed in a slot between the CPU and the GP either uses or passes (daisy chains) the BG3IN/BG3OUT and IACKIN/IACKOUT signals. If the board does *not* use or pass these two signals, then the appropriate backplane

†There is an illustration in Chapter 4, (titled "How to Jumper the Empty Slot Between Two Filled Slots"), which shows where the BG3 and IACK jumpers are located.

shunts (BG3IN/BG3OUT and IACKIN/IACKOUT) must be installed for the slot this board is in.

Installing Both the Graphics Processor and the Graphics Buffer

Jumper Settings—Installing the GP and GB

Configure the jumpers on the Graphics Processor like this:

1. at PCB grid location J-2,
   - install shunts J2, J3, and J7, and
   - remove shunts J1, J4, J5, J6, and J8 (if present).

   This sets the GP board ID to 0xEA.
2. At PCB grid location N-14,
   - install shunt J14.
3. It makes no difference whether or not any of the other shunts are installed.

Configure the jumpers on the Graphics Buffer like this:

1. at PCB grid location E-5,
   - place shunt for J4 between 2 and 3.
2. It makes no difference whether or not any of the other shunts are installed.

VME Base Address DIP Switch—Installing the GP and GB

Configure the VME base address DIP switch on the Graphics Processor like this:

1. at PCB grid location R-11,
   - flip switches 1, 3, 4, 6, 7, and 8 ON, and
   - switches 2 and 5 OFF.

   This procedure sets the base address to 0x210000 which is, by convention, the base address of the GP.

Installing the GP and GB into the Backplane

Install the GP and GB in slots 10 and 11 on the Sun-3/160C (they both must use the P2-A connector as a private bus between the two of them). It doesn't *really* matter which board is in which slot, however it is preferred you put the GP in slot 10 and the GB in slot 11.

Setting the Backplane Jumpers—Installing the GP and GB

1. Remove the BG3IN/BG3OUT shunt (J1003 if the GP is in slot 10) and the IACKIN/IACKOUT shunt (J1004 if the GP is in slot 10) from whichever slot which the Graphics Processor is in.†
2. It makes no difference whether or not the BG3IN/BG3OUT and the IACKIN/IACKOUT shunts are installed for the slot which the Graphics Buffer is in (the GB shorts these signals on the board and, therefore, the backplane

†There is an illustration in Chapter 4, (titled "How to Jumper the Empty Slot Between Two Filled Slots"), which shows where the BG3 and IACK jumpers are located.

shunts are redundant).

3. Make sure that the BG3IN/BG3OUT and IACKIN/IACKOUT daisy chain is continuous between the CPU and the GP. You do this by checking to see that any board installed in a slot between the CPU and the GP either uses or passes (daisy chains) the BG3IN/BG3OUT and IACKIN/IACKOUT signals. If the board does *not* use or pass these two signals, then the appropriate backplane shunts (BG3IN/BG3OUT and IACKIN/IACKOUT) must be installed for the slot this board is in.

4.8. Adding a Second Ethernet Controller

You can add a second Ethernet controller board to your system by putting it into a Multibus-to-VME adapter board, and the adapter board into slot 7, 8, or 9 — whichever is free. It is suggested that you place the second Ethernet controller board in slot 7, if it is free.

Multibus-VME Adapter Board Settings for Second Ethernet Controller

Settings for the Multibus-to-VME Adapter board when using a second Ethernet controller board are as follows:

		1	2	3	4	5	6	7	8
DIP 1	Section	ON	ON	ON	ON	ON	ON	ON	ON
DIP 2	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 3	Section	ON	ON	ON	ON	ON	ON	ON	ON
DIP 4	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 5	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 6	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 7	Section	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
DIP 8	Section	ON	ON	ON	ON	OFF	OFF	OFF	OFF
DIP 11	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 12	Section	OFF	OFF	ON	OFF	OFF	ON	ON	ON

JUMPER 1: Install shunts for BCLK and CCLK (jumper pin 1 to pin 2 and pin 3 to pin 4)

For more information, see the *User's Manual for the VME-Multibus Adapter Board*, Sun part number 800-1193.

Settings on the Ethernet Controller Board

Settings for the second Ethernet Controller board are as follows:

- DIP SWITCH U503

DIP Switch U503, located at the lower left corner, sets the base address of the registers. Sections 1-8 of the switch correspond to address bits A12 through A19, respectively. The switch settings for U503 are listed below, and the encoding is as follows; X = OFF, O = ON:

ON				O				O
OFF	X	X	X		X	X	X	
	1	2	3	4	5	6	7	8

- DIP SWITCH U505

DIP Switch U505 sets the base address of the on-board memory. Sections 1-4 of the switch correspond to address bits A16 through through A19, respectively. The switch settings for U505 are listed below, with the encoding as follows; X = OFF, O = ON:

ON			O					
OFF	X	X		X	X	X	X	X
	1	2	3	4	5	6	7	8

- DIP SWITCH U506

DIP Switch U506 selects the size of the Multibus port into on-board memory. The switch settings for U506 are listed below, and the encoding is as follows; X = OFF, O = ON:

ON		O	O			O	O	
OFF	X			X	X			X
	1	2	3	4	5	6	7	8

- J-101

J-101 selects the type of Ethernet transceiver the board will be used with. If the shunt is installed, Type 1 transceiver is selected; if shunt is not installed Type 2 transceiver is selected. (INSTALLED)

- J-400

J-400 allows the selection of M.BIG, or the input to Port B (bank select circuitry) which has the address lines for 256K DRAMs. (NOT INSTALLED).

- J-401

J-401 allows the selection of M.EXP, the enable for the P2 address and data buffers. Keeping J-401 unjumpered puts these buffers into a tri-state. (NOT INSTALLED).

- J-500

J-500 sets the interrupt level for Ethernet interrupts. The level is hardwired to Level 3 with a trace. The interrupt level can be changed by cutting this trace and installing another. Level 7 is closest to the edge of the board, Level 0 is closest to the center. J-500 requires NO Shunts, as it is hardwired to Interrupt Level 3. (NOT INSTALLED).

4.9. Reconfiguring for a 1K by 1K Display

The standard Sun-3/75 display monitor (1152 x 900 pixels) may be converted to a 1K by 1K display (1024 x 1024 pixels) by

- replacing the vertical and horizontal state machine PROMs on the CPU board, and
- readjusting the CRT for a square display image by making an entry in the EEPROM (see chapter 2).

This reconfiguration must be done at the factory, however. Consult your local Field Service representative for more information.

5

Subsystem Set-Up

2351 - EAGLE

2312 - 8" 84m
2322 - 8" 168m
2333 - 8" 337m

Subsystem Set-Up

This chapter gives step-by-step instructions on how to unpack, mount, and cable up those disk and tape subsystems which you are able connect to your Sun-3/160. Those options not mentioned in this section are not field-installable.

