S/320™ and S/640™ Installation Manual

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Hardware

S/MT Series Diagnostics Manual

MegaFrame/MightyFrame Expansion Cabinet Installation Manual

Operating Systems

MightyFrame Series Administrator's Reference Manual

CTIX Operating System Manual

Hardware

The *S/MT Series Diagnostics Manual* describes the tests and subtests used to verify proper operation of all S/MT Series systems and identify problems when they occur.

The *MegaFrame/MightyFrame Expansion Cabinet Installation Manual* describes how to install V-Box and X-Box expansion cabinets in MegaFrame and MightyFrame computer systems.

Operating Systems

The *CTIX Operating System Manual*, *CTIX Operating System Manual, Version B*, and the *MegaFrame CTIX Operating System Manual* describe the CTIX operating system, which is derived from the UNIX System V operating system. Each manual describes CTIX commands, application programs, system calls, library subroutines, special files, file formats, games, miscellaneous facilities, and system maintenance procedures. These manuals are the starting point for detailed information about CTIX features.

The *MightyFrame Series Administrator's Reference Manual* defines the responsibilities of a MightyFrame system administrator and provides procedures for the administrator to follow. The manual explains the concepts an administrator must understand to maintain a MightyFrame computer system, including user support, CTIX modes, CTIX file systems, peripheral devices, and troubleshooting procedures.

1
Overview

The S/320 and S/640 are high-performance computer systems designed around the MC68020 32-bit Microprocessor. Each is enclosed in the A-Box cabinet (shown in Figure 1-1).

System Introduction

This manual shows you how to install the S/320 and S/640 A-Box, which comes fully assembled.

S/320 SYSTEMS

The S/320 contains the following equipment:

- 500-watt power supply
- quarter-inch cartridge (QIC) streaming tape drive
- at least one hard disk drive
- Main Processor board (with 68020 CPU)
- local input/output (I/O) and memory card cage
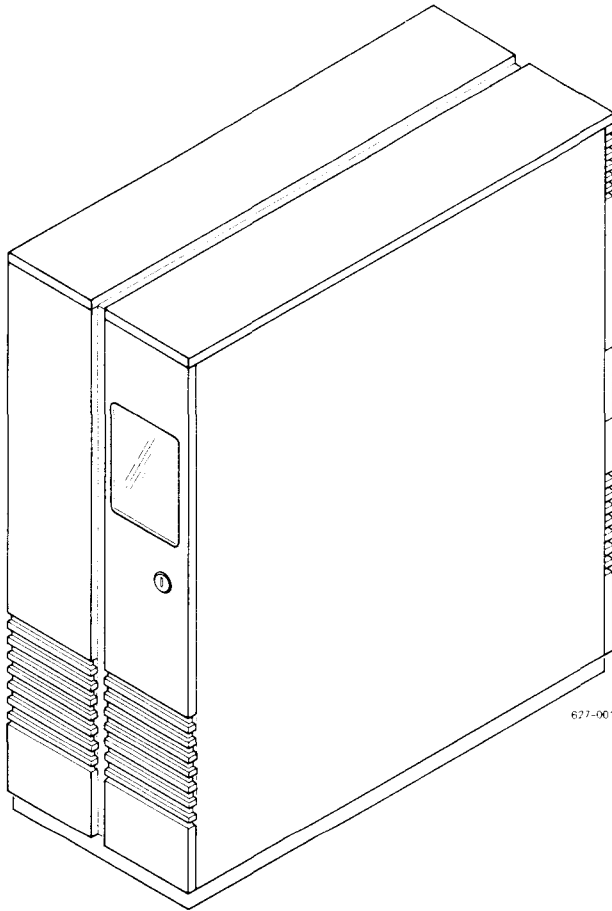
Figure 1-1.   S/320 and S/640 A-Box

In addition, the S/320 can contain any of the following expansion equipment:

- up to four Memory Expansion boards

- up to four 10-channel, RS-232-C Expansion boards, two 20-channel, RS-232-C Expansion boards, four Ethernet Combo boards, or any combination to fill four I/O slots

- one RS-422 Expansion board or one RS-232-C Input/Output (IOP) Accelerator Expansion board

- up to three hard disk drives

- optional VME card cage, VME Interface Adapter board, and VME expansion cards installed as ordered

S/640 SYSTEMS

The S/640 contains the following equipment:

- 500-watt power supply

- Small Computer System Interface (SCSI) tape drive

- one to three hard disk drives

- Main Processor board (with 68020 CPU and 68881 Coprocessor)

- local input/output (I/O) and memory card cage

In addition, the S/640 can contain any of the following expansion equipment:

- up to four Memory Expansion boards (4 Mb minimum required)

- up to four 10-channel, RS-232-C Expansion boards, two 20-channel, RS-232-C Expansion boards, four Ethernet Combo boards, or any combination to fill four I/O slots

- one RS-422 Expansion board or one RS-232-C Input/Output (IOP) Accelerator Expansion board

- up to three hard disk drives

- optional VME card cage, VME Interface Adapter board, and VME expansion cards installed as ordered

EXPANSION CABINETS

You can attach two types of expansion cabinets to the A-Box with the VME option installed. The X-Box contains room for four storage module devices (SMDs). The V-Box contains a ten-slot VME card cage and room for two SMDs. See the *Expansion Cabinet Installation Manual* and the *MightyFrame Series Administrator's Reference Manual* for information on installing and using X-Boxes and V-Boxes with your system.

Purposes of This Manual

This manual has several purposes:

- to aid you in the installation of your system

- to aid you in the installation of expansion cards, disk drives, and terminals

- to direct you to related documentation

INTENDED AUDIENCE

This manual can be used by people with various levels of computer experience. For example, some tasks, such as connecting the power cable, can be accomplished easily and with minimal computer experience. Other tasks, such as installing a hard disk drive, require more familiarity with computers.

MANUAL ORGANIZATION

There are eight chapters in this manual that are organized to guide you through the entire installation process. They are summarized in Table 1-1.

To install the A-Box for the first time, you should read Chapters 1 through 4.

- For a brief introduction to the S/320 and S/640 and an overview of this manual, read Chapter 1, "Overview."

- To choose a location and inspect the computer, see Chapter 2, "Getting Started."

- To connect terminals, parallel printers, serial printers, and modems, see Chapter 3, "Connecting Peripherals."

- To connect the power cable, turn on your power, and load the CTIX operating system, see Chapter 4, "Booting Your System."

To install expansion equipment in the A-Box, refer to Chapters 5 through 8.

- To properly power down and restart your system, see Chapter 5, "Powering Down and Restarting Your System."

- To install Memory and I/O Expansion boards, consult Chapter 6, "Installing Expansion Boards."

- To install the VME card cage, the VME Interface Adapter board, and VME Expansion cards, see Chapter 7, "Installing VME Equipment."

- To install hard disk drives, read Chapter 8, "Installing Hard Disk Drives."

In addition, the following information can be found in these appendixes.

- For a listing of S/320 and S/640 boot ROM status and error codes, see Appendix A, "System Status Codes."

- For additional information on system specifications, see Appendix B, "S/320 and S/640 Specifications."

- To determine the pin assignments for peripheral cable connectors, see Appendix C, "Cable Specifications."

- To clean the tape drive (QIC and SCSI), review Appendix D, "Tape Drive Maintenance."

- To replace the battery and fuses, consult Appendix E, "Replacing the Battery and Fuses."

- To install the MC68881 Floating-Point Coprocessor in the S/320, see Appendix F, "Installing the MC68881 Floating-Point Coprocessor in S/320 Systems."

A glossary of technical terms is located after the appendixes.

Table 1-1

TOPICS COVERED IN THIS MANUAL

Topic	Chapter
How to use this manual	1
Choosing a location	2
Inspecting your system	2
Attaching stabilizer bars	2
Connecting terminals	3
Connecting printers	3
Connecting modems	3
Starting terminals in Emulate mode	4
Loading CTIX	4
Turning on the power	4
Shutting down CTIX	5
Turning off power	5
Restarting the system	5
Installing memory expansion boards	6
Installing I/O expansion boards	6
Installing VME equipment	7
Installing VME expansion cards	7
Installing hard disk drives	8

Summary

This chapter introduced you to the S/320 and S/640 computer systems and presented an outline of this manual. The next chapter lists the tools and equipment you need to install your system, shows you how to inspect it, and finally shows you how to install the stabilizer bars.

2
Getting Started

This chapter addresses several issues that you need to consider before you install the S/320 or S/640. They include

- checking that you have the right tools

- choosing the best location for your system

- inspecting your system

- making sure that you have all the necessary equipment

- attaching the stabilizer bars

NOTE: If your system is already installed and you are adding equipment, you may not need to read this chapter. Instead, refer to Chapter 5.

Required Tools

You need the following tools to complete the procedures described in this manual:

- 1/4-inch hex nut driver

- 11/32-inch hex nut driver

- phillips screwdriver

- two flathead screwdrivers, one small and one large

These tools are contained in the optional tool kit (Part Number TE120).

Choosing a Location

The Installation Sheet showed you how to unpack the S/320 and S/640 A-Box. It also included some guidelines for temperature, electrical, and space requirements. Make sure that you consider these items carefully before proceeding.

The S/320 and S/640 fits into any environment that meets the following conditions:

Floor

> A floor or firm foundation resistant to abrupt movement. The floor may be carpeted, but it should be antistatically treated (or, place an antistatic mat directly under and around the enclosure).

Space

> The following items concern the space required around your system. Leave the following clearances:
>
> - Two feet of space to open the front and rear doors. Both doors open from right to left.
>
> - Space to access (without moving the computer) the Reset and Power switches. The Reset switch is located inside the front door and the Power switch inside the rear door.

- Space to route cables from the rear of the cabinet to expansion cabinets and other peripherals.

- Space to remove the top and side panels.

- Space to attach expansion cabinets.

Cabling

All cables should be routed from the bottom rear of the cabinet. Be sure cables are not placed in the way of chair legs or chair wheels, or in high-traffic areas.

NOTE: To assure compliance with ESD (electrostatic discharge) and EMI (electromagnetic interference) specifications, use only shielded cables at connect devices to the S/320 and S/640 (see Appendix C, "Cable Specifications"). The maximum cable length specifications are

RS-422	*1,200 feet (sum of all cables on cluster line) per channel*
RS-232-C	*50 feet (each cable)*
Parallel printer	*10 feet (each cable)*

Power outlets

A grounded electrical outlet conforming to electrical code requirements and not tied to the same circuit as other high-wattage electrical systems (such as lights or air conditioning) is required.

Operating temperatures

Operating temperature limits for the S/320 and S/640 are

Minimum	10°C (50°F)
Maximum	40°C (104°F)

Proper ventilation

> There should be no obstruction at the front or rear ventilation grills; adequate air-conditioning in the room should be provided to handle the heat (3300 Btus per hour for each system) generated by your system.

Power and environmental considerations are summarized in Appendix B, "S/320 and S/640 Specifications." The S/320 and S/640 physical dimensions are also listed in Appendix B.

Unpacking Your System

After you remove your system from the packing container and locate it so that its operating requirements are met, use this checklist to make sure that you have the following equipment:

Equipment from Shipping Container

☐   S/320 or S/640 A-Box

☐   Power cable

☐   Two stabilizer bars with thumbscrews

You will need at least one terminal and terminal cable to complete the installation procedures in this manual. Refer to the installation manual for your terminal for information on unpacking, assembling, and testing your terminal.

Terminals

☐   Terminals (RS-232-C and/or RS-422)

☐   Terminal cable (one per terminal RS-232-C and/or RS-422)

☐   Terminators (RS-422 only)

Your system is shipped fully equipped with whatever expansion equipment you ordered. Your system can contain some or all of the following:

Other Equipment

☐   up to four Memory Expansion cards

☐   up to four I/O Expansion cards

☐   VME Upgrade Kit (Part Number CV501)

☐   VME Expansion cards

☐   up to three hard disk drive(s)

Inspecting Your System

To inspect the S/320 or S/640 and make sure that it sustained no visible damage during shipping (see Figure 2-1):

1. Use a screwdriver to open the tool-operated lock on the front door. Check that both the lock and the door are in operating condition.

2. Check to see that all the drives are snapped in place.

You can see the memory side of the local card cage. In addition, a blank tape may be located to the left of the memory card cage. Remove the tape and its foam packing, and lay them aside for future use.

Follow these steps to inspect the rear of the cabinet.

1. Open the rear door. The door should open smoothly and extend until it is perpendicular to the cabinet. (See Figures 2-2 and 2-3.)

    You can see the Main Processor board, which contains one parallel printer connector, two RS-232-C connectors, and one connector for the Uninterruptible Power Supply (UPS). You can also see the I/O side of the local card cage and at least one hard disk drive mounted to the right of the Main Power switch.
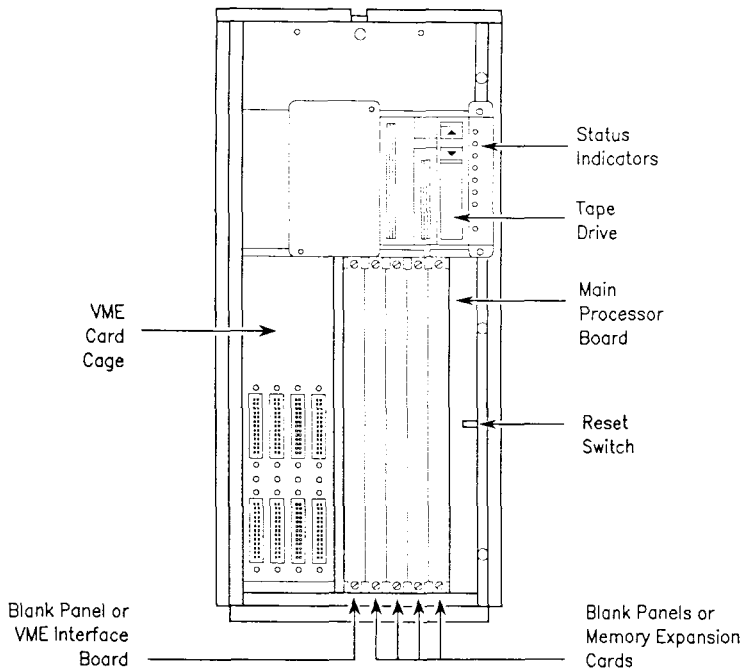
Figure 2-1.   Front Inside View

2. Your system may contain any one or all of several options, including expansion cards and hard disk drives. Make sure all expansion cards are attached securely to the local card cage.

3. Make sure that all disk drives are securely mounted in their respective drive slots.

   The system may also contain the VME card cage, which is attached to the right side of the local card cage. If so, make sure that the VME card cage is securely attached to the local card cage.
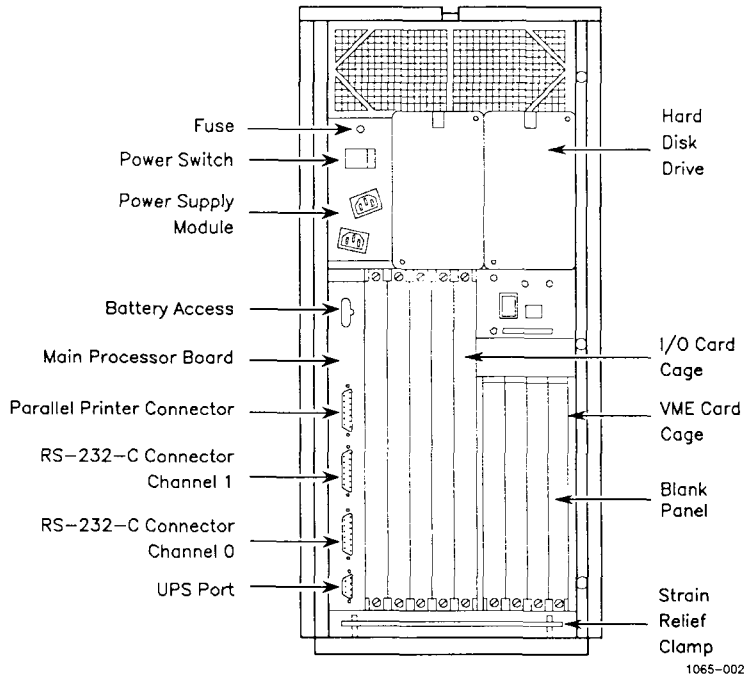
Figure 2-2. Rear Inside View (S/320)

Fuse

Power Switch

Power Supply
Module

Battery Access

UPS Port

Parallel Printer Connector

RS-232-C Connector
Channel 1

RS-232-C Connector
Channel 0

Main Processor Board

Hard
Disk
Drive

I/O Card
Cage

VME Card
Cage

Blank
Panel

Strain
Relief
Clamp

1065-003
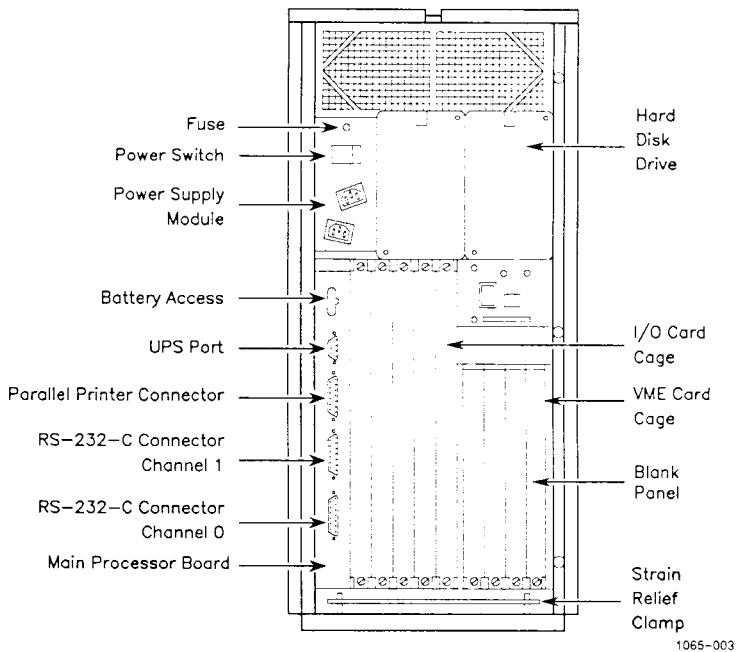
Figure 2-3. Rear Inside View (S/640)

Attaching the Stabilizer Bars

You must attach two stabilizer bars to the bottom of your system when it is
in a standalone configuration. Since the stabilizer bars prevent you from
moving the enclosure on its wheels and from attaching expansion cabinets,
be sure that it is situated in its permanent location before doing so.

WARNING

*Attaching the stabilizer bars is a two-person task. One person should lift
one end of the enclosure while the other slides the stabilizer bar under the
lifted end.*

To attach the stabilizer bars (see Figure 2-4):

1. Unpack the two stabilizer bars and the thumbscrews.

2. Open the front door.

3. Place one of the bars lengthwise against the front of the enclosure.

4. Lift the front of the enclosure up, and slide the bar underneath the frame.

5. Position the stabilizer bar so that its center hole is directly below the center hole along the bottom of the enclosure cabinet.

6. Insert one of the thumbscrews into the middle hole in the enclosure, and tighten the screw until the stabilizer bar is firmly attached to the cabinet.