5.1. 450 Disk Controller

The 450 SMD disk controller is installed in the pedestal card cage of the Sun-3/160 if you have the SMD disk subsystem. It is mounted upon a Multibus-to-VME Adapter board, recommended to be in slot 7 (if unoccupied by SCSI Board — see recommended board arrangement in chapter 4). The disk controller board is a 450 controller which *can* control up to four drives; however, because of cabling limitations (rear panels on the Sun-3/160 hook up to two drives) the system is configured for a maximum of two drives per controller.

The 450 SMD board has five cable connectors on its top: four 26-pin connectors and one 60-pin connector.

The 450 SMD is an intelligent storage module controller/formatter, which plugs directly into the Multibus-to-VME Adapter card. It directly connects via industry-standard A and B cables to one or two storage module drives which are available from a number of manufacturers. Sun Microsystems supports a family of such drives: the Fujitsu M2312K, M2322, and M2284 Micro-Disk Drives, and the M2351 Mini-Disk Drive, of which the M2322 and M2351 are field-installable.

CAUTION **Before continuing, make certain that all power is off to the Sun Workstation by:**

- **making certain that the OFF/ON switches to the Sun-3/160 pedestal and subsystem enclosure are OFF, and**
- **disconnecting the power cord before opening up any portion of the Sun Workstation, doing cabling of any sort, or altering peripheral/board configurations.**

If you need to install the board yourself, the following placement considerations and configuration details apply:

- The SMD board cannot share a P2 connector with the CPU or Expansion boards, as it has P2 traces which are incompatible with the CPU/Memory P2 bus. This means that the SMD board cannot go into any of slots 1 through 6

since the P2 bus in these six slots is shorted together. Likewise, the P2 connectors of slots 10, 11, and 12 are all shorted together; therefore if you are using a Graphics Processor board in one of these three slots, you cannot place the SMD board in any of these three slots (see the discussion of recommended board positions and P2 bus conflicts in chapter 4).

- Because the SMD board is a bus master, its relative slot number determines its priority (slot 1 is the highest-priority master). The board must be placed in a lower-priority position than the Sun-3 CPU board for proper handling of bus arbitration. It should also be placed in a lower-priority position than the 1/2-inch Tape Controller board, if there is one in the system. For this reason it is recommended that the SMD controller board be placed in slot 7 (if unoccupied by SCSI Board — see recommended board arrangement in chapter 4).
- Since the SMD board dissipates a fair amount of heat, it should be placed in the most central position *possible* in the backplane (subject to the considerations listed above).

Several sets of straps are provided for configuring the disk controller board. For proper operation in the Sun environment, the following options must be selected:

- Configure the SMD board for 16-bit I/O addressing at address 0xEE40 by installing exactly the following jumpers on jumper group JA through JE: JA3-JB3, JA8-JB8, JR1-JC1, JC2-JD2, JC3-JD3, JC4-JD4, and JE4-JE5.
- Configure the 450 for 24-bit memory addressing. Jumpers are: JM1-JM2 In; JM3-JM4 Out.
- Select interrupt level 2: wire pin E2 to pin JX4 (second pin from left in top row of JX pins).
- Enable the BPRO signal: jumper JE1 to JE2.
- Verify that jumpers JH1-JH2 and JN1-JN2 are NOT installed and leave other jumpers as shipped from the factory.

NOTE *For rev. N Xylogics controller boards and above, the jumpering for JH is different: jumper JH1 is connected to jumper JF1, which enables the activity LED. Also, there are no JN jumpers.*

The first controller is configured at address 0xEE40 by setting the JA through JE jumper group as described above. If you are configuring a second board, it should start at address 0xEE48: the jumper at JC4-JD4 should be out and one at JR4-JC4 should be in. The system can support a maximum of two 450 controller boards.

For the full specification and detailed description of the disk controller, see the supplied document: *Model 450 Peripheral Processor SMD Disk Subsystems Maintenance and Reference Manual.*

Setting the Multibus-to-VME Adapter Board for the SMD 450

The SMD controller board goes in a Multibus-to-VME Adapter board, and the adapter board is recommended to go into slot 7 (if unoccupied by SCSI Board — see recommended board arrangement in chapter 4). Settings for the Multibus-to-VME Adapter board when used with the SMD 450 are as follows:

```
Multibus Memory Space:  Not Used
Multibus I/O Space:     8 bytes starting at 0xEE40
DMA address size:       24 bits
Interrupt Vector:       0x48
BCLK, CCLK:             Needs external clocks
```

NOTE *Configure the Xylogics board for 24-bit operation.*

Switch Settings:

- For No Multibus Memory Space Response:

```
DIP 8—All OFF
DIP 6—All OFF
DIP 7—All  ON
DIP 5—All  ON
```

- For I/O space size 8:

```
DIP 2  Section    1    2    3    4    5    6    7    8
                  X   ON   ON   ON   ON   ON  OFF  OFF

DIP 4 All ON
```

- For I/O base address 0xEE40:

```
DIP 1  Section    1    2    3    4    5    6    7    8
                  X   ON  OFF   ON   ON   ON  OFF  OFF

DIP 3  Section    1    2    3    4    5    6    7    8
                 OFF  OFF  OFF   ON  OFF  OFF  OFF   ON
```

- For 24-bit Multibus DMA addressing:

```
DIP 11  Sections 1-4  All OFF    Sections 5-8 Don't Care
```

- For Interrupt Vector 0x48:

```
DIP 12  Section:   1   2   3   4   5   6   7   8
                  ON  ON  ON OFF  ON  ON OFF  ON
```

- For BCLK and CCLK:

```
JMP1    Section 1    INSTALLED      Section 2 INSTALLED
```

5.2. Fujitsu M2322 (260 Mbyte) Disk Subsystem

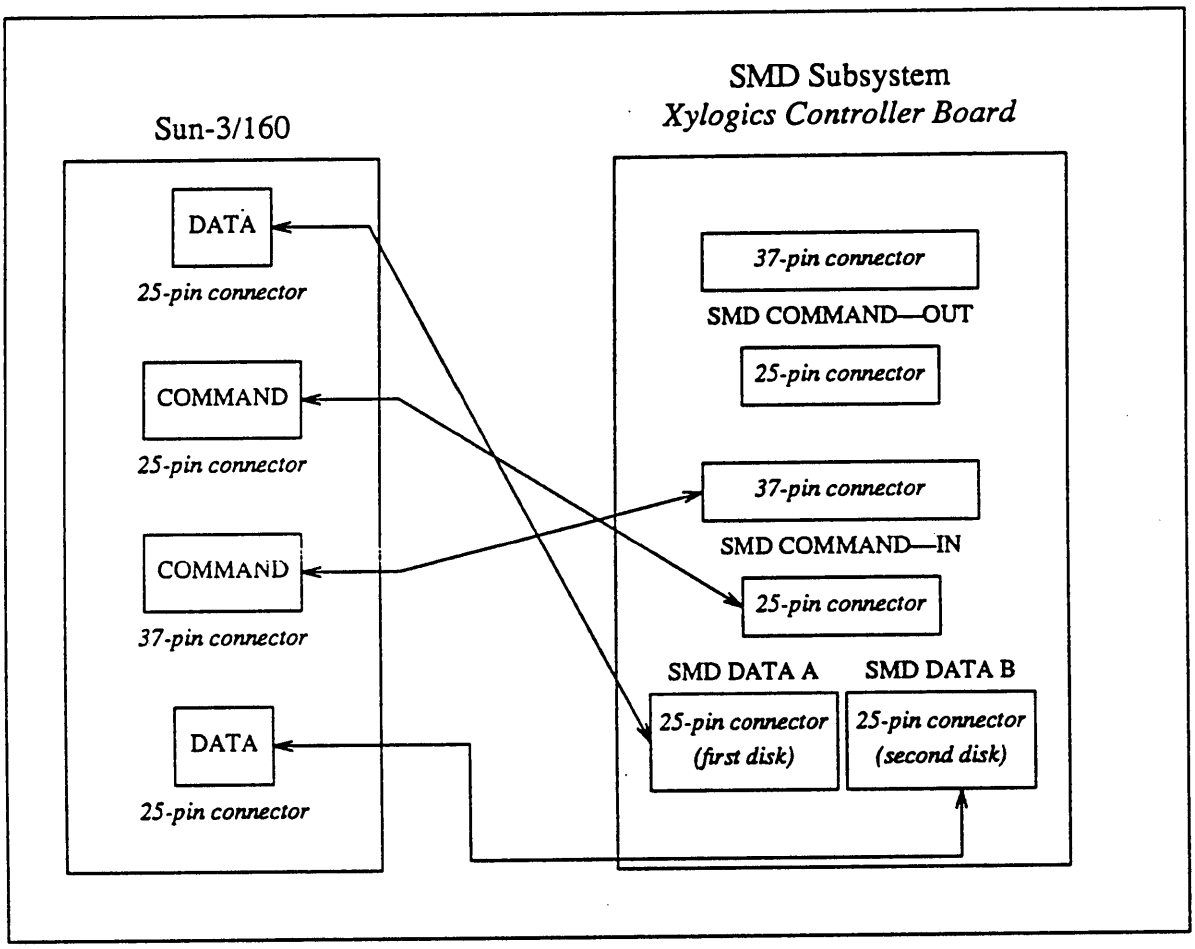
The Sun-3/160 may be supplied with two Fujitsu M2322 disk drives providing an additional 260 Mbytes (formatted) storage for the workstation. The pair of drives is mounted vertically in a second card cage/subsystem enclosure, and is controlled via an SMD Disk Controller board. The SMD board is mounted upon a Multibus-to-VME Adapter board, inside the Sun-3/160 pedestal, and cables from the disk drives run between this SMD board and the subsystem enclosure.

As shipped, all the internal cabling (including daisy-chaining) of the subsystem is complete and needs no set-up. Note also that head locks on the drives are fully automatic, so you should not have to open the subsystem enclosure at all.

CAUTION **Before continuing, make certain that all power is off to the Sun Workstation by:**

- **making certain that the OFF/ON switches to the Sun-3/160 pedestal and subsystem enclosure are OFF, and**
- **disconnecting the power cord before opening up any portion of the Sun Workstation, doing cabling of any sort, or altering peripheral/board configurations.**

Figure 5-1 *Cabling the M2322 Disk Subsystem*



External cabling runs as follows. The SMD subsystem enclosure is attached to the Sun-3/160 pedestal's backpanel via four shielded cables: two control cables (one 25-pin and one 37-pin), and two 25-pin data cables. The two control cables run from the connectors on the backpanel of the Sun-3/160 labelled "COMMAND" to the connectors on the SMD backpanel labelled "SMD COMMAND-IN."

The data cable for each drive runs from one of the two 25-pin "SMD DATA A" or "SMD DATA B" connectors on the disk subsystem backpanel to one of the two 25-pin "DATA" connectors on the Sun-3/160 backpanel.

- For the first drive, the data cable runs from "SMD DATA A" to the upper "DATA" connector on the Sun-3/160 backpanel.
- For the second drive, the data cable runs from "SMD DATA B" to the lower "DATA" connector on the Sun-3/160 backpanel.

For more information on the drive, see the *M2321/M2322 Micro-Disk Drives Engineering Specifications* Manual (Sun Part Number: 800-1029-01).

As shipped, the first drive is configured as unit number 0 by setting sections 4 and 8 of SW1 (accessible at the top of the drive) to *ON* and all other sections to *OFF*. The second drive is configured as unit number 1 by setting sections 4 and 1 of SW1 to *ON* and all other sections to *OFF*. SW2 and SW3 on both drives are set correctly as they come from Sun, and should be left alone: SW2 should have all sections *ON*, and SW3 should have section 3 *ON* and all others *OFF*.

5.3. M2351 (474 Mbyte) Disk

The 474 Mbyte disk subsystem is shipped in a single carton, along with its cables. The drive itself is shipped in nested boxes, and wrapped in a polyethylene bag. To unpack, mount, and cable up the M2351, follow the procedures below.

We recommend that you have the *M2351A/AF Mini-Disk Drive CE Manual* close at hand as you follow the instructions; it contains essential information.

1. Open the 474 Mbyte disk's outer shipping carton by cutting the binding straps with a knife or scissors, and opening the flaps.
2. When the box flaps are opened, the shock absorbers surrounding the internal carton are exposed. Remove the shock absorbers, and have AT LEAST two people lift out the internal carton.
3. Cut open the internal carton to expose the drive subsystem itself, wrapped in a polyethylene bag. Remove the two nylon straps.
4. With another person, lift the unit out of its bottom pad. Grasp the unit from the bottom to avoid damage to the sub-assemblies.

We recommend that you save the shipping carton and packing material for future use in case the product must be reshipped.

5. Remove the cover on the drive. Loosen the two Phillips screws that hold the card cage upright, and gently pivot and lift the card cage to a horizontal position to expose the "Vibration Preventative Block" (a piece of styrofoam) under the disk enclosure housing. Remove this block. Return the card cage to its upright position, and tighten the screws.
6. Locate the rotary actuator ("VCM") at the rear of the drive, near the cables. There is a small label which says

   "LOCK ←→ FREE"

   To the right of this label as you look at the back of the drive is a Phillips screw. Loosen the screw and rotate the locking lever to the unlocked position; tighten the screw in this second hole. ALWAYS LOCK the rotary actuator before moving the drive. For an illustration, refer to the manual which comes with the drive.