7. Repeat the procedure to attach the rear stabilizer bar.
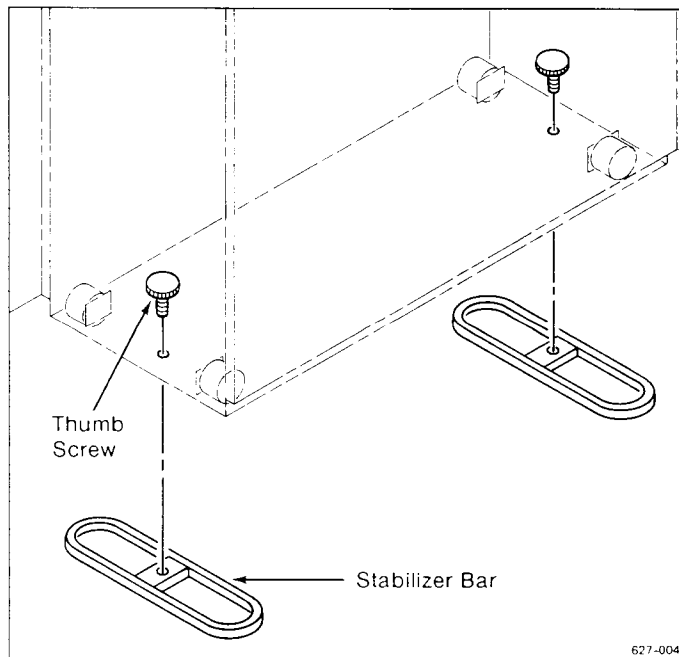
Figure 2-4. Installing the Stabilizer Bars

Summary

This chapter showed you how to locate and inspect the S/320 and S/640, as well as how to attach the stabilizer bars. The next chapter shows you how to attach peripherals.

If you are installing additional equipment before initially booting the system, read Chapters 6 through 8 first.

3
Connecting Peripherals

This chapter shows you how to connect peripherals to the S/320 and S/640. The following procedures are described:

- attaching terminals

- attaching parallel printers

- attaching serial printers and modems

Attaching Terminals

You can connect terminals to

- the Main Processor board (via RS-232-C channels)

- RS-232-C Expansion boards

- Ethernet Combo boards

- an RS-422 Expansion board

There are two types of terminals you can connect to RS-232-C connectors in the S/320 and S/640:

- any terminal with asynchronous, RS-232-C protocol (Freedom 100 or VT-100 terminals)

- a Programmable Terminal (PT) or a Graphics Terminal (GT) used in Emulate mode

Refer to the installation manual for your terminal for instructions to properly unpack, assemble, and test it. That installation manual also discusses the correct baud rates, start/stop bits, and parity settings for your terminal.

Additionally, the specifications and pin assignments required to assemble RS-232-C and RS-422 cables are contained in Appendix C of this manual.

NOTE: To configure terminals connected to expansion boards, see the chapter titled "Terminals and Modems" in the MightyFrame Series Administrator's Reference Manual.

THE MAIN PROCESSOR BOARD

The Main Processor board contains two 25-pin, RS-232-C connectors; one parallel printer connector; and one UPS connector. You can connect terminals to the two RS-232-C connectors, labeled Channel 0 and Channel 1. You must, however, connect the first terminal to Channel 0, since that is the only channel already configured in the software.

The 25-pin, RS-232-C connector on the Main Processor board requires an RS-232-C crossed cable with 25-pin connectors on both ends.

To connect a terminal to Channel 0:

1. Open the rear door.

   Notice the bar along the bottom of the computer. This is called the *strain relief clamp*. It holds the power and peripheral cables in place.

2. Use a screwdriver to remove one screw and loosen the other. Swing the strain relief clamp towards you and out of the way.

3. Insert the 25-pin connector into Channel 0 on the Main Processor board.

4. Insert the other 25-pin connector into the RS-232-C connector on the terminal.

5. Tighten the jackscrews that secure each connector in place (see Figure 3-1).

6. If you are not attaching any more cables, position the strain relief clamp over the cable, and secure it to the chassis.

Wait until you complete the steps in Chapter 4, "Booting Your System," before turning on the terminal.
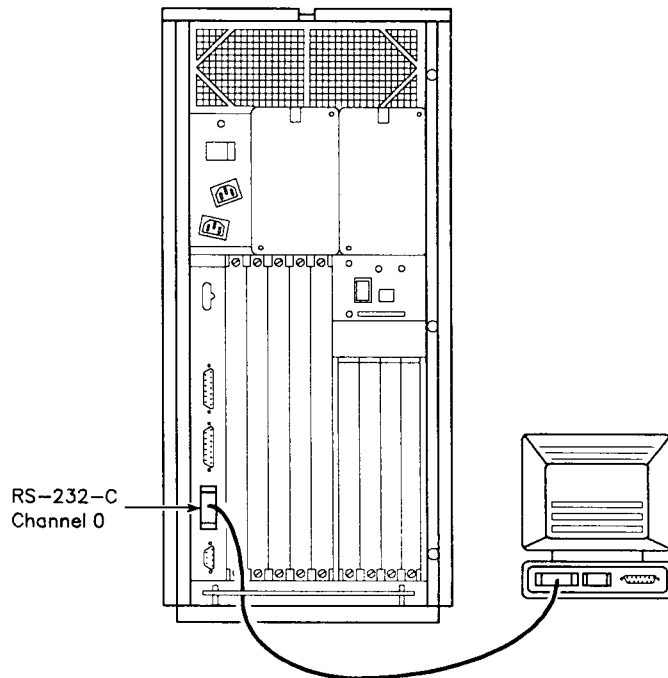
RS-232-C
Channel 0

1065-004

Figure 3-1. Attaching Terminal to Main Processor Board

RS-232-C AND ETHERNET COMBO EXPANSION BOARDS

You can install up to 40 additional RS-232-C channels on your system. The connectors on the expansion boards require 9-pin connectors, while the terminals require 25-pin connectors.

The 10-channel, RS-232-C Expansion board contains 10 connectors, labeled from bottom to top as Channel 2 through Channel 11. The 20-channel, RS-232-C Expansion board contains 20 connectors, labeled from bottom to top as Channel 2 through Channel 21. (This board takes up two slots in the card cage.) The Ethernet Combo board contains six RS-232-C channels, labeled from bottom to top as Channel 2 through Channel 7.

To connect a terminal to an RS-232-C Expansion board or Ethernet Combo board:

1. Loosen the strain relief clamp, and swing it out of the way if you have not already done so.

2. Insert the 9-pin connector end of the RS-232-C cable into a connector on the Expansion board (see Figure 3-2).

3. Insert the 25-pin connector on the other end of the cable into the RS-232-C connector on the terminal.

4. Tighten the jackscrews to secure each connector in place.

5. If you are not attaching any more cables, position the strain relief clamp over the cable, and secure it to the chassis.

THE RS-422 EXPANSION BOARD

There are four RS-422 cluster channels on the RS-422 Expansion board. You can connect up to eight RS-422 terminals to one RS-422 cluster channel, for a total of up to 32 RS-422 terminals.

To connect RS-422 terminals to your system, you need RS-422 cables with 9-pin connectors on both ends.

RS−232−C
Channel 2

1065−005

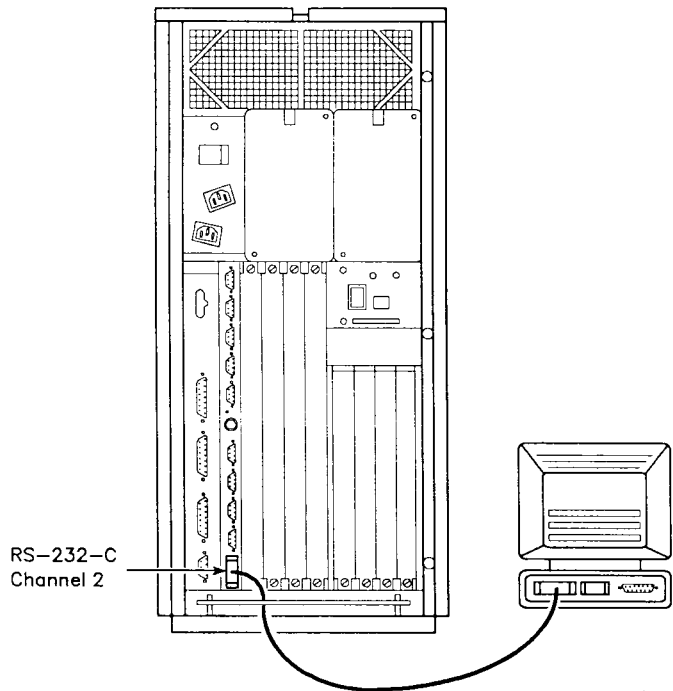**Figure 3-2.   Connecting a Terminal to an RS-232-C Expansion Board**

To connect RS-422 terminals:

1. Loosen the strain relief clamp and swing it out of the way if you have not already done so.

2. Insert a 9-pin connector into Cluster Channel 0 on the RS-422 Expansion board.

3. Insert the other 9-pin connector into one of the two RS-422 channels on the terminal.

4. Tighten the jackscrews to secure each connector in place.

The following instructions show you how to connect up to eight RS-422 terminals to one RS-422 cluster channel (see Figure 3-3). You need one RS-422 cable for each terminal, and one RS-422 terminator.

1. Connect the first terminal to Cluster Channel 0 on the RS-422 Expansion board.

2. Attach a 9-pin connector from a second RS-422 cable to the available RS-422 channel on the first terminal.

3. Attach the other 9-pin connector of the second RS-422 cable to one of the two RS-422 channels on the second terminal. Continue this daisy chain until as many as eight terminals are connected to each RS-422 cluster channel.

4. Tighten the jackscrews to secure each connector in place.

5. The last terminal in the cluster has one unused channel. It is advisable to insert an RS-422 terminator into that unused channel.

6. If you are not attaching any more cables, position the strain relief clamp over the cables, and secure it to the chassis.

Attaching Parallel Printers

Parallel printers are connected to the channel labeled Parallel Printer on any of the following:

- CPU board
- RS-422 Expansion board
- IOP Expansion board

NOTE: The parallel printer channel on the S/640 CPU board is a bidirectional channel.

Parallel printer connectors require parallel printer cables to complete the connection. See Appendix C for cable information and pin assignments.

RS—422 Expansion Card

RS—422 Cluster Channel 1   Terminator

1065-006

Figure 3-3.   Clustering Terminals to an RS-422 Expansion Board

The instructions for connecting a parallel printer to any parallel printer channel are identical. To connect a parallel printer,

1. Loosen the strain relief clamp and swing it out of the way if you have not already done so.

2. Insert the 25-pin connector into the parallel printer channel. (See Figure 3-4, which shows connection to an RS-422 Expansion board.)

3. Insert the 36-pin connector into the printer port.

4. Tighten the jackscrews that secure the connectors in place.

5. If you are not attaching any more cables, position the strain relief clamp over the cables, and secure it to the chassis.

RS—422 Expansion Card
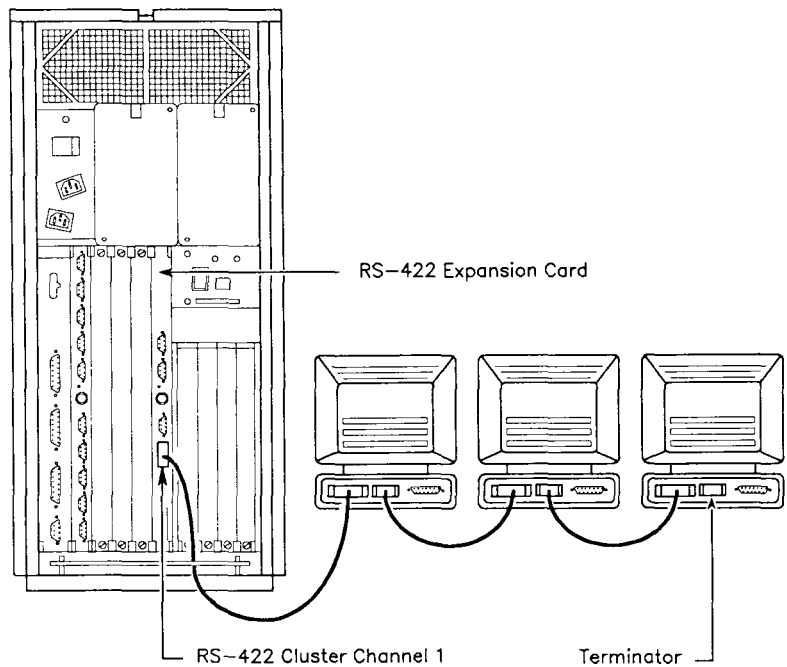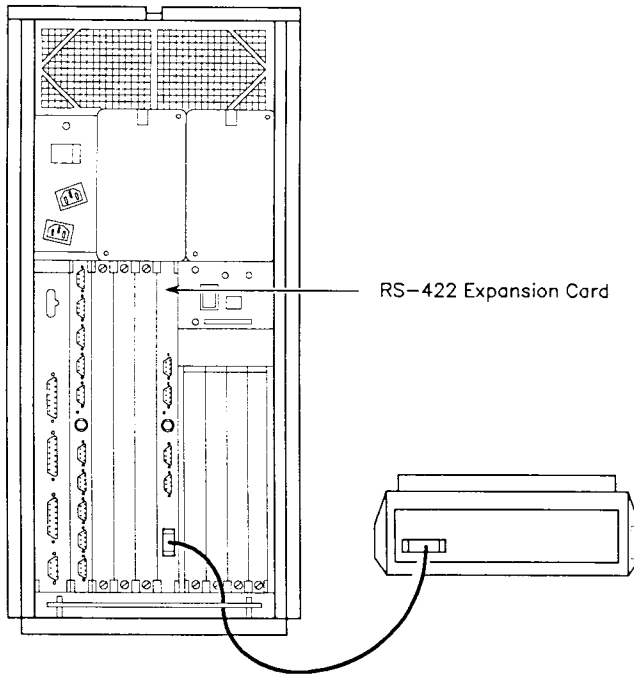
1065—007

Figure 3-4.   Attaching a Parallel Printer

Attaching Modems and Serial Printers

Modems and serial printers are connected to the RS-232-C channels on
the RS-232-C Expansion boards or Ethernet Combo board.   These
channels must be configured in the software to support these peripherals.
See the current Release Notice for more information.

An RS-232-C channel on an Ethernet Combo board or RS-232-C
Expansion board requires an RS-232-C cable with a 9-pin connector on
one end and a 25-pin connector on the other end.   See Appendix C for
cable information and pin assignments.

To connect a modem or serial printer to the Ethernet Combo board or RS-232-C Expansion board,

1. Loosen the strain relief clamp, and swing it out of the way if you have not already done so.

2. Insert the 9-pin connector into the channel on the Ethernet Combo board or RS-232-C Expansion board (see Figure 3-5).

3. Insert the 25-pin connector into the RS-232-C port on the modem or serial printer.

4. Tighten the jackscrews that secure the connectors in place.

5. If you are not attaching any more cables, position the strain relief clamp over the cables, and secure it to the chassis.

Summary

This chapter showed you how to connect peripherals to the S/320 and S/640. The next chapter shows you how to connect the power cables, power on the enclosure, and load the CTIX operating system.

RS-232-C
Channel 2
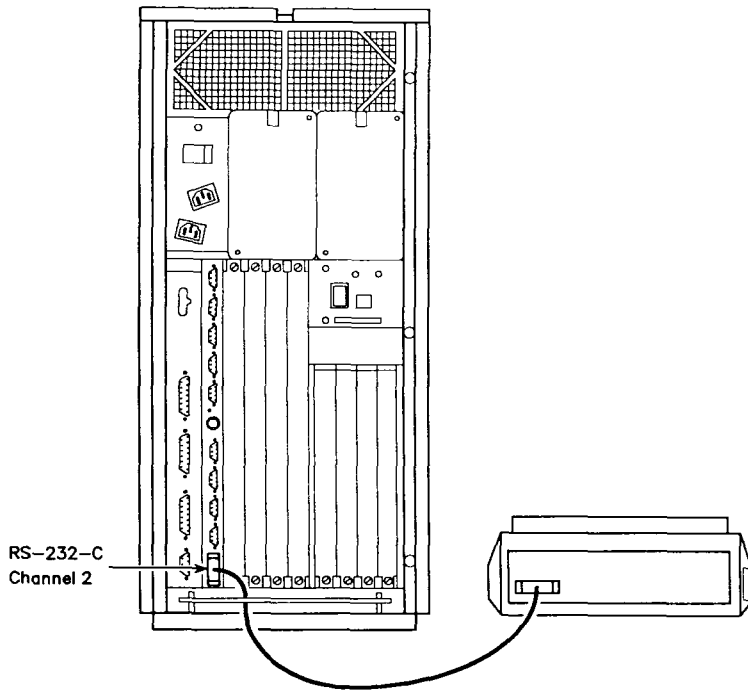
1065-008

Figure 3-5. Attaching a Serial Printer

4

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Booting Your System

This chapter shows you how to

- connect the power cable

- load the CTIX operating system

- turn on the power and initially boot your system

- start up PTs and GTs in Emulate mode

NOTE: The procedures discussed in this chapter pertain to initially booting the system and installing the CTIX operating system. At this time, if you have any expansion equipment to install, read chapters 6 through 8 before proceeding with this chapter.

Connecting the Power Cable

One end of the power cable must be inserted into the Power Supply Module. When you are looking at the rear of your system, the Power Supply Module is located in the upper left corner (see Figure 4-1).

To connect the main power cable:

1. Remove the power cable from its packing box.

2. Open the rear door.

WARNING

Check to see that your system is set for the correct voltage. The Power Supply Module contains a label that says

- *115 Volt Input*

- *230 Volt Input*

Make sure you are using the correct voltage.

3. Insert one end of the cable into the slot marked MAIN POWER on the Power Supply Module. (Make sure that the Power Switch is in the OFF position.)

4. Insert the other end of the cable into an ac power outlet.

5. Position the strain relief clamp over the terminal and power cables, and secure it to the chassis (see Figure 4-1).

6. If you installed the VME card cage, make sure that you also connected the VME power cable. Its proper connection is also illustrated in Figure 4-1.