CAUTION **Make certain that all power is off to the Sun Workstation before continuing, by:**

- **making certain that the OFF/ON switches to the Sun-3/160 pedestal and subsystem enclosure are OFF, and**
- **disconnecting the power cord before opening up any portion of the Sun Workstation, doing cabling of any sort, or altering peripheral/board configurations.**

7. As you stand at the rear of the drive, you'll see a small circuit board on your left-hand side. Make sure that
   - the line-termination circuit board has its component-side facing away from you, and is securely seated into "CNP42" on this board ("CNP42" is located next to "CNP41," the 60-pin connector for the control cable);
   - the grounding strap is fastened to "TB1" in the center of the circuit board. "TB1" is a small silver square topped by a Phillips screw. DO NOT connect the grounding strap to "TRM1" or "TRM2."

   For mounting instructions, see the M2351 manual, section 2.4.
8. The M2351 is connected to its own 19-inch backpanel plate by ribbon cables; the backpanel plate is then connected to the controller by control and data cables.

   The external control cables run from the sockets labelled "SMD COMMAND IN" on the subsystem backpanel to the sockets labelled "COMMAND" on the Sun-3/160 pedestal's backpanel. The data cable plugs into the either socket labelled "DATA" on the pedestal backpanel.

As shipped, this drive is configured as the first drive in the system, that is, unit number 0, by setting all sections of the drive address switch to *OFF*. The drive address switch is a 4-section DIP switch located on the small circuit board near the left rear of the drive.

5.4. SCSI ¼-Inch Tape Drive and Controller

The SCSI controller board goes into a Multibus-to-VME adapter board, which in turn goes into slot 7. Switch settings for the SCSI controller board are given in the section which tells you how to configure your Sun-3/160.

The SCSI ¼-inch tape drive is not field-installable, so its installation is not covered here. However instructions below tell you how to insert a tape cartridge.

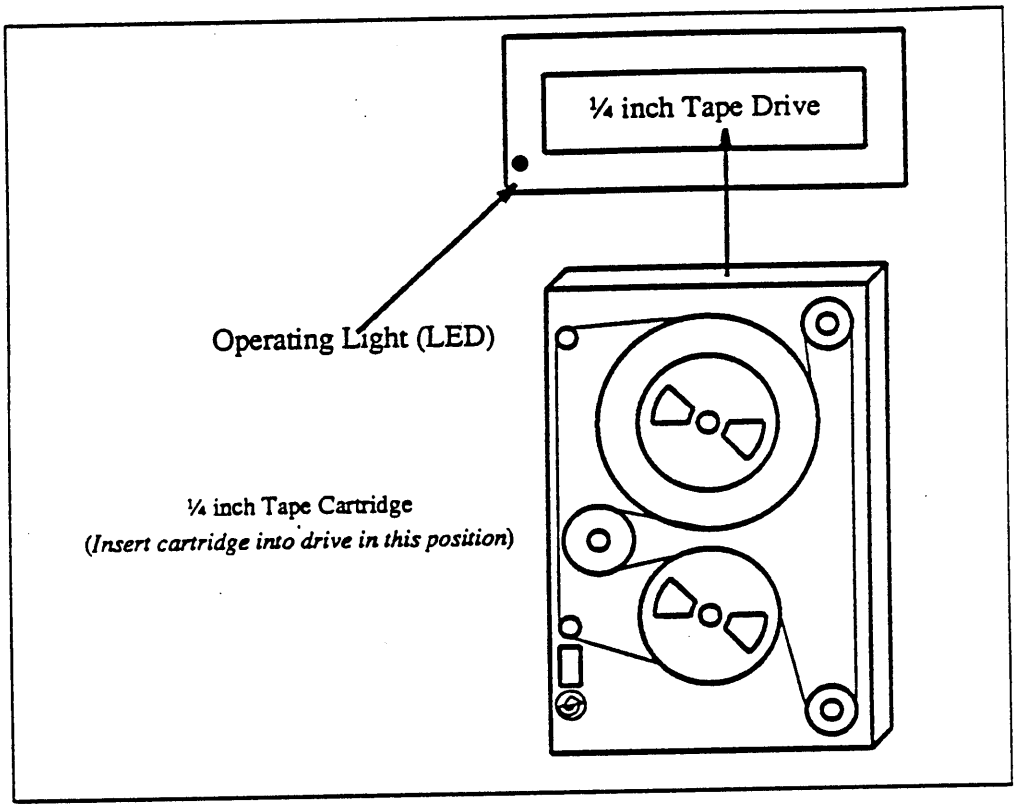
To load a cartridge,

1. Insert the tape cartridge as shown in the figure: read/write heads come in contact with the tape on the left side as the tape is inserted. Be careful not to actually touch the tape with your fingers.
2. Push the cartridge in until there is a click, and the cartridge locks in place.

To unload the tape cartridge,

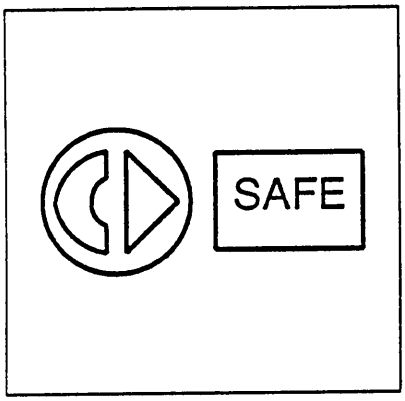
1. wait until all read or write activity has ceased.
2. Push against the cartridge; it should pop up and out of the tape drive.
3. Pull out the tape cartridge, being careful not to actually touch the tape with your fingers.

Figure 5-2 *How to Insert a Cartridge Into the ¼ Inch Tape Drive*

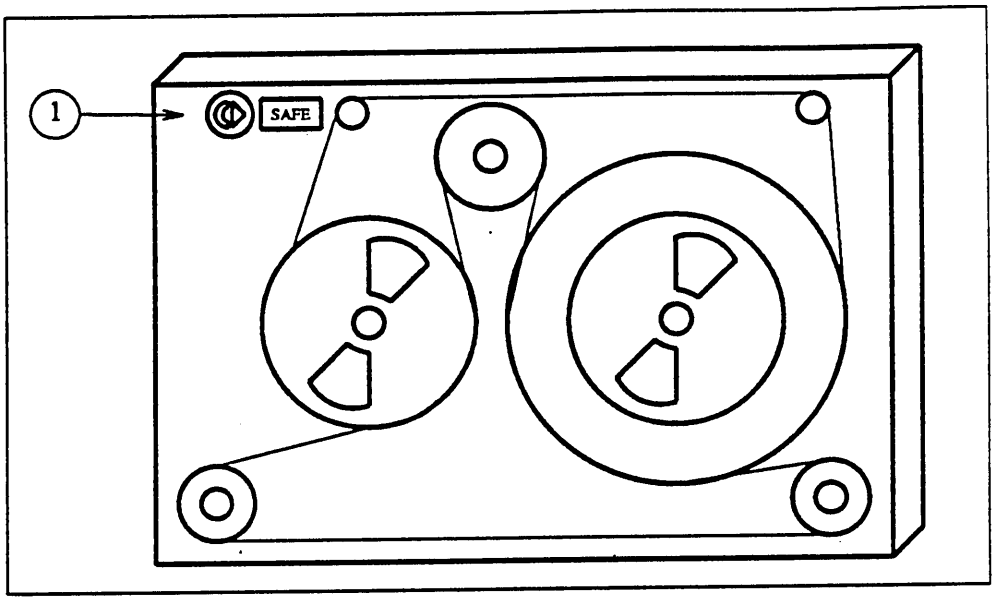


To protect the tape from being written on, turn the arrow that is on the left of the window marked "SAFE" until the arrow points at the word "SAFE" — the tape cannot be written when the arrow is in this position. Turning the arrow 180 degrees so that it points away from the word "SAFE" allows writing on the tape.

Figure 5-3 *Write Protecting a ¼-inch Tape Cartridge*



1 Write Protecting Tape Cartridge



5.5. ½-inch Streaming Magnetic Tape

The Sun Workstation may be shipped with a Control Data Streaming Tape Unit (STU) in the 92180 family of tape drives. This tape unit is an industry-standard tape unit which can operate at either 25 inches per second start/stop mode, or at 100 inches per second streaming mode. The magnetic tape unit is controlled via a Computer Products Corporation TAPEMASTER tape controller.

To unpack, mount, and cable up the ½-inch streaming magnetic tape subsystem, follow the procedures below.

NOTE *The shipping weight of the 1/2-inch Streaming Tape Unit and its shipping carton is approximately 117 pounds. The weight of the unit itself is about 100 pounds.*

1. Cut open the top of the Streaming Tape Unit's shipping carton with a short-bladed knife (so as not to damage the finish on the unit).
2. Fold back the flaps of the shipping carton to expose the inner tray, with manual and installation kit taped on top. Remove these items.
3. Remove the tray, and you will see the top of the unit with attached shipping frame.
4. Have someone assist you by grasping one side of the frame while you grasp the other; remove the unit from the carton and bottom inner tray, and place it on a table top.

We recommend that you save the shipping carton and all packing material for future use in case the product must be reshipped.

5. Carefully cut and remove the non-metallic band securing the Streaming Tape Unit's door.
6. Remove the filler blocks which are between the upper and lower PC board rear-mounted hinges.
7. Remove the door support blocks from under the door assembly. Leave the one-inch frame support block in place until the unit is ready for rack mounting. If you're not mounting the unit, simply leave the shipping frame on.
8. Remove the filler block which is between the shipping frame and underside of the PC boards by carefully pressing downward on the block, and sliding it backward and out from under the PC boards.
9. Remove the door stud from the installation kit. Screw the threaded end into the receptacle block inside the dust cover door. The tape unit will not run if the stud is not in place to engage the interlock switch.
10. To mount the unit in a 19-inch rack, first bolt the two hinge assemblies and stiffener bar to the rack. If you're not mounting the unit, skip to step 18 for cabling instructions.
11. Support the Streaming Tape Unit in a vertical position on the shipping frame, so that you can remove the four screws and detach the unit from the frame. After unmounting the unit, make sure another person is around to help you lift and maneuver it — this is **definitely** a two-person operation.

NOTE *After the shipping frame has been removed, do not try to support the weight of the tape drive by using the rear assemblies as lift points; you will severely damage them. Do not rest the weight of the drive on the rear assemblies; damage to the PC boards, regulator and filter will occur.*

12. When the frame is removed, install the two hinges on the top of the unit with the provided screws and lockwashers.
13. Position the Streaming Tape Unit onto the mounting hinges. The unit must be perpendicular to the rack for the hinges to be mated.
14. Place the unit in a closed position. Mark the area at which the adjustable pawl fastener of the unit contacts the mounting rail.
15. With the unit in an open position, install the bumper assembly into the mounting rail approximately one to two inches above the point at which the pawl fastener contacts the mounting rail.
16. Adjust the bumper assembly so that the tape deck is parallel to the mounting rack when the Streaming Tape Unit is in a closed position.
17. Place the unit in a closed position and secure it with the adjustable pawl fastener. Continue turning the pawl fastener clockwise until the unit is secure against the bumper assembly.

CAUTION **Before continuing, make certain that all power is off to the Sun Workstation by:**

- **making certain that the OFF/ON switches to the Sun-3/160 pedestal and subsystem enclosure are OFF, and**
- **disconnecting the power cord before opening up any portion of the Sun Workstation, doing cabling of any sort, or altering peripheral/board configurations.**

18. Connect the drive to the bulkhead plate via its two 50-pin flat ribbon cables. Look at the back of the tape drive: there are two large square circuit boards, one of which has two edge connectors on it. Connect the top edge connector ("J1") to connector "A" on the inside of the bulkhead; connect the bottom edge connector ("J2") via its 50-pin ribbon cable to connector "B."
19. Now, run the paired 37- and 25-pin shielded cables from the 1/2-INCH TAPE COMMAND A and B sockets on the bulkhead to the similarly labelled sockets on the pedestal's backpanel.
20. Internal to the pedestal, the Streaming Tape Unit's controller board must be mounted on a Multibus-to-VME Adapter board. The "A" cable then goes to connector "J1" on the TAPEMASTER tape controller board, and the "B" cable goes to "J2."

Please read the Control Data STU Reference Manual for more information on the ½-inch streaming drive.

5.6. ½-inch Streaming Tape Controller

If your Sun system is shipped with a ½-inch streaming tape unit, there should be a tape controller for that subsystem installed on a Multibus-to-VME Adapter board in the Sun-3/160 pedestal. The tape controller is either a TAPEMASTER board from Computer Products Corporation, or a Xylogics tape controller. The TAPEMASTER ½-inch streaming tape controller board has two 50-pin cable connectors on its outside edge (as viewed when installed in the card cage), and supports a data density of 1600 bits per inch (bpi). The Xylogics tape controller supports densities of both 1600 bpi and 6250 bpi.