7. Close the rear door.

Loading the CTIX Operating System

Before you can use your system, you must install the CTIX operating system. [Refer to the Release Notice for the CTIX operating system and the Installation tape, especially for Storage Module Drive (SMD) installation.]
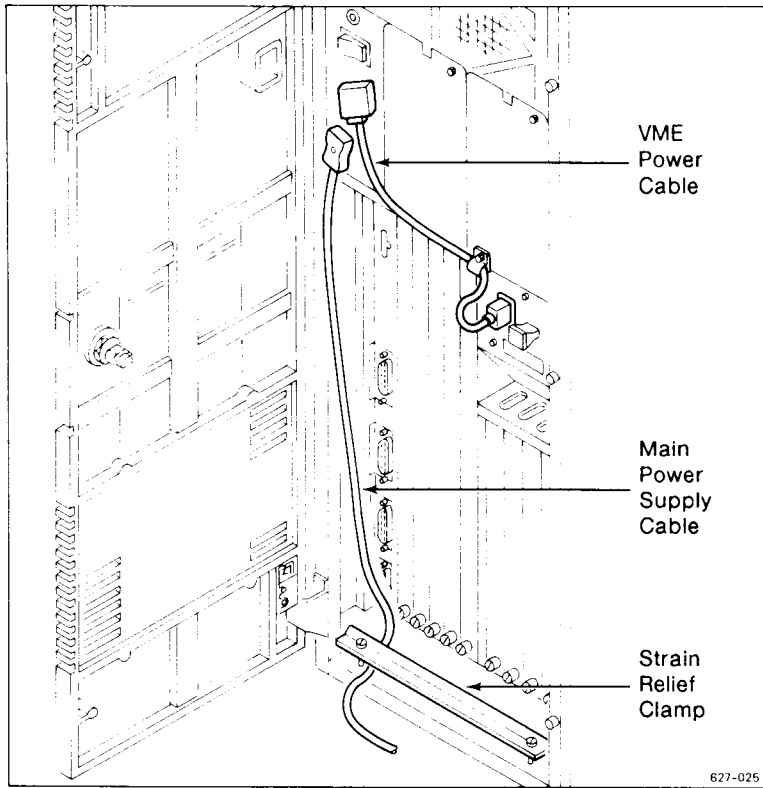
VME
Power
Cable

Main
Power
Supply
Cable

Strain
Relief
Clamp

627-025

Figure 4-1.   Connecting the Power Cable

To begin, insert the Installation tape into the tape drive as shown in Figure 4-2.
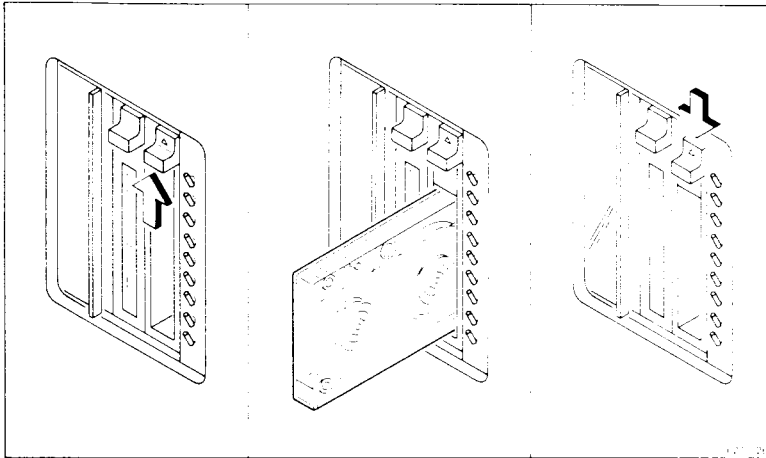

Figure 4-2.   Inserting an Installation Tape

Turning on the Power

When the Installation tape is in the tape drive, you can turn on the power. To do so, perform these steps:

1. Look for the small square hole in the upper left corner of the rear door. The Power switch is located here (see Figure 4-3).

2. Flip the Power switch to the ON position.

The fan should immediately come up to speed. If you move to the front of the computer, the nine indicators in the status panel flash their power-on sequence. (See Appendix A for an explanation of the status and error codes.) It takes about 30 to 40 seconds for the computer to power on.
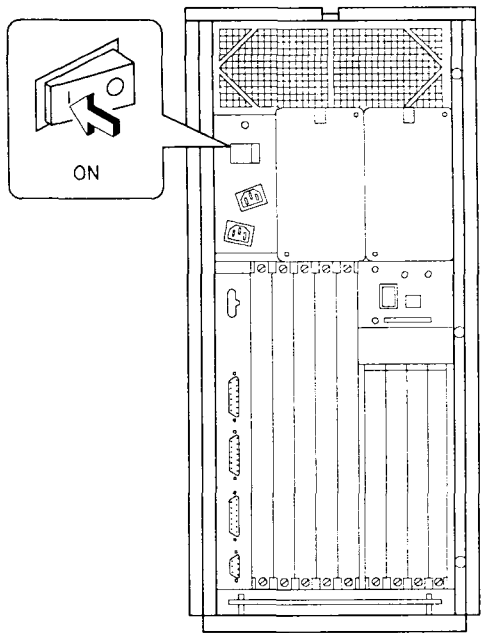
1065-009

Figure 4-3. Turning on the Power

NOTE: If you connected a PT or GT to Channel 0 on the Main Processor board, then you must start up that terminal in Emulate mode. If not, this error message is continually displayed on the terminal screen:

    E:AB

See "Starting up PTs and GTs in Emulate Mode" below for instructions on starting up your PT or GT in Emulate mode.

The following output appears on the screen of the terminal that is connected to Channel 0 on the Main Processor board:

    WELCOME TO MIGHTYFRAME CTIX
    Do you wish to continue and install
    the CTIX software on drive 0 ('yes' or 'no')?

To complete the installation of the CTIX operating system, refer to the Release Notice for the CTIX operating system.

Your system is now powered on. Refer to the *MightyFrame Series Administrator's Reference Manual* and the *MightyFrame Administrative Tools Manual* to properly configure the CTIX operating system for your needs.

Starting up PTs and GTs in Emulate Mode

If you connect a PT or GT to Channel 0 on the Main Processor board, that terminal must be started up in Emulate mode. Emulate mode causes the terminal to function as though it were communicating with your system on an RS-232-C line. To start up your PT or GT in Emulate mode:

1. Turn the terminal off.

2. Press the space bar down while you turn the terminal on. Continue to press the space bar down until the boot ROM prompt appears.

   The prompt from a PT with Version 2.0 boot ROM looks like this:

   ```
   V 2.0
   B,C,E,F,I,P,R,S,T,W:
   ```

   The prompt from a GT with Version 2.0 boot ROM looks like this:

   ```
   V 2.0
   T 222 F 801 R 09 P 00 I
   B,C,E,F,I,P,R,S,T,W:
   ```

   The prompt from a PT with Version 1.0 boot ROM looks like this:

   ```
   V 1.0
   B,C,E,F,M,R,S,T:
   ```

The prompt from a GT with Version 1.0 boot ROM looks like this:

```
V 1.0
T 222 F 801 R 09 P 00 I
B,C,E,F,I,P,R,S,T,W:
```

3. Press **E** (for Emulate) when one of these prompts appears.

The terminal now starts up in Emulate mode and functions likes an RS-232-C terminal. You can proceed to install the CTIX operating system as described in the Release Notice for the CTIX operating system.

Summary

This chapter showed you how to connect the power cable, load the CTIX operating system, and start up PTs and GTs in Emulate mode. The initial installation of your computer system is complete.

5

Powering Down and Restarting Your System

This chapter presents information on properly powering down your system. You must follow this procedure to prevent possible damage to the file system. (This procedure is also documented in the *MightyFrame Series Administrator's Reference Manual*.)

You need to power down your system whenever you

- install hard disk drives
- troubleshoot the system
- move the system to another location

To correctly power down your system, you will

- log in as root and find out who is using the system
- instruct everyone using the system to log out
- shut down the operating system
- power down the system

Information on properly restarting the S/320 and S/640 can be found at the end of this chapter.

Shutting down the Operating System

You must follow the sequence shown below in order to properly power down your system. Failure to do so may result in damage to the file system.

To properly shut down the operating system,

1. Type **root** and press **Return.**

2. Type the appropriate password and press **Return.**

3. Type **who** and press **Return.**

   A list of logged-in users appears on the screen. If other users are logged in, instruct them to log out before you continue with these steps. When you (root) are the only user logged onto the system, you can shut down all currently running processes.

4. Type **shutdown** and press **Return.** These messages appear on the terminal screen:

   SHUTDOWN PROGRAM

   Thu Jan 30 15:11:33 PST 1988

   Do you want to send your own message?:

5. Type **y** (for yes) or **n** (for no) and press **Return.** The shutdown program terminates all processes.

6. You can turn off the power when this prompt appears:

   OK to stop or reset processor

Shutting off the Power

Once you have shut down the operating system, you are ready to turn the power off.

NOTE: You must power off all SMDs attached to your system before turning the system power off.

To turn the power off,

1. Locate the power switch (see Figure 5-1).

2. Flip the switch to the OFF position.

You will immediately hear the fan stop, and the activity indicator on the front panel will no longer flash.
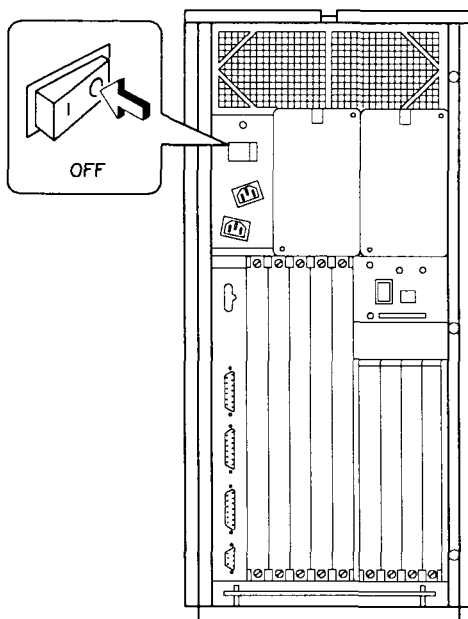
1065-010

Figure 5-1. Powering Down Your System

Restarting Your System

You are ready to turn the power back on to your system when the system is completely reassembled. To turn the power back on, simply flip the power switch to the ON position. The fans immediately come up to speed, and the indicators on the status panel flash their power-on sequence. After about 40 seconds, your system is ready for normal operation. If SMDs are attached to your system, power them up, and then reboot the system.

NOTE: When powering up systems containing one or more V-Boxes, use one of the following procedures to restart your system:

- *Hold the Reset switch on while turning the power on; then release the Reset switch.*

- *Power on the system, and then immediately reset it.*

6

Installing Expansion Boards

You can expand the memory and I/O capabilities of the S/320 and S/640 by installing any or all of the following expansion boards:

- four Memory Expansion boards

- four I/O Expansion boards (including 10- and 20-channel RS-232-C Expansion and Ethernet Combo)

- one RS-232-C IOP Expansion board or one RS-422 Expansion board

Before you install an expansion board, you must remove the blank panel from its respective slot in the local card cage. This chapter is therefore organized into these five topics:

- Powering down your system

- Removing blank panels

- Removing expansion boards (already installed in the card cage)

- Installing Memory Expansion boards

- Installing I/O Expansion boards

To install the VME card cage, VME Interface board, and VME Expansion cards, see Chapter 7, "Installing VME Equipment."

Powering Down Your System

You need to power down the S/320 or S/640 before you can install or re-
move an expansion board. See Chapter 5, "Powering Down and Re-
starting Your System," for instructions on properly powering down your
system.

Removing Blank Panels

In order to assure proper ESD/EMI and cooling performance, all empty
slots on both sides of the local card cage contain blank panels. You must,
however, remove the blank panel from a slot before you can install an
expansion board. Save the blank panels for future use.

Two captive screws secure each blank panel to the local card cage. Use
the steps below to remove blank panels from both the memory and I/O
sides of the local card cage.

1. Loosen each captive screw. (They remain attached to the
    blank panel.)

2. Remove the blank panel (see Figure 6-1).

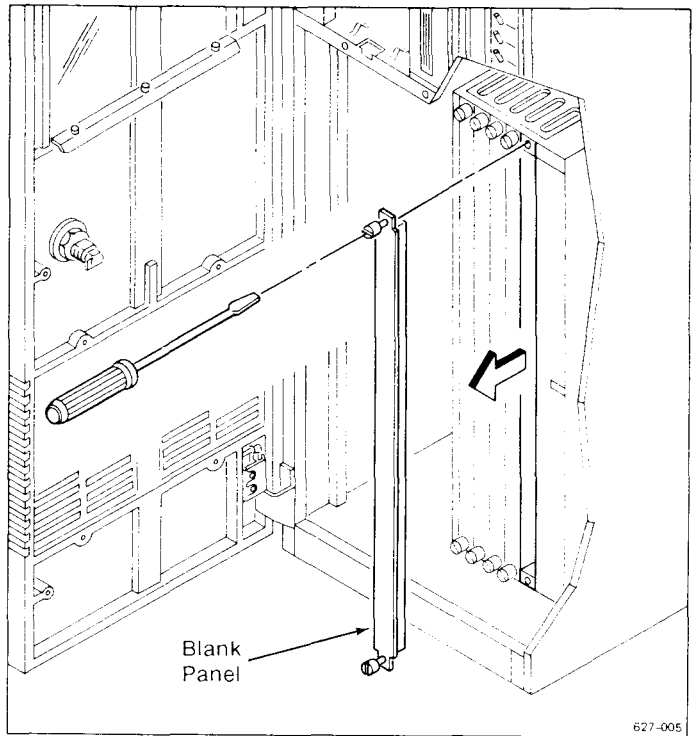*NOTE: Remember to leave blank panels in slots that do not contain
expansion boards.*

Figure 6-1.   Removing a Blank Panel

Removing an Expansion Board

If you are upgrading an expansion board, you may need to remove a board from the card cage. All expansion boards can be removed using the procedure below.

To remove an expansion board,

1. Disconnect all peripheral cables from the expansion board.

2. Using the 11/32-inch hex nut driver, loosen the jackscrew by turning it counterclockwise about 12 full revolutions.

3. Slide the board out of the card cage (see Figure 6-2).

4. If you are not installing another expansion board in this slot, install a blank panel in the following manner:

    a. Line up the two captive screws on the blank panel with the holes in the card cage.

    b. Tighten the captive screws with a flathead screwdriver.

NOTE: Blank panels must be installed in all vacant slots to assure proper ESD/EMI protection and cooling performance.
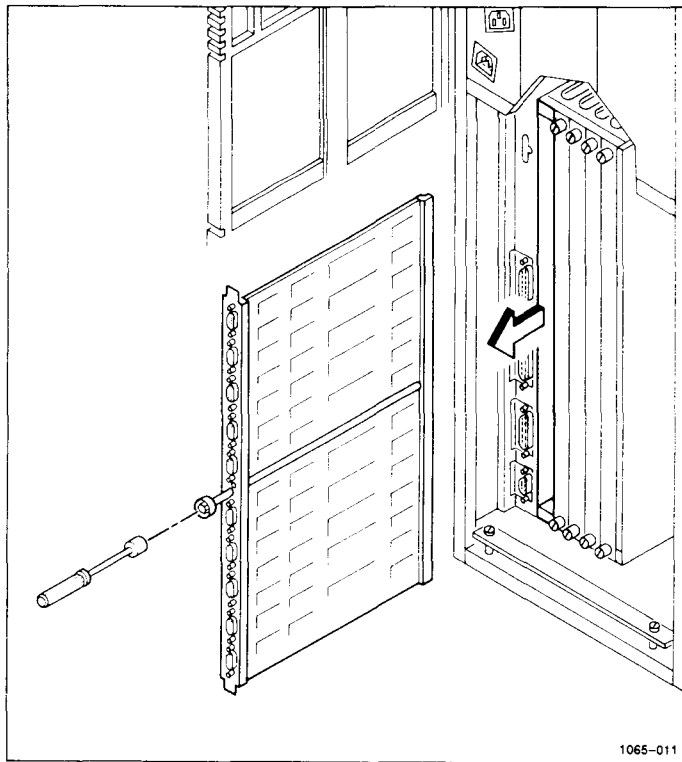
1065-011

Figure 6-2. Removing an Expansion Board

Installing Memory Expansion Boards

You can install up to four Memory Expansion boards in each system. The S/320 system can have 2- and 4-Mb boards. The S/640 can have 2-, 4-, and 8-Mb boards.

NOTE: All Memory Expansion boards for the S/640 can only be installed in the S/640. They cannot be installed in the S/320.

Similarly, S/320 Memory Expansion boards cannot be installed in the S/640.

Memory Expansion boards are installed in slots M1 through M4 on the memory, or front, side of the local card cage. Slot VME I/F is reserved for the VME Interface Adapter board only and does not support Memory Expansion boards.

For optimal performance, Memory Expansion boards should be installed contiguously from slot M1 through slot M4. Do not skip slots.

All Memory Expansion boards are installed the same way. To install a Memory Expansion board:

1. Open the front door.

2. Remove the blank panel from the slot.

3. Remove the Memory Expansion board from its box. The size of the board is denoted on the bottom of the board. The board must be installed so that this legend is located on the bottom of the board.

4. Slide the top and bottom edges of the board into the guides in the local card cage until the board meets a solid resistance (see Figure 6-3).

5. While holding the board, push it inwards, and use the 11/32-inch hex nut driver to tighten (turn clockwise) the jackscrew knob until it meets a solid resistance.

NOTE: Remember that blank panels must be installed in all vacant slots to assure proper ESD/EMI and cooling performance.
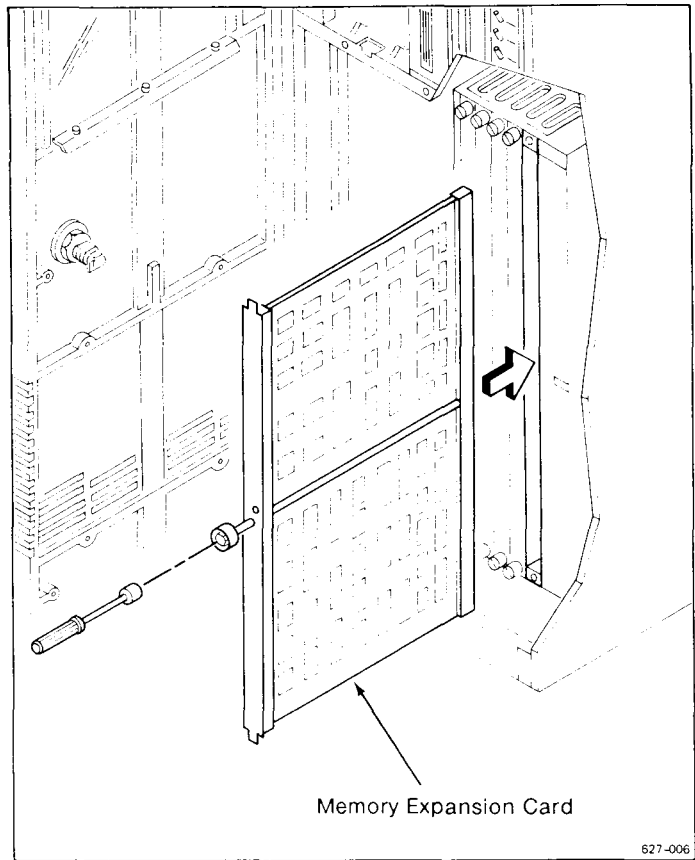
Memory Expansion Card

627-006

Figure 6-3. Installing a Memory Expansion Board

Installing I/O Expansion Boards

There are several types of I/O expansion boards that you can install. They are listed below and illustrated in Figure 6-4 (consult the current sales guide for a complete list of available boards).