CAUTION **Before continuing, make certain that all power is off to the Sun Workstation by:**

- **making certain that the OFF/ON switches to the Sun-3/160 pedestal and subsystem enclosure are OFF, and**
- **disconnecting the power cord before opening up any portion of the Sun Workstation, doing cabling of any sort, or altering peripheral/board configurations.**

If the Sun Workstation was not shipped with the tape controller board installed, you must install it. There are a few considerations involved in installation:

- The TAPEMASTER or Xylogics board may not be placed on the same P2 connector as the Sun-3 CPU and Expansion boards. This means that the TAPEMASTER or Xylogics board cannot go into any of slots 1 through 6 since the P2 bus in these six slots is shorted together. Likewise, the P2

connectors of slots 10, 11, and 12 are all shorted together; therefore if you are using a Graphics Processor board in one of these three slots, you cannot place the ½-inch tape controller board in any of these three slots (see the discussion of recommended board positions and P2 bus conflicts, in chapter 4).

- The ½-inch streaming tape controller is a Multibus master. This means that the relative number of its slot determines its priority (slot 1 is the highest-priority master). The board must be placed in a lower-priority position than the CPU. If you have a 450 SMD Controller board in your system as well, place the ½-inch tape controller board in a higher-priority position; otherwise, the SMD board will lock out the ½-inch tape controller (due to its higher data transfer rate).

Configuring the TAPEMASTER ½-inch Tape Controller

If you are installing the TAPEMASTER board in a Sun-3/160, please verify that locations 1 to 2 on the TAPEMASTER board are **not** jumpered; they should be jumpered for serial backplanes only (such as the Model 100U backplane).

Also, locations 3 to 4 and 52 to 53 must be jumpered for proper handling of CBRQ/: if these locations are jumpered, the tape controller will surrender the bus to a higher-priority master, when that master activates CBRQ/.

As shipped, the tape controller board should be already set up to work correctly in a Sun system. Refer to the Computer Products Corporation TAPEMASTER Manual for details of configuring the board if required.

Configuring the Multibus-to-VME Board with TAPEMASTER Controller

The TAPEMASTER controller goes on a Multibus-to-VME board, preferably in slot 7 (if unoccupied by SCSI Board — see recommended board arrangement in chapter 4). Settings for the Multibus-to-VME board when using the TAPEMASTER controller are:

```
Multibus Memory Space:   Not Used
Multibus I/O Space:      2 bytes starting at 0x00A0
DMA address size:        20 bits
Interrupt Vector:        0x60
BCLK, CCLK:              Needs external clocks
```

Switch Settings:

- For No Multibus Memory Space Response:

```
DIP 8—All OFF
DIP 6—All OFF
DIP 7—All  ON
DIP 5—All  ON
```

- For I/O space size 2:

DIP 2	Section	1	2	3	4	5	6	7	8
		X	ON	ON	ON	ON	ON	ON	ON

DIP 4 All ON

- For I/O base address 0x00A0:

DIP 1	Section	1	2	3	4	5	6	7	8
		X	OFF	ON	OFF	ON	ON	ON	ON

DIP 3	Section	1	2	3	4	5	6	7	8
		ON	ON	ON	ON	ON	ON	ON	ON

- For 24-bit Multibus DMA addressing:

DIP 11 Sections 1-4 All OFF Sections 5-8 Don't Care

- For Interrupt Vector 0x60:

DIP 12	Section	1	2	3	4	5	6	7	8
		ON	ON	ON	ON	ON	OFF	OFF	ON

- For BCLK and CCLK:

JMP1 Section 1 INSTALLED Section 2 INSTALLED

Configuring the Xylogics ½-inch Tape Controller

The Xylogics ½-inch tape controller supports data densities of both 1600 bpi and 6250 bpi. You may have two controllers in your Sun-3/160; settings for these controller boards are given below. "xt0" is the first controller; "xt1" is the second controller. ON means that the location is jumpered; OFF means that it is not jumpered.

Table 5-1 *Xylogics ½-inch Tape Controller Board Jumpers*

	xt0	xt1
jumper	*setting*	*setting*
JA-JB	4 ON 8 ON all others off	4 ON 8 ON all others off
JD	1,4,5,6,7,8 ON	1,4,6,7,8 ON
JG	1 OFF 2 ON	1 OFF 2 ON
JH	1 OFF 2 ON	1 OFF 2 ON
JJ	ON	ON
JK	3 ON all others off	3 ON all others off
JL	OFF	OFF
JM	OFF	OFF
JN	ON	ON

Setting the Multibus-to-VME Adapter for the Xylogics ½-inch Controller

The Xylogics controller goes on a Multibus-to-VME board, preferably in slot 7 (if unoccupied by SCSI Board — see recommended board arrangement in chapter 4). Settings for the Multibus-to-VME board when using the FIRST Xylogics controller (xt0) are:

```
Multibus Memory Space:   Not Used
Multibus I/O Space:      8 bytes starting at 0xEE60
DMA address size:        Not Used
Interrupt Vector:        0x64
BCLK, CCLK:              Needs external clocks
```

Switch Settings:

- For No Multibus Memory Space Response:

```
DIP 8—All OFF
DIP 6—All OFF
DIP 7—All  ON
DIP 5—All  ON
```

- For I/O space size 8:

```
DIP 2  Section    1    2    3    4    5    6    7    8
                  X   ON   ON   ON   ON   ON   OFF  OFF

DIP 4 All ON
```

- For I/O base address 0xEE60:

		1	2	3	4	5	6	7	8
DIP 1	Section	X	ON	OFF	OFF	ON	ON	OFF	OFF
DIP 3	Section	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON

- For DMA:

```
DIP 11  Sections 1-4  All OFF   Sections 5-8 Don't Care
```

- For Interrupt Vector 0x64:

		1	2	3	4	5	6	7	8
DIP 12	Section	ON	ON	OFF	ON	ON	OFF	OFF	ON

- For BCLK and CCLK:

```
JMP1   Section 1   INSTALLED     Section 2 INSTALLED
```

Settings for the second Xylogics tape controller (xt1) are:

```
Multibus Memory Space:  Not Used
Multibus I/O Space:     8 bytes starting at 0xEE68
DMA address size:       Not Used
Interrupt Vector:       0x65
BCLK, CCLK:             Needs external clocks
```

Switch Settings:

- For No Multibus Memory Space Response:

```
DIP 8—All OFF
DIP 6—All OFF
DIP 7—All  ON
DIP 5—All  ON
```

- For I/O space size 8:

		1	2	3	4	5	6	7	8
DIP 2	Section	X	ON	ON	ON	ON	ON	OFF	OFF

```
DIP 4 All ON
```

- For I/O base address 0xEE68:

		1	2	3	4	5	6	7	8
DIP 1	Section	X	ON	OFF	OFF	ON	OFF	OFF	OFF
DIP 3	Section	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON

- For DMA:

DIP 11	Sections 1-4	All OFF	Sections 5-8 Don't Care

- For Interrupt Vector 0x65:

		1	2	3	4	5	6	7	8
DIP 12	Section	OFF	ON	OFF	ON	ON	OFF	OFF	ON

- For BCLK and CCLK:

JMP1	Section 1	INSTALLED	Section 2 INSTALLED

5.7. Jumper and Switch Settings for the Systech ALM Board

The ALM controller board goes in a Multibus-to-VME Adapter board, and the adapter board is recommended to go into slot 7 and 8, or 8 and 9 — whichever is available. The ALM (Asynchronous Line Multiplexer) board is also known as the MTI (Multiple Terminal Interface) board.