- 10-channel RS-232-C
- 20-channel RS-232-C
- Ethernet Combo
- RS-422
- RS-232-C IOP Accelerator
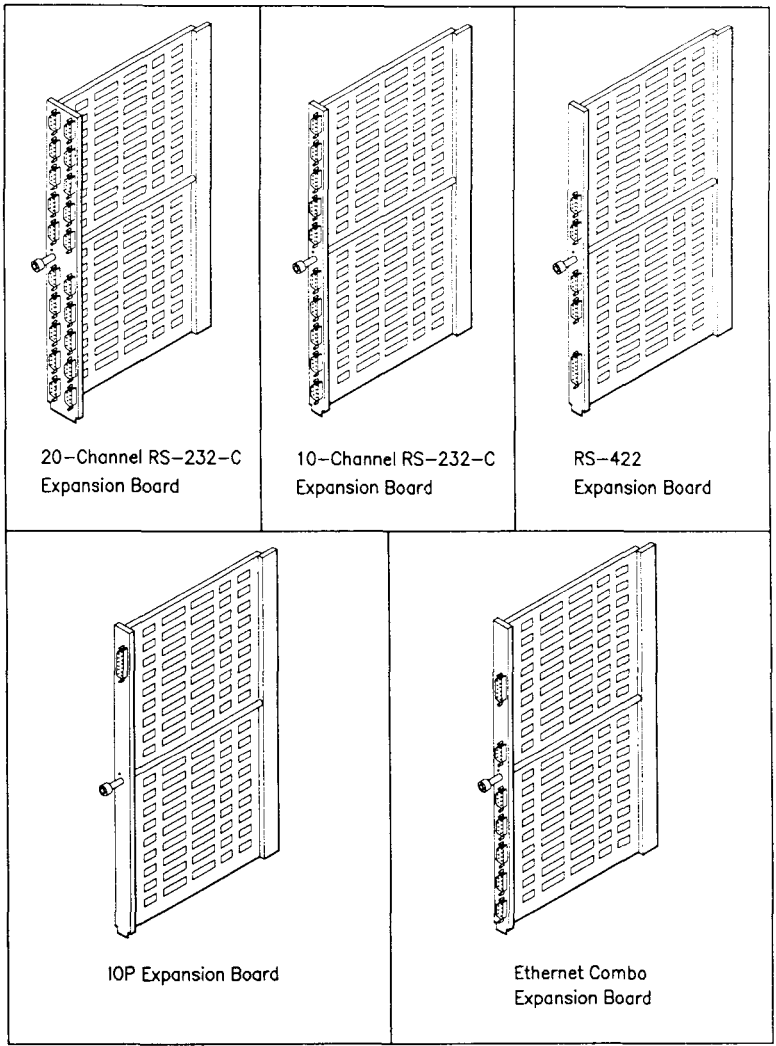
Figure 6-4. I/O Expansion Boards

20-Channel RS-232-C Expansion Board

10-Channel RS-232-C Expansion Board

RS-422 Expansion Board

IOP Expansion Board

Ethernet Combo Expansion Board

1065-012

Table 6-1 displays the slots into which these I/O Expansion boards can be installed.

When you install I/O Expansion boards, position each board so that the connector with the lowest number is at the bottom of the board. For example, Channel 2 on the 10- and 20-channel, RS-232-C Expansion boards should be at the bottom of the board.

Table 6-1
I/O EXPANSION SLOTS

Type of I/O Board	IO1	IO2	IO3	IO4	X5
RS-232-C 10-channel	x	x	x	x	
RS-232-C 20-channel*	x	x	x		
Ethernet Combo‡	x	x	x	x	
RS-232-C IOP Accelerator†					x
RS-422†					x

*The 20-channel, RS-232-C Expansion board occupies two slots in the card cage.

†You cannot install both the IOP and RS-422 Expansion boards in the same system because each can only be installed in slot X5.

‡In S/320 systems with the VME option installed, the Ethernet Combo board cannot be installed if an RS-422 Expansion board or IOP Expansion board is installed in slot X5.

To install an I/O Expansion board:

1. Open the rear door.

2. Remove the blank panel from the slot.

3. Remove the I/O Expansion board from its box.

4. Slide the board into the guides in the card cage until the board meets a solid resistance (see Figure 6-5).

5. While holding the board, push it inwards, and use the 11/32-inch hex nut driver to tighten (turn clockwise) the jackscrew knob until it meets solid resistance.

Remember that blank panels must be installed in vacant slots to assure proper ESD/EMI and cooling performance.

Summary

This chapter showed you how to install Memory and I/O Expansion boards. The next chapter shows you how to install the VME card cage, VME Interface board, and VME Expansion cards.

To connect peripherals to the expansion boards read Chapter 3, "Connecting Peripherals." To turn on the power, read Chapter 5, "Powering Down and Restarting Your System."
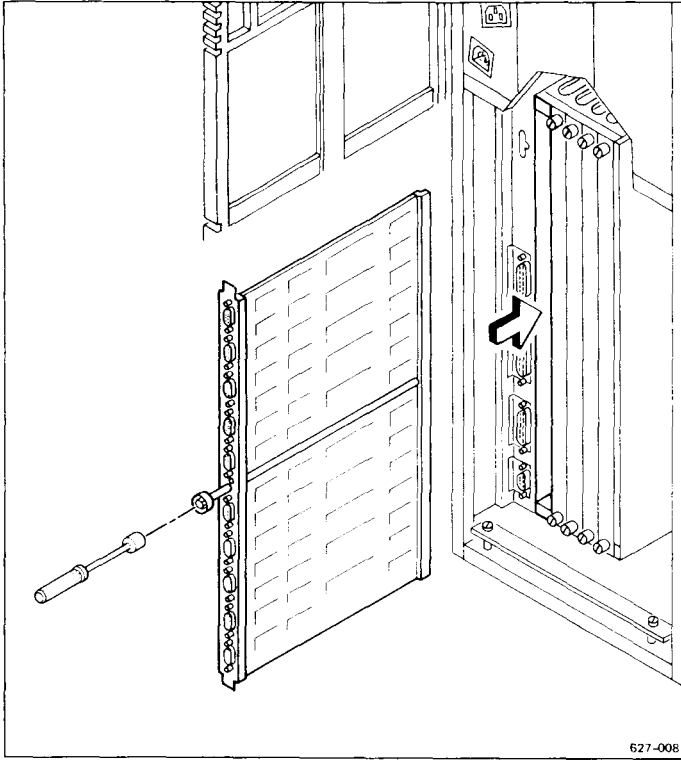
627-008

Figure 6-5. Installing an I/O Expansion Board

7
Installing VME Equipment

This chapter shows you how to install the VME card cage, the VME Interface board, and VME Expansion cards. You need the following equipment, contained in the VME Upgrade Kit (Part Number CV501), to completely install the VME card cage and make it operable:

- one VME card cage

- one VME power supply

- one VME power cable

- one VME Interface Adapter board

- one cable clamp

- three 1/4-inch, self-tapping screws

Powering Down Your System

You need to power down the S/320 or S/640 before you can install or remove VME expansion equipment. See Chapter 5, "Powering Down and Restarting Your System," for instructions on properly powering down your system.

Installing the VME Card Cage

To install the VME card cage, you must remove the top and left side panel from the enclosure as follows:

1. Move to the front of the computer, and open the front door.

2. To release the top panel, use the 1/4-inch hex nut driver to loosen the screw on the top panel latch. Rotate the screw counterclockwise, approximately one-half turn.

3. Push the top panel back about 1/2 inch to free the top panel from the cabinet. Lift the top panel straight up and off, as shown in Figure 7-1.

4. Remove the outer side panel on the left side of the enclosure. Grasp each side of the side panel, and lift it up 1/2 inch. Pull it towards you and away from the frame, as in Figure 7-1. Lay it aside.

Notice the two plates attached to the chassis (see Figure 7-2). You must remove these two plates before you can install the VME card cage. To remove the plate attached to the local card cage:

1. Gently lift the left side of the plate up slightly, and slide it about 1/2 inch towards the back of the enclosure. Lift the plate clear of the chassis, and set it aside for future use.

2. Remove the plate attached to the top of the I/O card cage. Use a 1/4-inch hex screwdriver to loosen the two screws that hold the plate in place (see Figure 7-2). Remove the screws and the plate, and set them aside for future use.

Caution: *Make sure that slots X5 (in the rear) and VME I/F (in the front) are empty. If not, slide the card that occupies each slot out 3 inches prior to installing the VME card cage.*

Left
Side
Panel

Top
Panel

Top
Panel
Latch

Right
Side
Panel
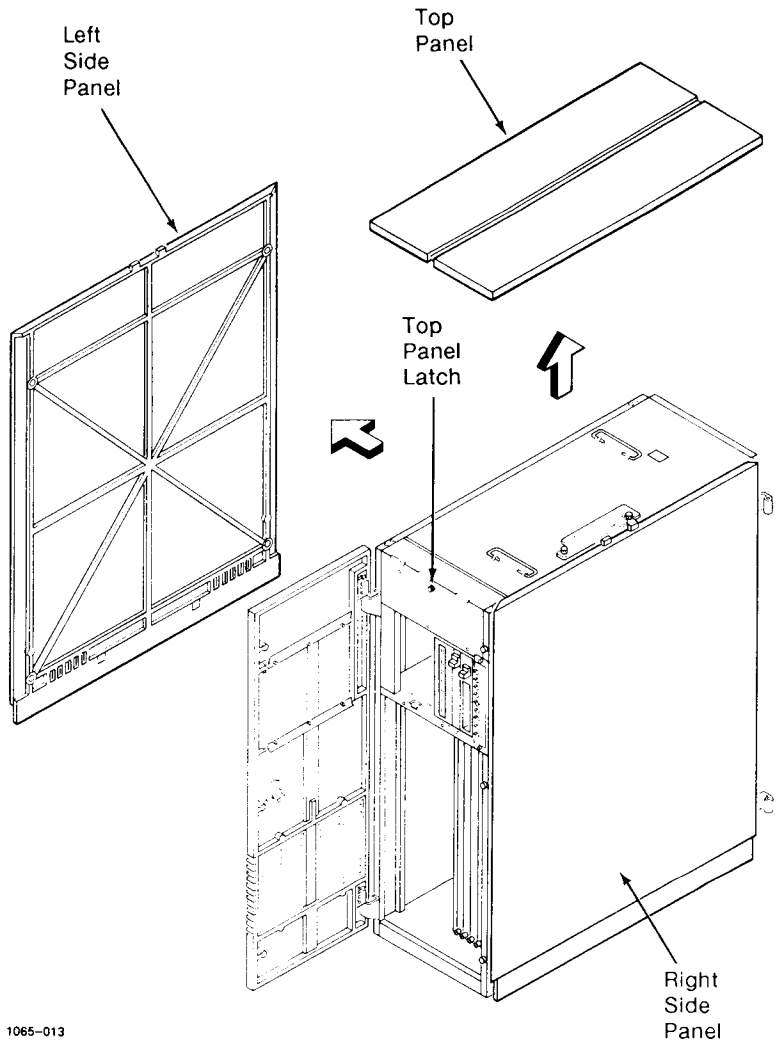
1065-013

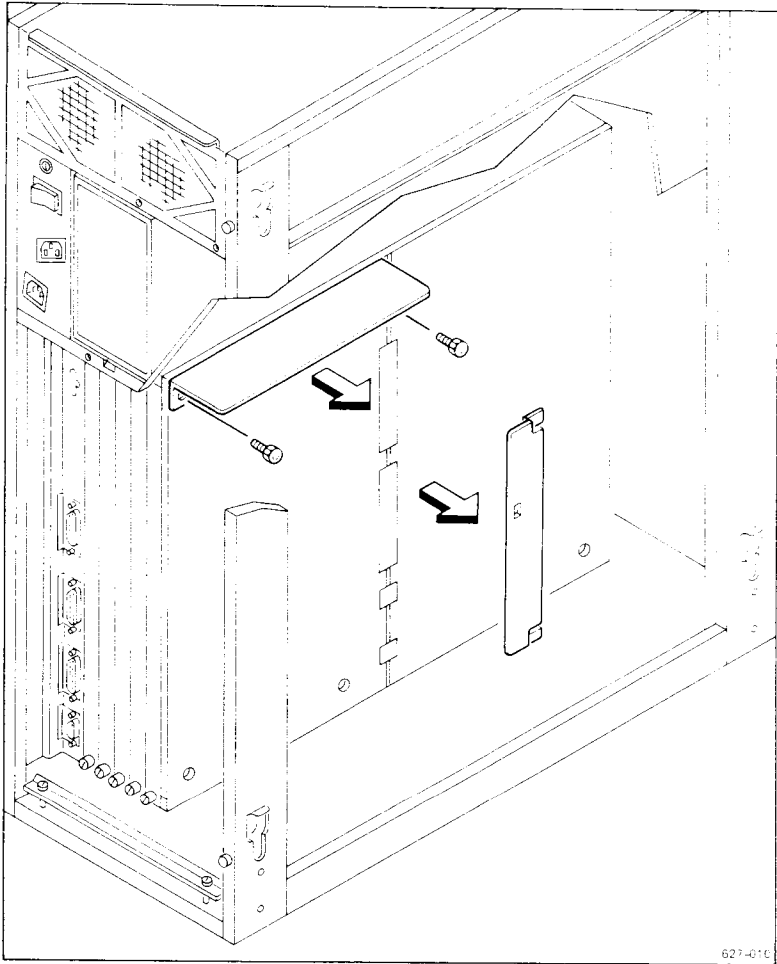**Figure 7-1.   Removing the Top and Side Panels**

Figure 7-2. Protective Plates

To install the VME card cage,

1. Carefully slide the VME card cage through the open side of the enclosure and into place, taking care not to damage the connectors on the VME card cage and local I/O card cage (see Figure 7-3).

2. Work the VME backplane notch into the I/O backplane, setting the VME card cage assembly into place (see Figure 7-4).

3. Use the 1/4-inch hex nut driver to tighten the four jackscrews that secure the VME card cage to the local card cage.

4. Install the two self-tapping screws that secure the VME card cage to the frame.
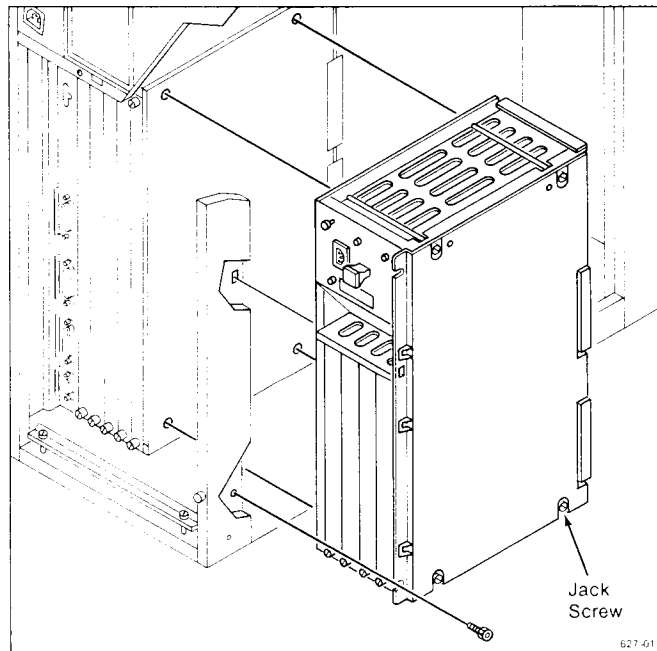
Figure 7-3. Positioning the VME Card Cage
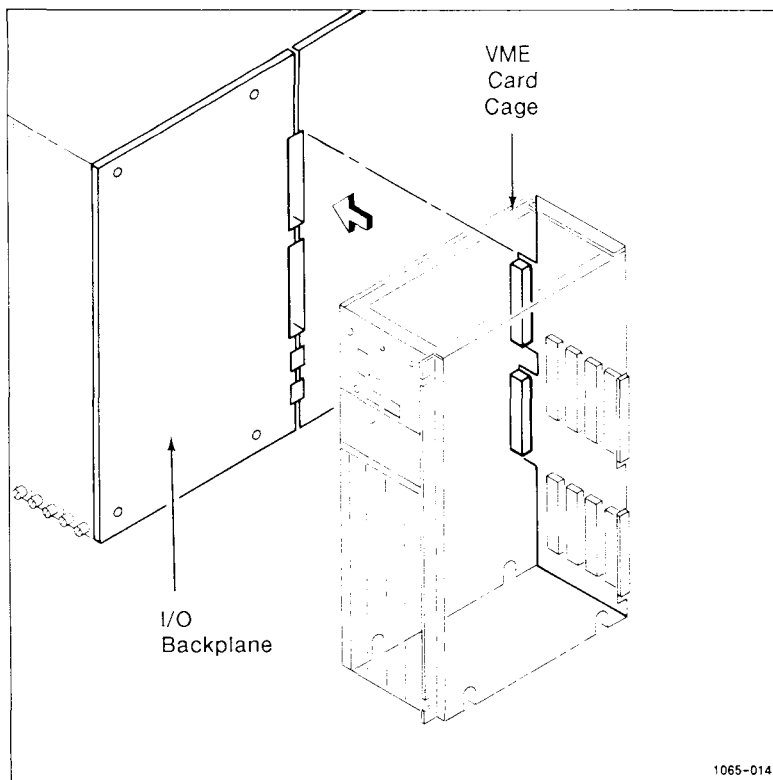
Figure 7-4. **Installing the VME Card Cage**

Follow the steps below to connect the VME power cable, as shown in Figure 7-5:

1. Attach the VME power cable to the frame with the cable clamp.

2. Plug the VME power cable into the Main Power Supply.

3. Plug the other end of the power cable into the VME Power Supply.

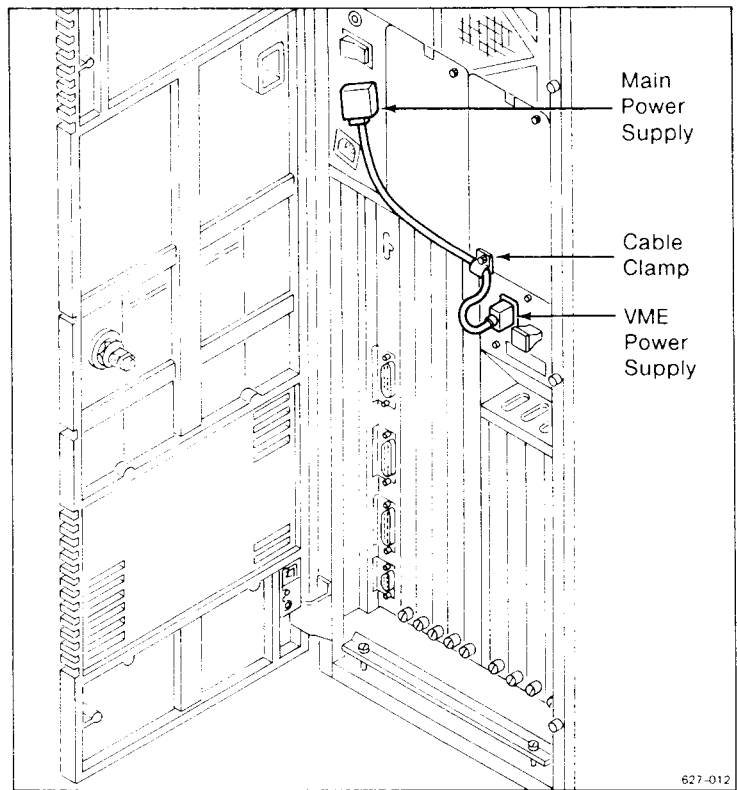4. Install the cable clamp using the hex head screw with the 1/4-inch hex nut driver.

Figure 7-5. Attaching the VME Power Cable

The VME card cage is now in place. If you want to install single-height VME Expansion cards and disk drives in your system, leave the outer panels off while you continue. If you do not want to install single-height cards and drives, replace the top and side panels before you continue, as follows:

1. Replace the left side panel.

2. Replace the top panel, and tighten the latch screw in the front of the cabinet to secure the panel in place.

Installing the VME Interface Adapter Board

To make the VME card cage operative, you must install the VME Interface Adapter board in slot VME I/F, which is located on the memory, or front, side of the local card cage.

NOTE: The VME Interface Adapter board is installed in slot VME I/F only. The VME card cage cannot function unless the VME Interface board is properly seated in the memory side of the local card cage.

1. Open the front door.

2. Use a flathead screwdriver to remove the blank panel from slot VME I/F.

3. Remove the VME Interface Adapter board from the packing container.

4. Slide the top and bottom edges of the board into the guides in the card cage until the board meets a solid resistance (see Figure 7-6).

5. While holding the board, push it inwards, and use the 11/32-inch hex driver to tighten (turn clockwise approximately 10 full turns) the jackscrew knob until it meets a solid resistance.

Installing VME Expansion Cards

The following information shows you how to install VME Expansion cards in the A-Box. You can also use the following instructions to install VME Expansion cards in the V-Box. See the *Expansion Cabinet Installation Manual* for details concerning the V-Box.
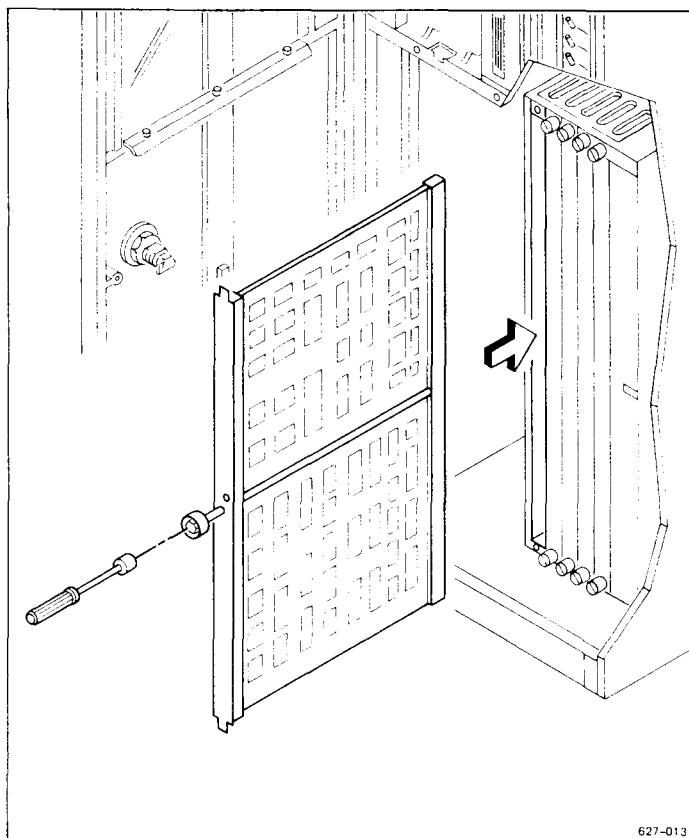
Figure 7-6.   Installing the VME Interface Adapter Board

There are several VME Expansion cards available, including the following (see the current sales guide for a complete list):

- Half-Inch Tape Controller

- Ethernet Controller

- SMD Controller

VME Expansion cards are installed in slots P6 through P9. The most natural way to install VME Expansion cards is contiguously from slot P6 through slot P9. However, slots can be skipped in order to group cards according to DMA or interrupt priority. Consult the IEEE VME Specification C.1 for details.

NOTE: The A-Box has certain limitations on the combination of VME Expansion cards that can be supported. Read Appendix G before installing VME Expansion cards to determine correct and incorrect configurations.

To install a VME Expansion card,

1. Open the rear door.

2. Use a flathead screwdriver to remove the blank panel from the slot (see Figure 7-7).

   NOTE: It may be easier to remove adjacent blank panels while you install VME Expansion cards. Be sure, however, to replace the blank panels.

   Additionally, some VME Expansion cards may need to be configured before you install them in your system. If so, consult the manual of the respective expansion card before you continue.

3. Remove the VME Expansion card from its packing container.

4. Slide the VME Expansion card into the VME card cage slot, jiggling the card vertically as you insert it.

5. Tighten the screws at the top and bottom of the card to secure it to the card cage.

6. If the VME Expansion card contains a bulkhead, you need not replace the blank panel. Otherwise, place the blank panel in exactly the same position it was in before you removed it.
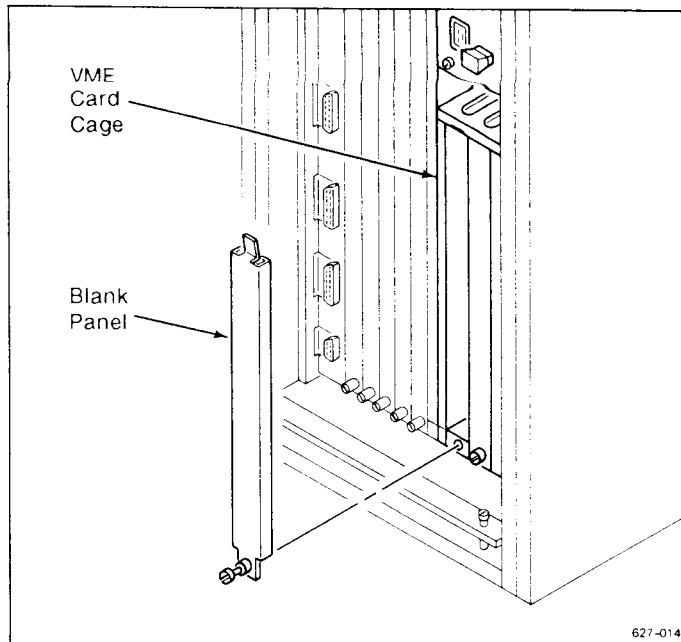
Figure 7-7. Removing a Blank Panel from the VME Card Cage

To make the card operable, you must remove the jumpers from their respective card cage slot.

1. Open the front door. Notice that the pins behind each VME card slot contain jumpers (see Figure 7-8).

2. Remove the jumpers from behind the slot into which you installed the VME Expansion card.

NOTE: Jumpers must be removed from behind those slots that contain VME Expansion cards. Leave the jumpers in place for those slots that do not contain VME Expansion cards.
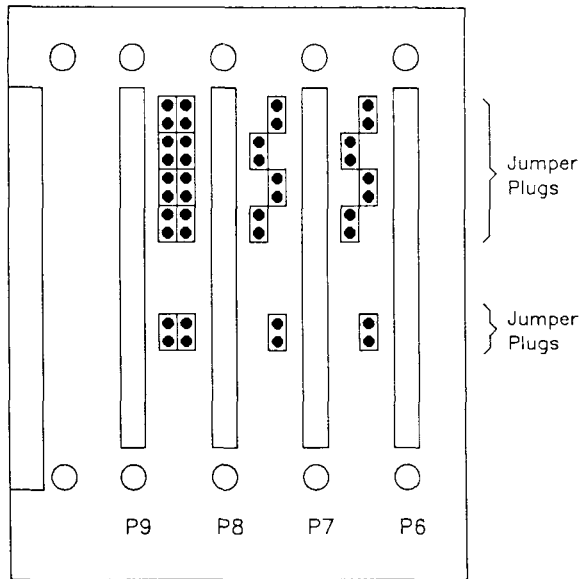
1065-015

Figure 7-8.   VME Card Cage Jumpers

SINGLE-HEIGHT VME EXPANSION CARDS

You must attach a single-card adapter to the VME card cage before you can install single-height VME Expansion cards. The single-card adapter provides space for two single-height VME Expansion cards. The following information shows you how to install the single-card adapter and single-height VME Expansion cards.

Single-Card Adapter

The left side panel should be removed from the enclosure before you install the single-card adapter. When the left side panel is removed:

1. Assemble the single-card adapter by snapping the two card guides to the sheet metal (see the instructions shipped with the single-card adapter upgrade kit).

2. Move to the open left side of the enclosure.

3. Place the single-card adapter against the backplane at the appropriate slot location in the VME card cage (see Figure 7-9). You can properly locate the adapter by orienting the two offset protrusions on the sheet metal with the offset holes on the backplane.

4. Use the screw that was supplied with the single-card adapter (see Figure 7-8) and, from the rear of the backplane, secure it to the VME card cage backplane.

When the single-card adapter is in place, you can install two single-height cards in one VME slot. The first card should be installed in the bottom half of the slot.

Single-Height Card

To install a single-height card:

1. Grasp the VME Expansion card, and insert it into the card slot (see Figure 7-9), jiggling the card vertically as you insert it.

2. Tighten the two screws on the VME Expansion card: one to the single-card adapter and the other to the VME card cage.

The single-height VME Expansion card is now installed. Use the steps above to install other single-card adapters and single-height VME Expansion cards.
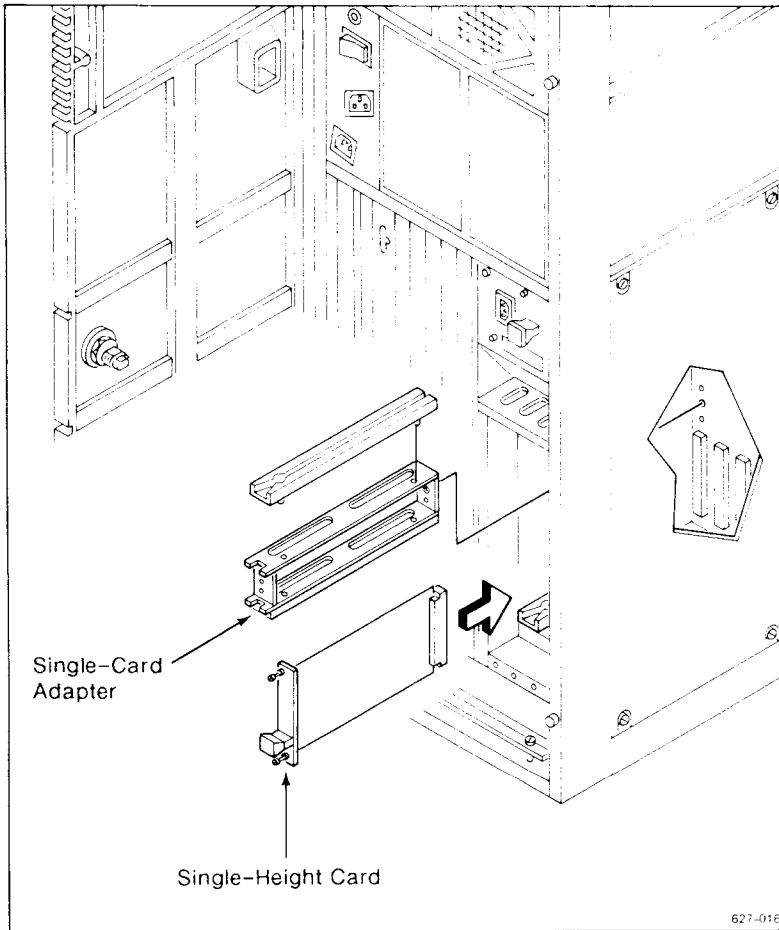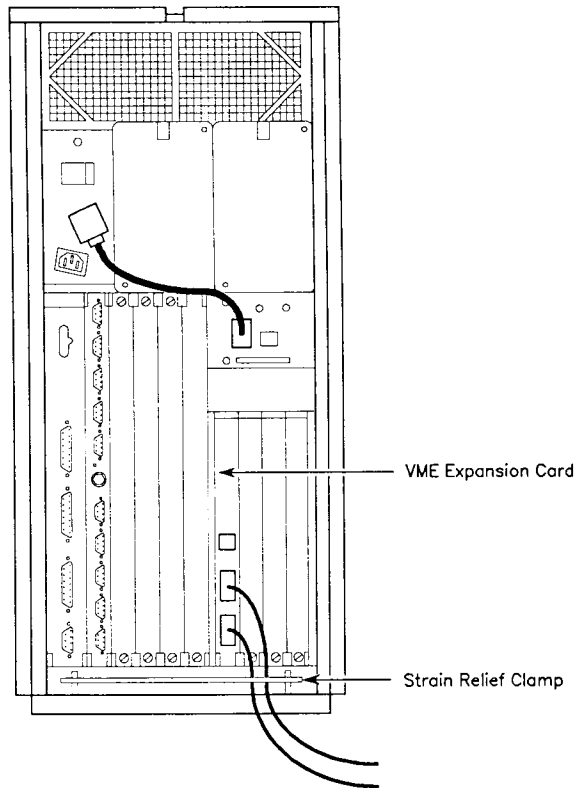
Single-Card
Adapter

Single-Height Card

627-016

Figure 7-9.   Single-Height VME Expansion Cards

CONNECTING PERIPHERALS

See the manual for each VME Expansion card for information on
connecting peripherals to the cards.   Remember to route the cables
under the strain relief clamp, as shown in Figure 7-10 (this is especially
important for half-inch tape and SMD cables).

Figure 7-10. Routing VME Expansion Card Cables

Summary

This chapter showed you how to install the four-slot VME card cage, the VME Interface Adapter board, and VME Expansion cards. It also showed you how to install single-height VME Expansion cards. The next chapter shows you how to install hard disk drives in the system.

If you are finished expanding your system, read Chapter 5 to turn on the power.

8

Installing Hard Disk Drives

The S/320 and S/640 contain four drive slots, labeled TAPE, D0, D1, and D2. Each system is shipped with one QIC (S/320) or SCSI (S/640) tape drive mounted in the slot labeled TAPE and one hard disk drive in slot D0. This chapter shows you how to install hard disk drives in slots D1 and D2.

Before starting, check to see that you have the following tools and equipment:

- hard disk drives
- 1/4-inch hex nut driver
- flathead screwdriver
- phillips screwdriver

In addition, there are three cables you must connect to each disk drive. The three cables, radial, daisy chain, and power, are already installed in the enclosure.

Powering Down Your System

You need to power down the S/320 or S/640 before you can install or remove disk drives. See Chapter 5, "Powering Down and Restarting Your System," for instructions on properly powering down your system.

Removing the Top and Side Panels

Before you install a hard disk drive, remove the top and side panels from the enclosure. If you are continuing from Chapter 4, then the top and left side panel have already been removed, and you can proceed directly to step 7.

To remove the top and side panels:

1. Open the front door.

2. Release the top cover. To do so, use the 1/4-inch hex nut driver to loosen the screw on the top cover latch. Rotate the screw counterclockwise, approximately one-half turn.

3. Push the top panel back about 1/2 inch to free the top panel from the cabinet. Lift the top panel straight up and off (see Figure 8-1).

4. Lay the panel aside.

5. Move to the QIC tape drive side, and grasp the side panel at both sides. Lift it straight up about 1/2 inch, and then pull the panel towards you until it is free of the cabinet (see Figure 8-1).

6. Lay the panel aside.

7. Repeat this procedure to remove the other side panel.

Top
Panel

Left
Side
Panel

Right
Side
Panel

627-017
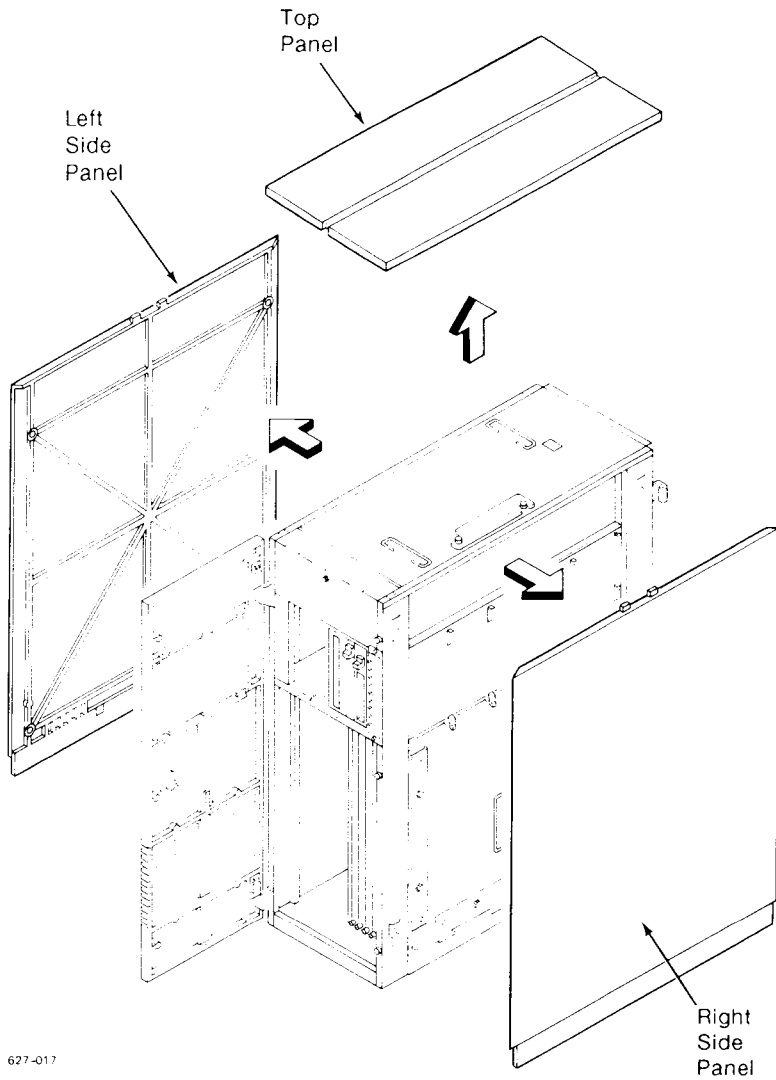
Figure 8-1.   Removing the Top and Side Panels

Next, you must remove the inner side panels. Each inner side panel is different. The side panel closest to the QIC tape drive has four tabs along the bottom edge that secure it to the CPU pan. The other panel has four differently notched tabs along its bottom edge that secure the panel to the frame. The instructions for removing each panel are the same.

To remove the inner side panel:

1. Loosen the two screws that secure each inner panel to the frame. Do not remove the screws completely; simply loosen them enough so that you can slide each panel up and out.

2. Place your fingers under the lip of the panel and push up; then pull the panel toward you (see Figure 8-2). Lay the panel aside.

Installing a Hard Disk Drive

The second and third hard disk drives are installed in slots D1 and D2, respectively. Slot D1 is in the rear of the enclosure, next to the existing hard disk drive. Slot D2 is in the front of the enclosure, next to the QIC tape drive. On the inside of the front and rear doors are attached the error maps for any installed disk drives. They are located according to labels D0, D1, and D2.

Steel plates are installed in all drive slots to assure proper ESD/EMI and cooling performance. However, they must be removed in order to install the hard disk drive. To do so, perform these steps:

1. Use the 1/4-inch hex nut driver to loosen the two screws that hold the plate in place, and then remove the plate (see Figure 8-3).