There are five switches on the controller board, and they are set:

		1	2	3	4	5	6	7	8
Switch 1:	set to NORMAL (not DIAG)								
Switch 2:	Section	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF
Switch 3:	Section	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
Switch 4:	Section	OFF	OFF	ON	ON	ON	ON	ON	OFF
Switch 5:	Section	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF

5.8. Setting the Multibus-to-VME Adapter for the Systech ALM

The ALM controller board goes in a Multibus-to-VME Adapter board, and the adapter board is recommended to go into slot 7 and 8, or 8 and 9 — whichever is available. The ALM (Asynchronous Line Multiplexer) board is also known as the MTI (Multiple Terminal Interface) board. Settings for the Multibus-to-VME Adapter board when used with the Systech ALM/MTI are as follows:

		1	2	3	4	5	6	7	8
DIP 1	Section	ON	ON	ON	OFF	ON	ON	ON	OFF
DIP 2	Section	ON	ON	ON	ON	ON	ON	ON	OFF
DIP 3	Section	ON	ON	ON	ON	ON	OFF	OFF	ON
DIP 4	Section	ON	ON	ON	ON	ON	ON	ON	ON
DIP 5	Section	ON	ON	ON	ON	ON	ON	ON	ON
DIP 6	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 7	Section	ON	ON	ON	ON	ON	ON	ON	ON
DIP 8	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 11	Section	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP 12	Section	ON	ON	ON	OFF	ON	ON	ON	OFF

For more information, see the *User's Manual for the VME-Multibus Adapter Board*, Sun part number 800-1193.

6

Environmental and Electrical Specifications

Environmental and Electrical Specifications

This section describes the environmental requirements for the Sun-3/160.

NOTE *This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It 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.*

6.1. Physical Environment

The Sun-3/160 is manufactured for the following physical environment:

Table 6-1 *Physical Environment Specifications for the Sun-3/160*

	Operating	*Non-Operating*
Ambient Temperature	0°C to 40°C	–20°C to 75°C
	(32°F to 104°F)	(–4°F to 167°F)
Humidity (non-condensing)	5% to 80%†	5% to 80%†
Altitude	0m to 1892m	0m to 12192m
	0 to 6000 feet	0 to 40000 feet

† at 40° Centigrade

The 474 Mbyte Disk is manufactured for the following physical environment:

Table 6-2 *Physical Environment Specifications for the 474 Mbyte Disk*

	Operating	*Non-Operating (in storage)*
Ambient Temperature	10°C to 40°C	–40°C to 60°C
	(50°F to 104°F)	(–40°F to 140°F)
Humidity (non-condensing)	20% to 80%	5% to 95%
Altitude	0m to +3000m	0m to +12000m

The 168 Mbyte Disk is manufactured for the following physical environment:

Table 6-3 *Physical Environment Specifications for the 168 Mbyte Disk*

	Operating	*Non-Operating*
Ambient Temperature	5°C to 40°C	–40°C to 60°C
	(41°F to 104°F)	(–40°F to 140°F)
Humidity (non-condensing)	20% to 80%	5% to 95%
Altitude	0m to +3000m	0m to +12000m

The 1/2 inch Streaming Tape Unit is manufactured for the following physical environment:

Table 6-4 *Physical Environment Specifications for the 1/2 inch Streaming Tape Unit*

	Operating	*Non-Operating*
Ambient Temperature	10°C to 40°C	–10°C to 50°C
	(50°F to 104°F)	(+14°F to 122°F)
Humidity (non-condensing)	20% to 80%	10% to 90%
Altitude	0m to +3000m	0m to +3000m
	(688 millibars-9.98 psi)	(688 millibars-9.98 psi)

6.2. Electrical Specifications

Table 6-5 *DC Output Ratings for the Sun-3/160 Power Supply*

Voltage	*Amps*
+5 VDC	120 amps
+12 VDC	15 amps
–12 VDC	5 amps
–5 VDC	10 amps

Table 6-6 *Typical Sun-3/160 Component Power Consumption*

Part Number	*Component*	*Amps @ +5V*	*Amps @ –5V*	*Amps @ +12V*	*Amps @ –12V*	*Total Watts*
501-1094	2060 CPU board 4 Mbyte	12.9	0.8	–	–	68.5
501-1096	2061 Expansion board 2 Mbyte	2.7	–	–	–	13.5
501-1097	2061 Expansion board 4 Mbyte	3.5	–	–	–	17.5
501-1055	Graphics Processor	16.1	–	–	–	80.5
501-1020	Graphics Buffer	2.0	–	–	–	10.0
501-1045	SCSI	3.0	–	–	–	15.0
501-1014	Color board	15.3	5.3	–	0.2	105.4
501-1053	Backplane	0.5	–	–	–	2.5
501-1066	SMD controller with adapter	8.2	0.6	–	–	44.0
501-1059	VME-to-VME	1.6	–	–	–	8.0
501-1054	VME-to-Multibus	2.0	–	–	–	10.0
501-1004	Ethernet board	5.4	–	–	–	27.0
370-0502	Tapemaster ½ inch Tape Controller board	4.6	–	–	–	23.0
370-1010	Adaptec ACB-4000	1.8	–	–	–	9.0
370-1034	5-¼ inch Winchester 85 Mbyte	2.2	–	3.4	–	51.8
370-1011	Sysgen	2.6	–	–	–	13.0
370-1037	¼ inch tape drive	3.3	–	2.7	–	48.9
	Fans (each)	–	–	0.4	–	4.8

Table 6-7 *Power Supply Specifications*

Nominal AC Input Voltage	*Operating Range*	*Frequency Range*
115 VAC	94-128 VAC	47-70 Hz
230 VAC	180-260 VAC	47-70 Hz

Table 6-8 *Monitor Power Consumption*

Monitor Requirements *(Both B/W and Color)*
150 watts (511.95 BTUs/hour)