2. Lay the plate aside, because you will replace it after the drive is installed.

NOTE: Some systems require that the screws securing the plate be removed altogether. In these cases, the steel plate need not be replaced, as explained later in this section.
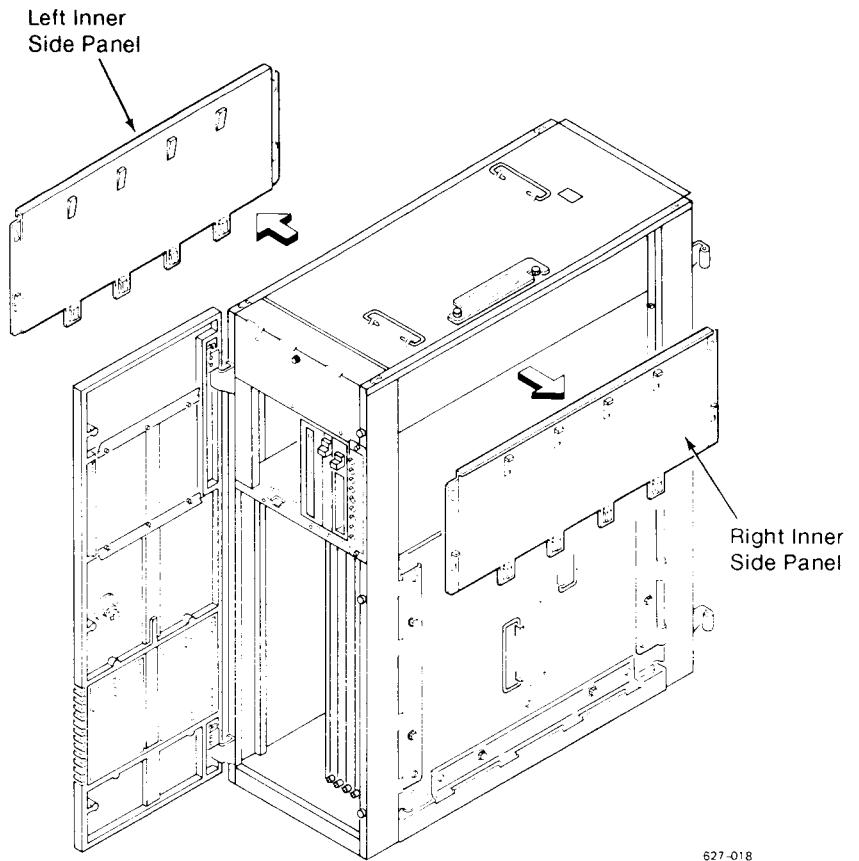
Left Inner
Side Panel

Right Inner
Side Panel

627-018

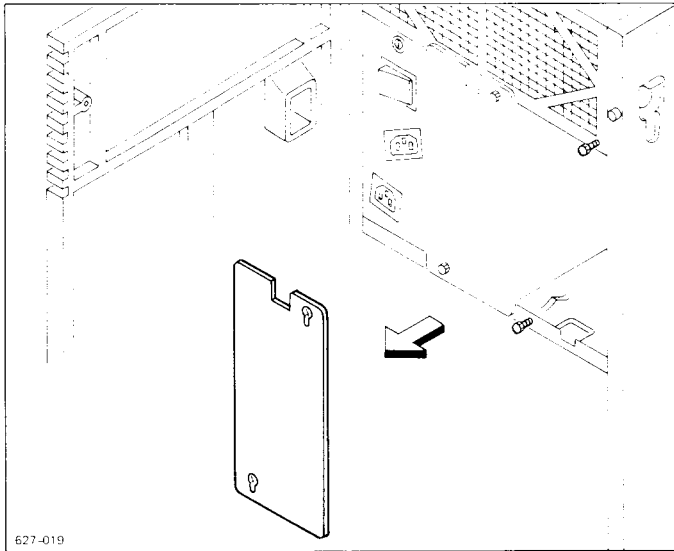**Figure 8-2.** **Removing the Inner Side Panels**

Figure 8-3. Removing the Steel Plate

To install the hard disk drive:

1. Remove the hard disk drive from its shipping container.

2. Remove the small plastic bag from the drive, and save the enclosed error map.

> *NOTE: Some systems do not have copies of their respective disk drive error maps attached to the inside of the front and rear doors. In these cases, remove the small plastic bag from the disk drive before you install it, and attach it to the correct position on the respective door.*

3. Position the drive so that the cable connectors are closest to the CPU pan assembly. See the *MightyFrame Peripherals Manual* for more information on your drive. Figure 8-4 contains an example of positioning a drive.
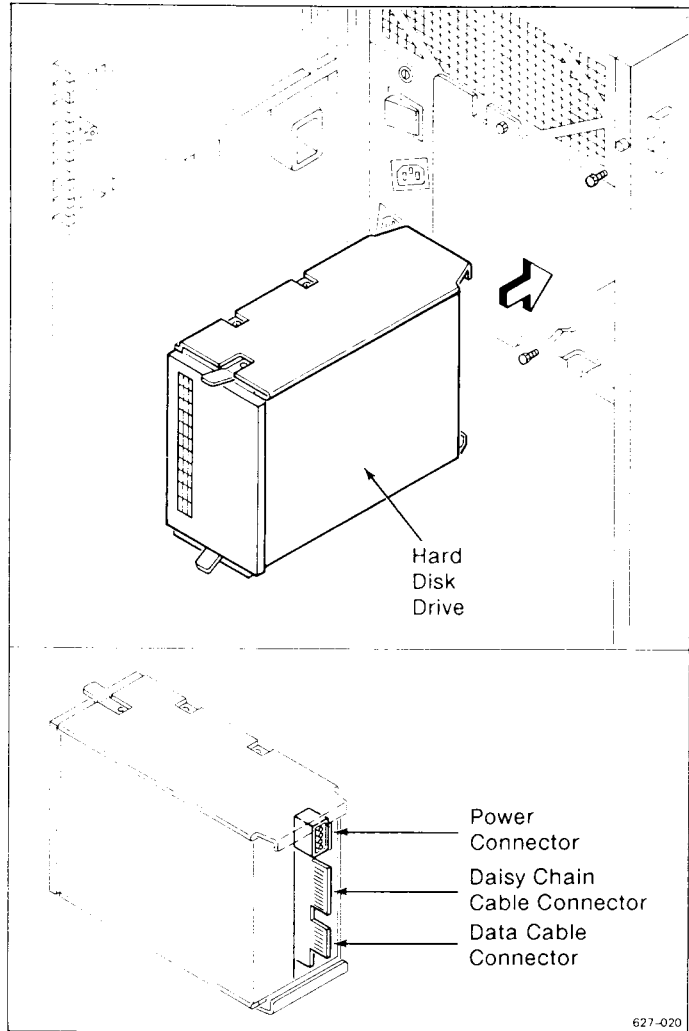
Figure 8-4. Installing a Hard Disk Drive

There are two rows of extruded, or raised, guides along the top and bottom of each drive slot. These guides form the path into which you slide the disk drive.

The mounting bracket on the drive contains ridges on both the top and bottom. Those ridges fit between the guides to secure the disk drive in place.

NOTE: It is easier to connect the three cables in the enclosure to the disk drive before you slide the drive all the way into the slot. You should leave about 2 inches of the disk drive outside the cabinet.

To connect the drive cables:

1. Slide the drive into the drive slot until about 2 inches of the drive remain outside the enclosure.

2. Connect the three cables as shown in Figure 8-5. Make sure that the cables lie on the inside of the vertical bar that is situated behind the drive.

3. After you connect the cables, push the drive all the way into the slot until the locking spring on the bottom of the drive snaps into the slot on the chassis.

4. Replace the steel plate over the drive. Tighten the two screws that hold it in place.

Once the drives are securely in place, you can reassemble the enclosure.

1. Replace the inner side panels. (Recall that each one is different.) Install the inner side panel with the four tabs next to the CPU pan assembly. Tighten the two screws that hold each panel in place.

2. Replace the side and top panels.

Summary

This chapter showed you how to install hard disk drives. See Chapter 5 to turn on the power. Also, refer to the *MightyFrame Series Administrator's Reference Manual* for information on configuring the new drives.
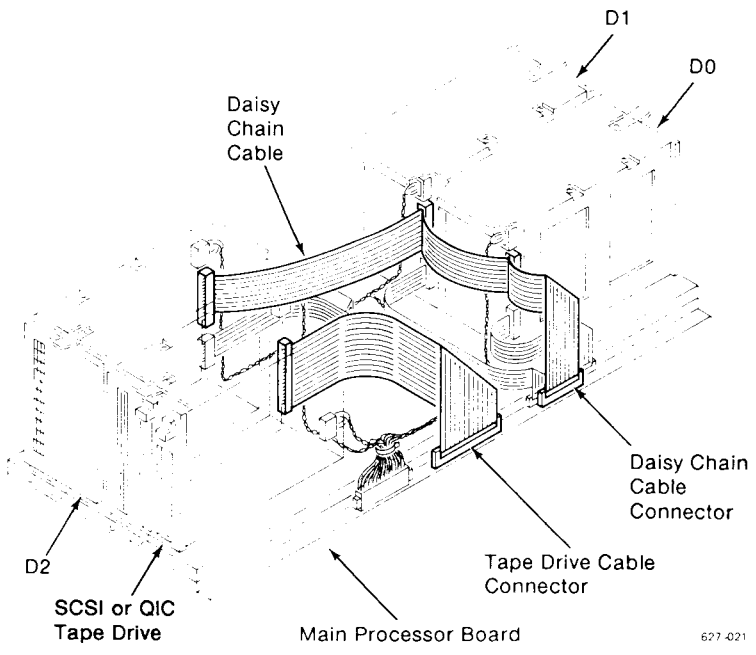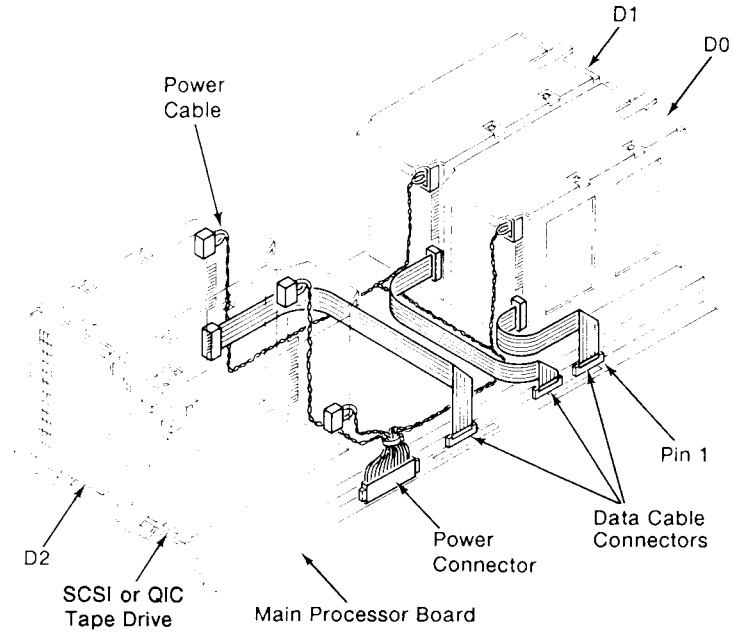
Figure 8-5.   Connecting the Disk Drive Cables

Appendixes

A
System Status Codes

This appendix contains a summary of the S/320 and S/640 bootstrap sequence.

Front Panel Display

The boot sequence is activated when the S/320 or S/640 is powered on or reset. The front panel, shown in Figure A-1, is identical for each system and contains the power and eight status LEDs.

- LED4 through LED0 illustrate the boot sequence error and status codes. LED4 is the MSB; LED0 is the LSB.

- LED5 lit indicates the CPU is executing from ROM. LED5 off indicates the CPU is executing from RAM. (During normal operation, LED5 lit indicates the CPU is in User mode.)

- LED6 lit indicates the CPU is executing LOADER in "C." (During normal operation, LED6 is an idle status indicator.)

- LED7 is lit when LED4 through LED0 display an error code; LED7 is off when LED4 through LED0 display a status code.

During the boot sequence, the eight status LEDs cycle through the bootstrap sequence. LED7 should be off (indicating the display is a status code and not an error code).
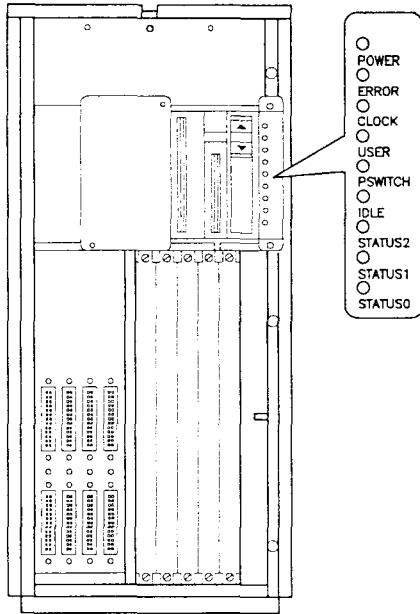
1065—019

Figure A-1.   S/320 and S/640 Front Panel

S/320 Status Codes

The following steps describe the boot sequence. The step number refers to the LED status code that appears while the step is being executed. During some steps, the CPU executes more than one task.

Code	Action Performed by CPU
00h	Reset LEDs. Open page 00h. Save CPU registers and memory map.
01h	Unused.
02h	Page RAM address pattern test, read/write.
03h	Page RAM inverse address pattern test, read/write.
04h	Page RAM 0B's pattern test, read/write.
05h	Page RAM 1B's pattern test, read/write.
06h	Save BSS.
07h	Enter C. Disable interrupts.
08h	Save crash dump table.
09h	Sizing memory.
0Ah	Attempt once to initialize tape controller. Go to 0Dh if successful.
0Bh	Reload EEPROM. Call VME initialization area. Make one attempt each to recalibrate all drives.
0Ch	Continue attempting to recalibrate drives. Will hang here if the QIC tape drive is nonoperational. Will go to 0Eh when successful.
0Dh	Dump from memory to tape; then go to 10h.
0Eh	Search once for dump area on disks. If unsuccessful, go to 10h.

Code	Action Performed by CPU
0Fh	Dump physical memory to disk.
10h	Base RAM address pattern test. Read/write without parity.
11h	Base RAM inverse address pattern test. Read/write without parity.
12h	Base RAM address pattern test. Read/write with parity.
13h	Base RAM inverse address pattern test. Read/write with parity.
14h	Base RAM address pattern with 0x1000000 test Read/write with parity.
15h	Expansion memory address pattern test. Read/write with parity.
16h	Expansion memory inverse address pattern test. Read/write with parity.
17h	Expansion memory address pattern with ORed bit test. Read/write with parity.
18h	Search QIC and onboard disks once for Loader. Go to 1Eh if successful.
19h	Rewrite EEPROM to memory. Attempt once each to recalibrate all drives. Go to 1C if successful.
1Ah	Continue attempting to recalibrate all drives.
1Bh	Unused.
1Ch	Search for Loader on all disks. Go to 1E when successful.
1Dh	Unused.
1Eh	Load Loader.
1Fh	Executing Loader (from QIC).

S/320 Error Codes

Table A-1 lists the bootstrap sequence error codes.

Table A-1

S/320 BOOTSTRAP ROM SEQUENCE ERROR CODES
(Page 1 of 2)

Code	Status
01h	8259 read-back error.
02h	Base RAM read/write 0Bs and 1Bs at 0xFF0 failed.
03h	Unexpected NMI during memory sizing.
04h	QIC tape status shows fatal error.
05h	Not enough good physical memory to map loader (128K bytes required).
06h	NMI: Page frame number does not match expected number during memory sizing.
07h	Parity error during sizing on any memory board.
10h	Error during base RAM address pattern test. Read/write without parity.
11h	Error during base RAM inverse address pattern test. Read/write without parity.
12h	Error during base RAM address pattern test. Read/write with parity.
13h	Error during base RAM inverse address pattern test. Read/write with parity.
14h	Error during page RAM address pattern read/write test.
15h	Error during page RAM inverse address pattern read/write test.

Table A-1

S/320 BOOTSTRAP ROM SEQUENCE ERROR CODES
(Page 2 of 2)

Code	Status
16h	Error during page RAM address test.
17h	Error during page RAM 0B's pattern read/write test.
18h	Error during page RAM 1Bs pattern read/write test.
19h	Error during RAM address stack and BSS (b000 to 16000) read/write without parity test.
1Ah	Error during RAM inverse address stack and BSS (b000 to 16000) read/write without parity test.
1Bh	Error during RAM address and ORed 1B read/write without parity test.

S/640 Boot Sequence and Status Codes

A system reset or power-up resets the General Control register, driving all of its outputs low. All of the LEDs light, and bit 3, RT– (ROM Transpose), is asserted. Shortly after the reset pulse, the CPU outputs the reset address, $00000000. RT– maps $00000000 to $80000000, the ROM base address.

The CPU obtains a longword vector address and stack value from $80000000. The vector points to the starting address of the bootstrap routine. The CPU then begins executing the routine.

The following steps describe the boot sequence. The step number refers to the LED status code that appears while the step is being executed. During some steps, the CPU executes more than one task.

Code	Action Performed by CPU
00h	Negates RT– and resets all LEDs except LED5+ (in-PROM indicator).
	Initializes memory board(s).
	Tests location 0 in the memory cache (at $48000000) to verify that the memory cache is functional.
	Saves internal register contents in the memory cache.
	Turns on the internal (CPU) instruction cache.
01h	Flushes the data cache through unmapped memory accesses, clearing all dirty bits.
02h	Tests the memory cache to verify that all dirty bits are cleared.
03h	Tests memory cache data RAMs (starting at $48000000).
04h	Checks dirty bits at every memory cache location. All should be set.
05h	Tests memory cache tag RAMs. (This also initializes tags for step at code 0Ah, below.)
06h	Tests complete memory cache circuitry through unmapped accesses.
07h	Tests PTC tag RAMs.
08h	Tests PTC data RAMs.
09h	Tests DMA mapper RAMs.

Code	Action Performed by CPU

0Ah   Tests memory cache through PTC; first initializes PTC tag and data RAMs, and then tests memory cache through PTC (starting at initialization starting address).

0Bh   Tests PROM BSS and stack area (first time that memory boards are checked).

0Ch   Tests PROM BSS and stack through MMU.

0Dh   Leaves assembler part of PROM.

0Eh   Begins executing in C code. Turns on LED6.

    Makes a unity map and clears the BSS.

    Initializes RS-232-C channel 0, and prints out following message (which indicates that the CPU is executing from the PROM bootstrap program at the indicated version level):

        MightyFrame II Version X.X

    Masks out interrupts from the 8253 timer and tests the 8259 interrupt controller.

0Fh   Saves the contents of the crash dump table. (When it anticipates a crash, the CPU loads the crash dump table with Kernel status information.)

10h   Direct tests physical memory to determine memory size.

11h   Initializes the SCSI controller and attempts to read the volume home block off the SCSI peripheral (base system SCSI peripheral is QIC tape). If the tape contains a dump area, the CPU advances to step 14h.

Code	Action Performed by CPU

12h   Turns off the internal instruction cache and then checks to see if the VME Interface board EEPROM is available. If it is, the CPU copies the contents of the EEPROM to memory and then turns the cache back on. The CPU makes one attempt each to recalibrate the tape and disks in the following order:

1. SCSI peripheral (QIC tape)

2. onboard disk

3. bootable VME disks (if one is present; EEPROM directed)

If the CPU is successful, it goes to step 15h.

13h   Continues to try to recalibrate a tape or disk, meanwhile displaying the code 13h. When successful, the CPU goes to step 15h.

14h   If tape contained a dump area (from step 11h), the CPU dumps memory to tape and then advances to step 17h.

15h   The CPU searches for a dump area on onboard disks, then VME disks, examining each disk once. If the CPU cannot find a disk dump area, it advances to step 17h.

16h   Dumps memory to disk.

17h   Tests physical memory.

18h   Searches for a loader program (Loader) on tape or an onboard disk, examining each drive once. If the CPU finds Loader, it goes to step 1Eh.

Code	Action Performed by CPU

19h   Turns off the internal instruction cache and then checks to see if the VME Interface board EEPROM is available. If it is, the CPU copies the contents of the EEPROM to memory and then turns the internal cache back on. The CPU makes one attempt each to recalibrate the tape and disks in the following order:

1. SCSI peripheral (QIC tape)

2. onboard disk

3. bootable VME disks (if one is present, under direction of the EEPROM)

The CPU advances to step 1Ch if it is successful.

1Ah   The CPU continues to try to recalibrate a tape or disk drive, meanwhile displaying the code 1Ah. The CPU advances to step 1Ch, if it can recalibrate a tape or disk.

1Bh   Not used.

1Ch   The CPU searches for Loader in the following order.

1. SCSI peripheral (QIC tape)

2. onboard disk

3. bootable VME disks (if present, under direction of the EEPROM)

The CPU advances to step 1Fh when it finds Loader.

1Dh   Not used.

1Eh   The CPU loads Loader.

1Fh   The CPU begins executing from LOADER. The bootstrap sequence is completed.

S/640 Error Codes

Table A-2 lists the bootstrap sequence error codes.