Table 6-9 *½ inch Streaming Tape Electrical Specifications*

Input Voltage (VAC)	*Average Input Current*	*Average Continuous Power*
120 VAC (104-128 VAC)	*(not available)*	170 W at 12.5 ips
220/240 VAC (191-256 VAC)	2.0 amps at 100 ips	220 W at 100 ips

Table 6-10 *Power Requirements for the 474 Mbyte Disk*

Voltage (VAC)	*Frequency (Hz)*	*Current (Amps)*
100	50/60	5.7/5.4
120	60	4.6
220	50	2.8
240	50	2.6

Table 6-11 *Fuses*

Item	AC Fuse size
Pedestal	15 amps, slow-blow
Color monitor	5 amps
Monochrome monitor	1.5 amps, slow-blow

A

Connector Pinouts and Serial Port Signals

Connector Pinouts and Serial Port Signals

This appendix contains the pinouts for the 2060 CPU board's:

- Keyboard/Mouse Connector
- Serial Port(s)
- Ethernet Connector
- Video Connector

and also contains a signal description of the serial ports.

NOTE *In the following connectors, only those pins actually connected to something are listed; open pins are not documented.*

A.1. Connectors on the 2060 CPU board

Table A-1 *Pinout of Mouse/Keyboard Connector*

Mouse/Keyboard DB-15 Connector			
Pin	Signal	Pin	Signal
1	RXD0	8	GND
2	GND	9	GND
3	TXD0	10	VCC
4	GND	11	VCC
5	RXD1	12	VCC
6	GND	14	VCC
7	TXD1	15	VCC

Table A-2 *Pinout of Serial Ports A and B*

Serial Ports A and B			
Pin	Signal	Pin	Signal
2	TXD	8	DCD
3	RXD	15	DB
4	RTS	17	DD
5	CTS	20	DTR
6	DSR	24	DA
7	GND		

Table A-3 *Pinout of Ethernet Connector*

Ethernet			
Pin	Signal	Pin	Signal
2	E.COL+	9	E.COL-
3	E.TXD+	10	E.TXD-
5	E.RXD+	12	E.RXD-
6	GND	13	+12V
7	VCC		

Table A-4 *Pinout of Video Connector†*

Video			
Pin	Signal	Pin	Signal
1	VIDEO+	6	VIDEO-
3	HSYNC	7	GND
4	VSYNC	8	GND
		9	GND

†Video+ and Video- are at ECL voltage levels; HSYNC and VSYNC are at TTL voltage levels.

Figure A-1 *Locating Jumpers on the 2060 Board*

TO BE ADDED

A.2. Description of Serial Port Signals

Below is a brief description of serial port signals. The "data communications equipment" mentioned below might be a printer, a plotter, a modem, or any other device which uses an RS-232-C or an RS-423 interface. A signal called "output" flows from the Sun-3/160 towards the peripheral device. An "input" signal flows from the peripheral into the Sun-3/160. Those pins not mentioned are not used on the Sun-3/160 — that is, they are open.

Figure A-2 *A Typical DTE/DCE Configuration*

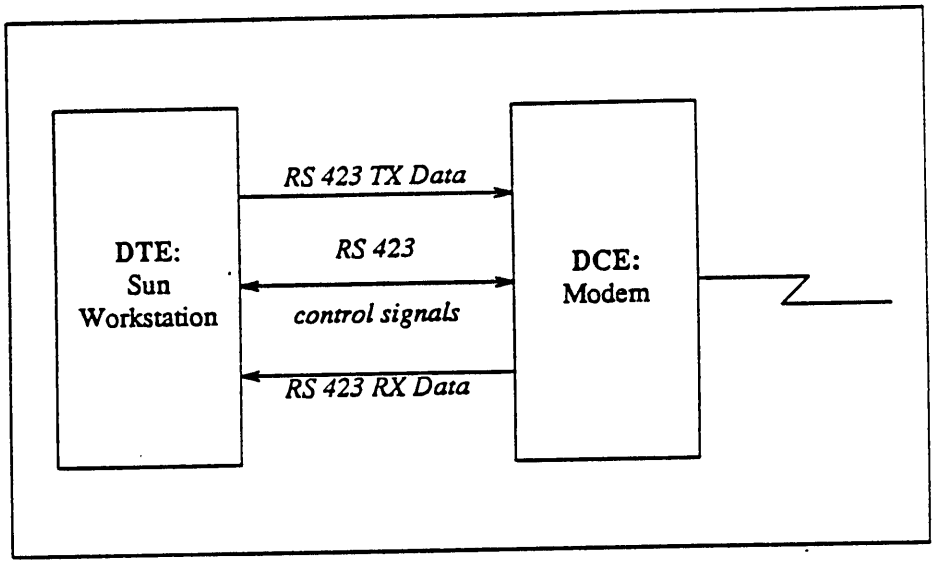


Table A-5 *Description of Serial Port Signals*

Pin	*Signal*	*Signal Name*	*Direction (Input or Output)*	*Description*
2	TXD	Transmit Data	output	The actual data transmitted to the data communications equipment.
3	RXD	Receive Data	input	The actual data received from the data communications equipment.
4	RTS	Request to Send	output	Signal sent to the data communications equipment, asking if it is ready to start accepting data.

Table A-5 *Description of Serial Port Signals— Continued*

Pin	*Signal*	*Signal Name*	*Direction (Input or Output)*	*Description*
5	CTS	Clear to Send	input	Signal from the data communications equipment saying it is ready to accept data.
6	DSR	Data Set Ready	input	Signal from the data communications equipment indicates the status of the local data set — that is, a peripheral connected to the Sun-2.
7	GND	Signal Ground	none	Signal Gound provides a reference level for the signal voltages.
8	DCD	Data Carrier Detect	input	The data communications equipment has detected "carrier," for example, a modem senses tones sent to it by another modem over phone lines.
15	DB	Transmit Clock from DCE	input	Transmit clock from the modem. This signal is usually not used for asynchronous devices (most terminals, printers, modems, etc.).
17	DD	Receive Clock from DCE	input	Receive clock from the modem. This signal is usually not used for asynchronous devices (most terminals, printers, modems, etc.).
20	DTR	Data Terminal Ready	output	Indicates that the Sun-2 is powered on and willing to communicate as the "local data terminal" with the data communication equipment (for example, the modem).
24	DA	Transmit Clock from DTE	output	Provides transmit clock from the Sun-2. This signal is usually not used for asynchronous devices (most terminals, printers, modems, etc.).

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Revision History

Revision	Date	Comments
50	15 October 1985	Beta release of this Hardware Installation Manual.

READER COMMENT SHEET

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