Table A-2
S/640 BOOT ROM SEQUENCE ERROR CODES

Code	Status*
00h	Memory cache is not functional (00h)
02h	Dirty bits did not clear (02h)
03h	Bad memory cache data RAMs (03h)
04h	Dirty bits did not set (04h)
05h	Bad memory cache tag RAMs (05h)
06h	Bad memory cache RAMs (06h)
07h	Bad PTC tag RAMs (07h)
08h	Bad PTC data RAMs (08h)
09h	Bad DMA mapper (09h)
0Ah	Failed memory-cache-through-MMU test (0Ah)
0Bh	Bad memory (0Bh)
0Ch	Failed memory-through-MMU test (0Ch)
0Eh	8259 read-back error
0Fh	Unexpected NMI during sizing
10h	SCSI tape shows fatal error
11h	Not enough physical memory for Loader†
12h	NMI‡
13h	Hard memory error during sizing
14h	Memory board test error

*Parenthetic code indicates boot sequence step.

†128K bytes of good memory are required.

‡Page frame number does not match expected number, created during memory sizing.

B

S/320 and S/640 Specifications

This appendix contains two tables that summarize the power and environmental requirements and physical measurements of the S/320 and S/640.

Table B-1

S/320 AND S/640 POWER
AND ENVIRONMENTAL REQUIREMENTS

115 volts

    Voltage range   85 to 130 Vrms 8A
    Frequency range   47-63 Hz

230 volts

    Voltage range   180 to 260 Vrms 4A
    Frequency range   47-63 Hz

Temperature

    Operating   10°C to 40°C
    Nonoperating   -40°C to 60°C

Humidity

    Operating   20% to 80% RH*
    Nonoperating   5% to 95% RH*

Altitude

    Operating   0 to 10,000 feet
    Nonoperating   0 to 30,000 feet

*Relative humidity, noncondensing

Table B-2
S/320 AND S/640 CABINET MEASUREMENTS

Cabinet	Height	Width	Depth
A-Box	29 inches 73.66 cm	11.5 inches 29.21 cm	26 inches 66.04 cm
X-Box or V-Box	29 inches 73.66 cm	16 inches 40.64 cm	26 inches 66.04 cm

C

Cable Specifications

This appendix defines specific hardware and software characteristics applicable to the S/320 and S/640 for the following:

- parallel printer interface

- RS-232-C communications interface

- RS-422 cluster communications interface

For each interface, the following will be provided: a description of its function and pin assignments, cabling diagrams, and a list of parts required to build the cable.

A list of recommended vendors for cables and cable hardware is included at the end of this appendix.

NOTE: To ensure compliance with FCC and VDE emissions regulations, peripherals connected to the S/320 and S/640 systems must use Convergent Technologies (or equivalent) recommended terminators and cables. The cables incorporate special bulk cable and shielding terminations (that is, 360° shielding from connector shell to connector shell with low energy leakage). Off-the-shelf cables and terminators may not provide the shielding required to meet FCC and VDE emissions requirements. It is the user's responsibility to do whatever testing is required to assure overall system compliance.

Parallel Printer Interface

The parallel printer interface provides a Centronics-compatible interface to parallel-interface printers. The parallel line printer can be connected to the connectors that are labelled Parallel Printer on the main CPU board, the RS-422 Expansion board, and the IOP Expansion board.

INTERFACE SIGNALS

The parallel printer interface supports the following signals:

Signal	Function
LPT0+ to LPT7+	Eight bits of data sent from the S/320 or S/640 to the printer
LPTSTROBE-	Handshake line from the S/320 or S/640 to the printer
LPTACK-	Acknowledge signal from the printer to the S/320 or S/640 indicating that a character has been accepted and that another one can be sent
LPTBUSY+	Status line to the S/320 or S/640 indicating that the printer cannot currently accept data
LPTNOPAPER+	Status line to the S/320 or S/640 indicating that the printer is out of paper
LPTSELECT+	Status line to the S/320 or S/640 indicating that the printer has been selected, has paper, and is ready to print

PARALLEL PRINTER CABLING

Assembly: Parallel printer cable

Function: Connects parallel printers to the S/320 and S/640

Pin Assignments:

A S/320 or S/640 (plug)	B Printer (plug)	Assignment
1 ⟶	2	LPT0+
2 ⟶	3	LPT1+
3 ⟶	4	LPT2+
4 ⟶	5	LPT3+
5 ⟶	6	LPT4+
6 ⟶	7	LPT5+
7 ⟶	8	LPT6+
8 ⟶	9	LPT7+
9 to 11 ⟷	21 to 23	GND (spare conductors)
12 ⟷	24	LPPRESENT-
13, 15 ⟷	25, 26	GND (spare conductors)
14 ⟶	1	LPTSTROBE-
16 ⟵	10	LPTACK-
17 ⟵	11	LPYBUSY+
21 ⟵	12	LPTNOPAPER+
22 ⟵	13	LPTSELECT+
23, 24 ⟷	19, 20	GND (spare conductors)
25 ⟷	17	Chassis ground (shield)

1065-024

Parallel Printer Cable Construction:
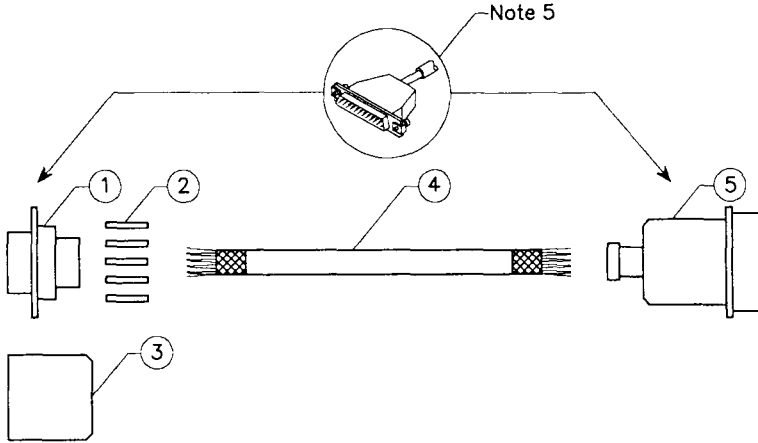
273A-036

Item	Quantity	Description
1	1	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	25	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	1	Connector shell and strain relief. Use AMP part number 745173-3 or equivalent.
4	10 feet	30-conductor shielded cable. Use Alpha part number 5279/15 or equivalent.
5	1	36-pin Blue Ribbon type connector assembly (male). Use AMP part number 57-30360 or equivalent.
6	AR	Copper foil (part number 80-00025).

Notes:

1. The chassis ground must be connected to the shield drain wire at both ends.

2. A twisted pair consists of a signal and ground.

3. All four unused connectors must be connected to ground at both ends.

4. The vinyl insulation must be stripped back at the 36-pin printer connector so that the metal strain relief clamps down on the conducting shield.

5. Wrap foil around wires. Solder copper foil to the braid and metal connector shell around the entire periphery.

6. The cable must be 10 feet (3 meters) maximum. Longer cables must be approved by the printer manufacturer.

RS-232-C Communications Interface

The main CPU board contains two RS-232-C communications channels that allow asynchronous and synchronous communications. Both channels contain 25-pin connectors and are capable of 9600 baud. The RS-232-C Expansion boards contain ten or twenty 9-pin channels that allow asynchronous communications at 9600 baud. The Ethernet Combo board contains six 9-pin channels that allow asynchronous communications at 9600 baud.

RS-232-C communications control is handled by programmable, dual-channel, full-duplex 8530 Serial Communications Controllers (SCCs). SCCs accept data from the CPU in parallel format and convert it into a continuous serial data stream for transmission.

INTERFACE SIGNALS

The following signals are supported by the RS-232-C channels:

Signal	Function
Transmit Data	Data transmitted to the data communications equipment (DCE).
Request to Send	Transition from 0 to 1 commands the DCE to enter the transmit mode; the DCE responds by activating Clear to Send line.
Data Terminal Ready	Indicates to DCE that communications channel is online and ready to operate.
Receive Data	Data received by the DCE.
Clear to Send	Indicates to the communications channel that the DCE is ready to transmit data.
Data Set Ready	Indicates to the communications channel that the DCE is online and ready to operate.
Carrier Detect	Indicates to the communications channel that a signal is being received.
Ring Indicator	Indicates to the communications channel that a ringing signal is being received.

RS-232-C CABLING

Two types of cables can be connected to the RS-232-C channels on the S/320 and S/640: straight and crossed.

Straight cables   Connect DCE to the S/320 and S/640. Some modems are data terminal equipment (DTE) and require crossed cables. Refer to the manufacturer's specifications to determine the type of modem you are connecting.

Crossed cables   Connect DTE, such as terminals and serial printers, to the S/320 and S/640.

RS-232-C crossed cables with 25-pin connectors on each end are required to connect terminals to the main CPU board. RS-232-C cables, straight or crossed, with 25-pin connectors on one end and 9-pin connectors on the other end are required to connect terminals, serial printers, or modems to an RS-232-C Expansion board.

Assembly: Straight 25-pin to 25-pin cable for RS-232-C communications

Function: Connects modems (DCE) to 25-pin RS-232-C connectors on the CPU board

Pin Assignments:

Asynchronous Connections

A S/320 or S/640 (plug)	B DCE (plug)	Assignment
1 ← →	1	Protective ground (shield)
2 →	2	Transmit Data
3 ←	3	Receive Data
4 →	4	Request to Send
5 ←	5	Clear to Send
6 ←	6	Data Set Ready
7 ← →	7	Signal Ground
8 ←	8	Carrier Detect
20 →	20	Data Terminal Ready

1065-025

Synchronous Connections

A S/320 or S/640 (plug)	B DCE (plug)	Assignment
1 ← →	1	Protective ground (shield)
2 →	2	Transmit Data
3 ←	3	Receive Data
4 →	4	Request to Send
5 ←	5	Clear to Send
6 ←	6	Data Set Ready
7 ← →	7	Signal Ground
8 ←	8	Carrier Detect
14 ← →	14	Secondary Transmit Clock
15 ←	15	Transmit Clock
16 ←	16	Secondary Receive Clock
17 ←	17	Receive Clock
20 →	20	Data Terminal Ready
22 ←	22	Ring Indicator
24 ← →	24 *	DTE Transmit Clock

1065-025

*Pin 24 is not gated in the S/320 or S/640. If it is not used in your application, do not connect it.

Straight Cable (25-pin to 25-pin) Construction:
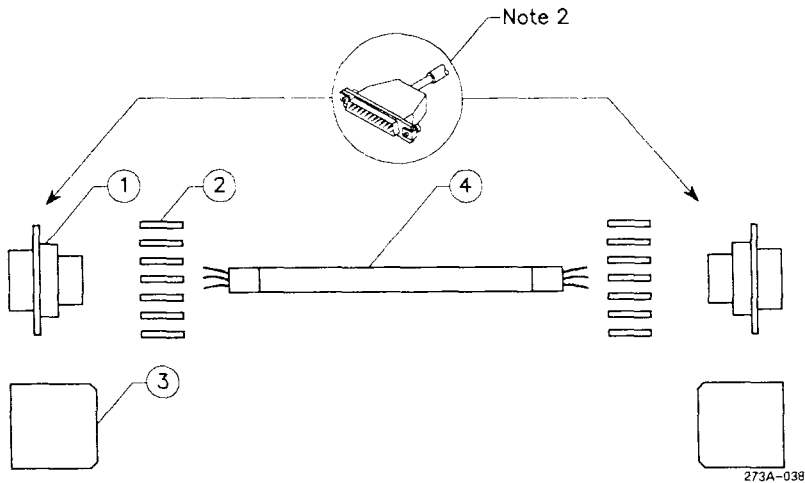
273A-038

Item	Quantity	Description
1	1	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	18	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	1	Connector shell, strain reliefs, and grounding. Use AMP part number 745173-3 or equivalent.
4	25 feet	10-conductor shielded cable. Use Alpha part number 5120 or equivalent.
5	AR	Copper foil (part number 80-00025).

Notes:

1. To meet ESD performance requirements, the minimum length of this cable is 25 feet (7.62 meters). To meet system performance specifications, the maximum length of this cable is 50 feet (15 meters).

2. Wrap foil tape around wires. Solder copper foil to the braid and metal connector shell around the entire periphery.

Assembly: Straight adapter cable (25-pin to 9-pin) for RS-232-C communications

Function: Adapts 25-pin, RS-232-C straight cable to 9-pin channels on an RS-232-C Expansion board

Pin Assignments:

A S/320 or S/640 (plug)	B DCE (socket)	Assignment
1 ⟶	2	Transmit Data
2 ⟶	4	Request to Send
3 ⟶	6	Data Set Ready
4 ⟶	20	Data Terminal Ready
5 ⟶	8	Carrier Detect
6 ⟶	3	Receive Data
7 ⟶	5	Clear to Send
8 ⟶	7	Ground
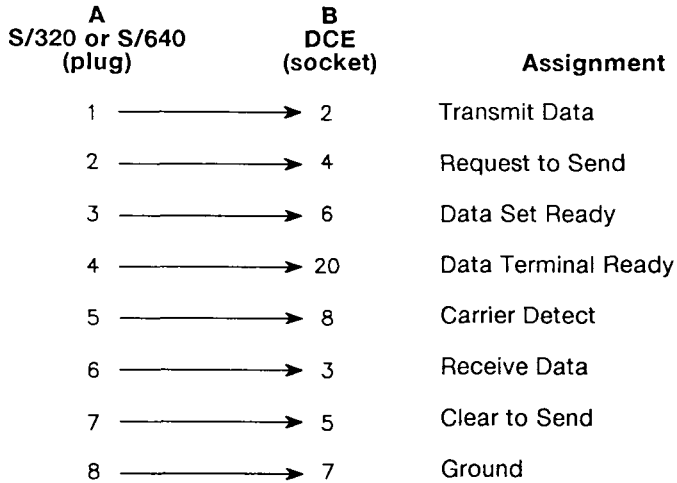
273A-039

Straight Adapter Cable (25-pin to 9-pin) Construction:
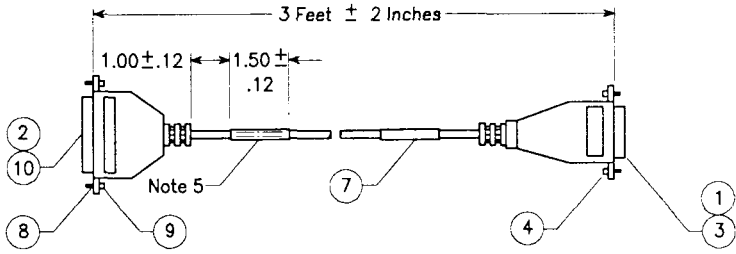
Crimp Style Ferrule or Solder Flow for 360°
Connection Between Braid and Metallic Shield and
Between Connector and Metallic Shield

1.90 max
Cover Length

Note 2 Both Ends

Note 3
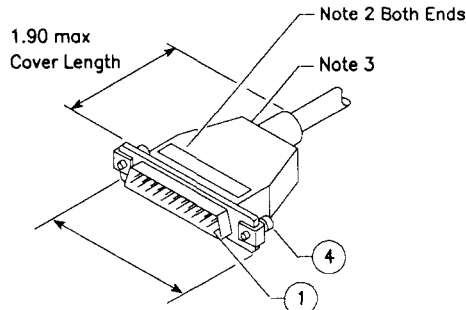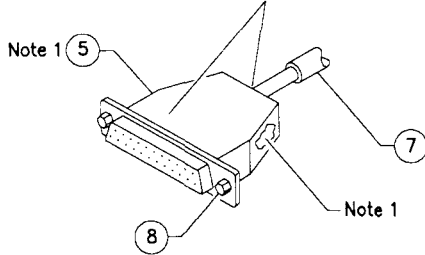
1.250 max (9pos)/2.125 max (25 pos)
Cover Overlap to Connector Shell (if Used)

273A-040

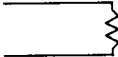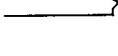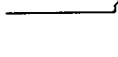| Item	Quantity	Description
1	8	Contact, crimp pin
2	1	25-position, D-type, socket assembly
3	1	9-position, D-type, plug assembly
4	2	Screw and retainer (male)
5	1 foot	Copper foil tape
6	2 feet	Black copper wire, 300V
7	3 feet	3-conductor shielded cable
8	2	Screw lock (4-40)
9	2	Hex nut (4-40)
10	8	Socket, crimp pin (female)

Notes:

1. Primary conductors must be fully encompassed and strain relieved by inner mold. Copper foil shield must cover inner mold.

2. Permanently mark part number, dash number, and revision level approximately where shown.

3. Molded cover: material, polyvinyl chloride or equivalent rated UL 94HB or better. Appearance of mold may vary within the noted dimensions. Cable jacket must be fully encompassed and strain relieved by molded cover.

4. 100% electrical test/certification required by vendor.

5. Place a 1 1/2-inch piece of *green* colored shrink tubing (Raychem Versafit or equivalent) at both ends of the cable. Permanently mark on shrink tubing "RS-232-C Only" in black characters that are at least 9/10-inch high to avoid confusion with RS-422 9-pin connectors.

Assembly: Crossed 9-pin to 25-pin cable for RS-232-C communications

Function: Connects DTE to an RS-232-C Expansion board

Pin Assignments:

A (9-pin)		B (25-pin)	Assignment
6	←→	2	~~Data Set Ready~~
1	←→	3	Transmit Data
2	← ┐ ┌ →	4	Request to Send
7	← ┤ ├ →	5	Clear to Send
3	← ┘ └ →	6	~~Receive Data~~
8	←→	7	Ground
5	← ┐ ┌ →	8	Carrier Detect
4	← ┘ └ →	20	Data Terminal Ready

273A-041
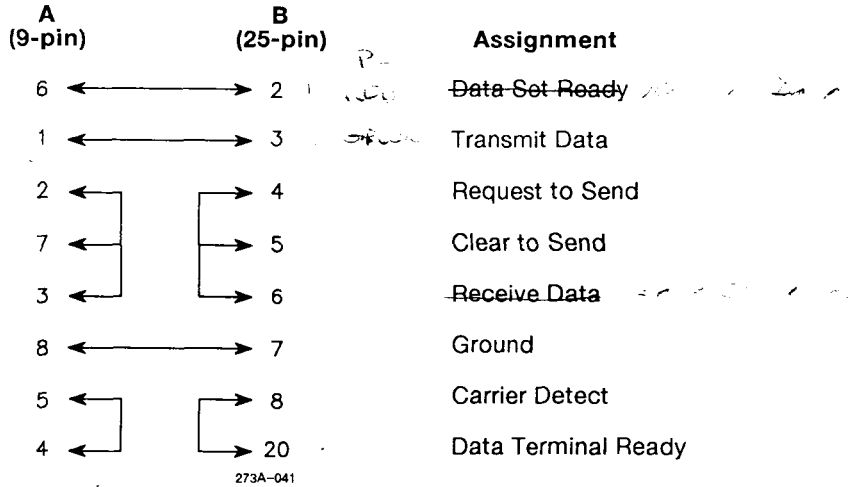
9-Pin to 25-Pin Crossed Cable Construction:
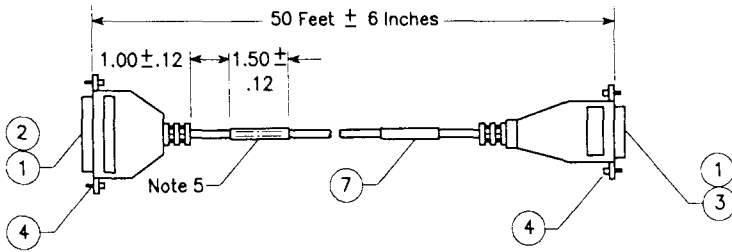
Crimp Style Ferrule or Solder Flow for 360°
Connection Between Braid and Metallic Shield and
Between Connector and Metallic Shield

1.90 max
Cover Length

Note 2 Both Ends

Note 3
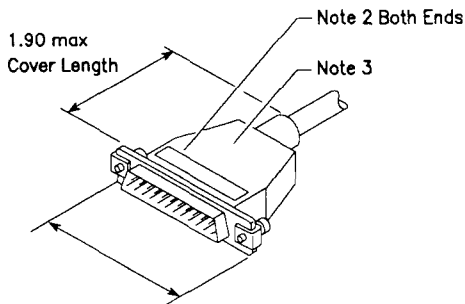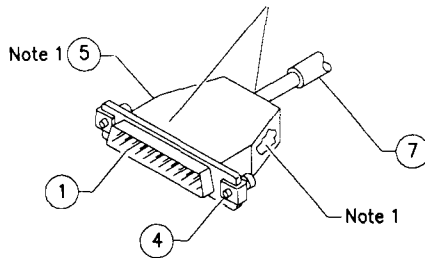
1.250 max (9pos)/2.125 max (25 pos)
Cover Overlap to Connector Shell (if Used)

273A-042

Item	Quantity	Description
1	16	Contact, crimp pin
2	1	25-position, D-type, socket assembly
3	1	9-position, D-type, plug assembly
4	4	Screw and retainer (male)
5	AR	Copper foil tape
6	2 feet	Black copper wire, 300V
7	3 feet	3-conductor shielded cable

Notes:

1. Primary conductors must be fully encompassed and strain relieved by inner mold. Copper foil shield must cover inner mold.

2. Permanently mark part number, dash number, and revision level approximately where shown.

3. Molded cover: material, polyvinyl chloride or equivalent rated UL 94HB or better. Appearance of mold may vary within the noted dimensions. Cable jacket must be fully encompassed and strain relieved by molded cover.

4. 100% electrical test/certification required by vendor.

5. Place a 1 1/2-inch piece of *green* colored shrink tubing (Raychem Versafit or equivalent) at both ends of the cable. Permanently mark on shrink tubing "RS-232-C Only" in black characters that are at least 9/10-inch high to avoid confusion with RS-422 9-pin connectors.

Assembly: Crossed 25-pin to 25-pin cable for RS-232-C communications

Function: Connects DTE to 25-pin connectors on the CPU board

Pin Assignments:

Assignment	S/320 or S/640 (plug)	DTE (plug)	Assignment
Protective Ground (Shield)	1 ◄──────► 1		Protective Ground (Shield)
Transmit Data	2 ─────► 3		Receive Data
Receive Data	3 ◄───── 2		Transmit Data
Request to Send	4	4	Request to Send
Clear to Send	5	5	Clear to Send
Signal Ground	7	7	Signal Ground
Data Set Ready	6	6	Data Set Ready
Carrier Detect	8	8	Carrier Detect
Data Terminal Ready	20	20	Data Terminal Ready

273A-043

Cable Specifications   C-19
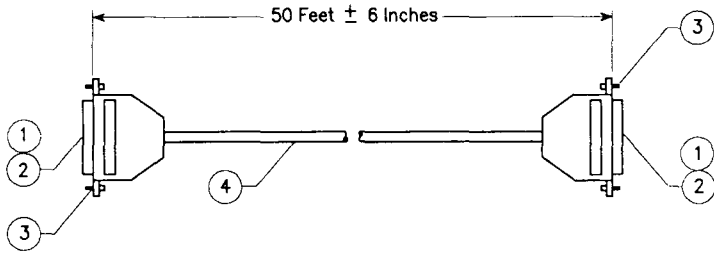
Crossed Cable Construction:

50 Feet ± 6 Inches

Crimp Style Ferrule or Solder Flow for 360°
Connection Between Braid and Metallic Shield and
Between Connector and Metallic Shield

Note 1

⑤ Note 1 Inner Mold

1.40 max Cover Length

Note 3

1.53 max Cover Width

.620 max Cover Width

2.125 max Cover Overlap to
Connector Shell (if Used)

Note 2 Both Ends
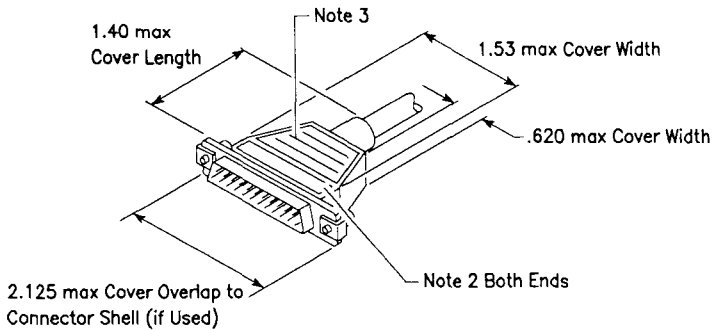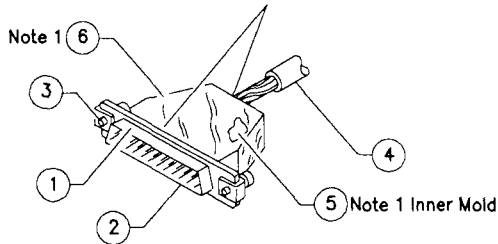
273A-044

Item	Quantity	Description
1	2	25-pin plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	16 or 18	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	2	Connector shell, strain reliefs, and grounding. Use AMP part number 745173-3 or equivalent.
4	25 feet	3-conductor shielded cable. Use Alpha part number 5114 or equivalent.
5	2	Inner crimp ferrule. Use AMP part number 2-745129-1.
6	2	Outer crimp ferrule. Use AMP part number 745130-8.

Notes:

1. Data terminal devices that have metal connectors use Convergent Technologies RS-232-C cable, part number 61-00302, or equivalent.

2. If the DTE has a plastic shell connector, pin 1 must be connected at both ends for proper grounding.

RS-422 Cluster Communications Interface

RS-422 terminals are connected in a daisy-chain configuration to cluster channels on the RS-422 Expansion board. Each cluster channel on the board can support up to eight RS-422 terminals.

INTERFACE SIGNALS

The RS-422 interface uses the following signals:

- CLK+

- CLK-

- DATA+

- DATA-

- GND

RS-422 CLUSTER COMMUNICATIONS CABLING

Assembly: RS-422 cluster communications

Function: Connects RS-422 terminals to the RS-422 Expansion board

Pin Assignments:

Connector A (plug)	Connector B (plug)	Assignment
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	CLK+
7	7	CLK-
8	8	DATA+
9	9	DATA-

273A-045

Cluster Cable Construction:
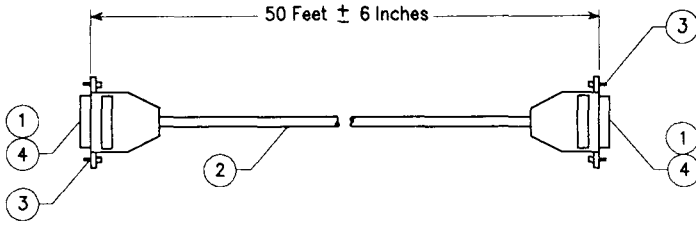
50 Feet ± 6 Inches

Crimp Style Ferrule or Solder Flow for 360°
Connection Between Braid and Metallic Shield and
Between Connector and Metallic Shield

Note 1 Inner Mold

Note 3

1.40 max
Cover Length

.800 max Cover Width

.620 max Cover Width

Note 2 Both Ends
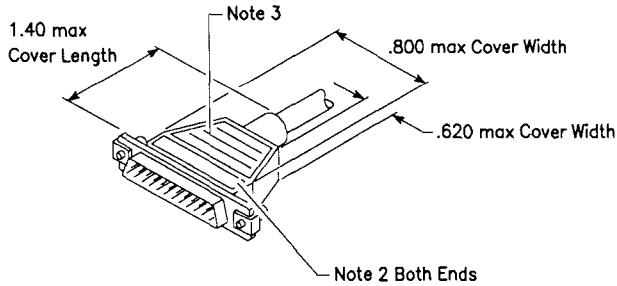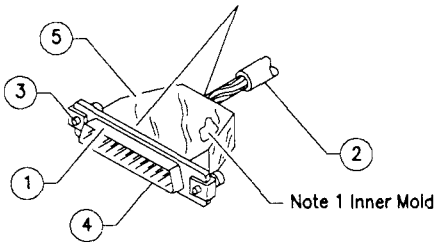
273A-046

Item	Quantity	Description
1	2	9-pin D-type plug assembly (male). Use AMP part number 205204-4 or equivalent.
2	25 to 1,200 feet	4-conductor, shielded, twisted-pair cable. Use Belden part number 9829 or equivalent.
3	4	Screw and retainer, male (part number 58-00061).
4	8	Connector contacts. Use AMP part number 66507-3 or equivalent.
5	AR	Copper foil (part number 80-00025).

Notes:

1. Primary conductors must be fully encompassed and strain relieved by inner mold. Copper foil shield must cover the inner mold.

2. Permanently mark part number, dash number, and revision level where shown.

3. Molded cover: color, grey; material, polyurethane or equivalent rated UL 94HB or better. Cable jacket must be fully encompassed and strain relieved by molded cover.

4. Pins 6 and 7, and pins 8 and 9, are each twisted pairs.

5. The maximum total length of a cluster communications line is 1,200 feet (365.85 meters). The minimum cable length between terminals is 25 feet (7.62 meters).

Assembly: RS-422 terminator

Function: Terminates the cluster communications line and ends the cluster

Pin Assignments:

Connector A (plug)		Assignment
1		
2		
3		
4		
5		
6	⎤ 100 ohm	CLK+
7	⎦	CLK-
8	⎤ 100 ohm	DATA+
9	⎦	DATA-

273A-047

Terminator Construction:

Fold One Lead as Shown and Cut to .50

Pin 6 — Pin 1
Pin 9 — Pin 5

1.50 max
1.25 max
.90 max
Pin 1
.50 ± .06

Note 3
Note 2
Mark Part No., Rev Level on Near Side
Mark "100 OHM" on Opposite Side
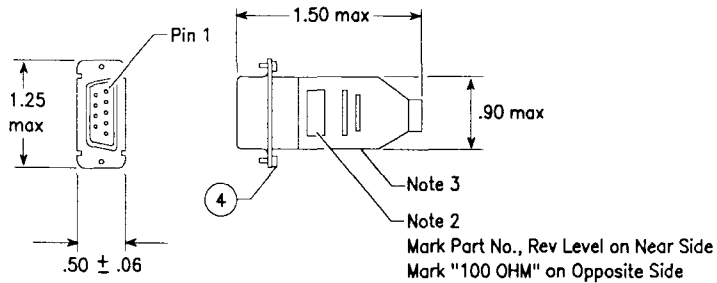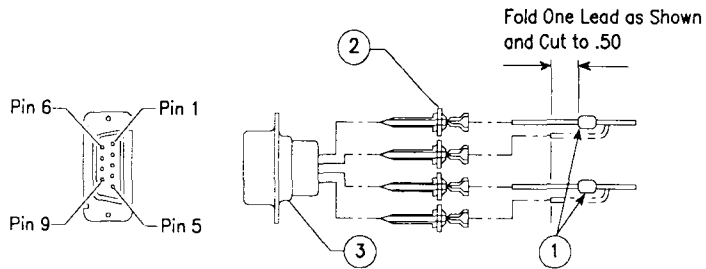
273A-048

Item	Quantity	Description
1	2	100-ohm, 1/4W resistor.
2	4	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	1	9-pin, D-type, plug assembly (male). Use AMP part number 205204-4 or equivalent.
4	2	Screw and retainer, male (part number 58-00061).

Notes:

1. Appearance may vary within dimensions shown.

2. Mark part number and revision level in area shown.

3. Molded cover: color, grey; material, polyurethane or equivalent rated UL 94HB or better.

4. A terminator must be installed at each end of the cluster communications daisy chain.

Assembly: RS-422 cable splice

Function: Joins two cluster communications cables

Pin Assignments:

Cable A (socket)	Cable B (socket)	Assignment
1	1	
2	2	
3	3	
4	4	
5	5	
6 ◄────────► 6		CLK+
7 ◄────────► 7		CLK-
8 ◄────────► 8		DATA+
9 ◄────────► 9		DATA-

273A-049

Cable Splice Construction:
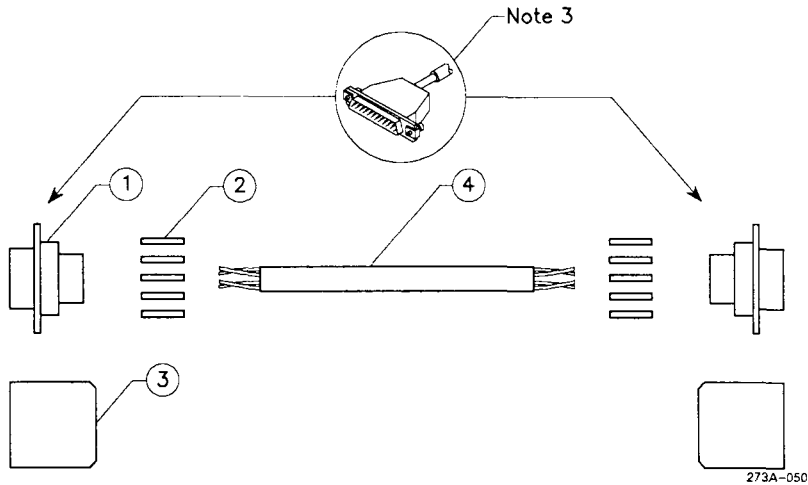
Item	Quantity	Description
1	2	9-pin, D-type, socket assembly (female). Use AMP part number 205203-4 or equivalent.
2	10	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	2	Connector shell and strain relief. Use AMP part number 745171-5 or equivalent.
4	0.5 feet	4-conductor, twisted-pair, shielded cable. Use Belden part number 9829 or equivalent.
5	AR	Copper foil (part number 80-00025).

Notes:

1. Pins 6 and 7, and pins 8 and 9, are each twisted pairs.

2. The maximum total length of a cluster communications line is 1,200 feet (365 meters).

3. Wrap foil tape around wires. Solder copper foil to the braid and metal connector shell around the entire periphery.

Cable Vendors

The recommended vendors of cable components are listed below.

Alpha Wire Corp.
711 Lidgerwood Avenue
Elizabeth, NJ 07207
(201) 925-8000

Computer Crafts, Inc.
57 Thomas Road
Hawthorne, NJ 07506
(201) 423-3500

AMP, Inc.
Harrisburg, PA 17105
(717) 564-0100

Helix Wire Corp.
217 Hamilton Street
Leominster, MA 01453
(617) 534-1434

Astro Wire & Cable Corp.
50 Gardner Street
Worcester, MA 01613
(617) 754-3281

Mohawk Wire & Cable Corp.
9 Mohawk Drive
Leominster, MA 01453
(617) 537-4538

Belden Corp.
P.O. Box 1980
Richmond, IN 47374
(317) 983-5200

D

This appendix describes the proper cleaning procedures for the QIC tape drive in the S/320 and the SCSI tape drive in the S/640. The information below applies to both drives.

QIC Tape Drive

The tape drives use a quarter-inch cartridge (QIC) tape of 600 feet. It is recommended that you use 3M DC-600A Tape Cartridges.

The tape drive has a MTBF (mean-time-between-failures) of 5000 power-hours and a MTTR (mean-time-to-repair) of one half-hour. Recommended full service life is five years.

Tape Drive Head Maintenance Procedure

If you are using new tape cartridges, the heads must be cleaned after every two hours of actual use. For other cartridge conditions, cleaning should be performed at eight-hour intervals during normal use. Normal use is defined as two to three hours of actual drive use in a regular eight-hour day. If normal use is exceeded, or if the tape is used in extreme environments (high humidity and temperature extremes), the heads may need to be cleaned every four to six hours.

CLEANING EQUIPMENT

To clean the tape drive heads, you need a tape drive head cleaning kit, which contains the following items:

- swabs (not cotton)

- cleaning solution (95% isopropyl alcohol)

- aerosol container of compressed air

The Inmac Tape Drive Head Cleaning Kit, Part Number 7150, contains these items. You may also need a lamp or flashlight to see inside the tape drive.

Caution: *Do not use a cleaner cartridge. It may damage the head assembly or the cartridge, or both.*

CLEANING PROCEDURE

Perform the following steps to clean the tape drive heads (see Figure D-1):

1. Open the small plastic door on the front door of the S/320 or S/640 by sliding it all the way to the left.

2. If necessary, remove the tape from the tape drive by firmly pushing the slide lever up until you reach the lever stop, about 1/2 inch. The lever action causes the head assembly to move away from the cartridge. This triggers the tape ejector, which lifts the cartridge clear from the retaining lip and pushes it out of the slot.

3. After you remove the tape, move the head assembly back into the tape contact position by pushing the slide lever down until it locks into place, about 1/2 inch.

   As you do so, notice the tape head in the rear of the tape drive move down.

Tape Sensor Holes

Head Spring Assembly
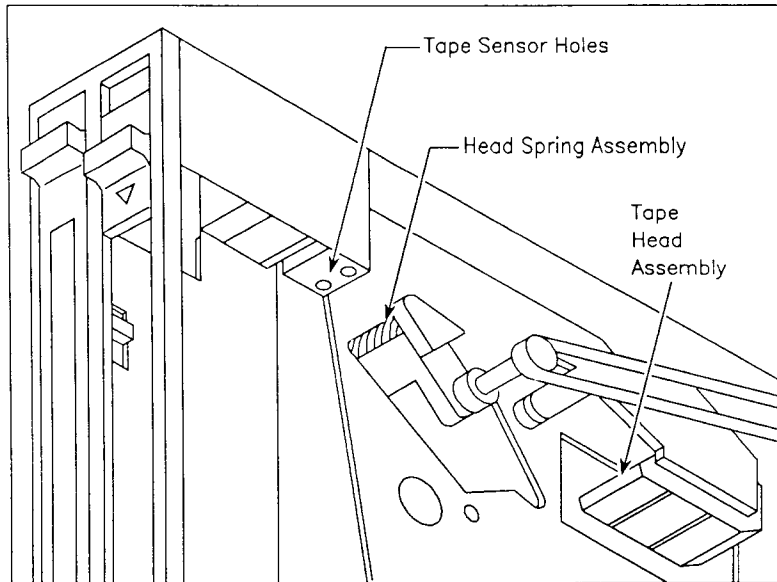
Tape
Head
Assembly

1065-020

Figure D-1. Cleaning the QIC Tape Drive

4. Dampen a swab by dripping the cleaning solution onto the dual-colored spade end of the swab.

Caution: *Do not contaminate the cleaning solution by dipping the swab into it.*

5. Insert the swab, spade-end first, through the cartridge access lot until you touch the tape head.

6. Use the coarse, green side of the swab to clean the head. Use a toothbrush-type motion to do so.

7. Remove the swab, and redampen it with another application of cleaning solution.

8. Use the swab to clean the head again. This time use the fine, white side of the swab and the same toothbrush-type motion you used earlier.

9. Remove the swab. Insert a clean, dry swab, and remove any residual cleaning fluid.

10. Discard both swabs. Store the unused swabs so that they collect no dust or debris.

11. Inspect the tape sensor holes, located inside the tape drive near the head spring assembly (see Figure D-1). Clean the tape hole sensor openings as needed by using the aerosol container of compressed air.

12. Push the slide lever up to move the head assembly back into the retract position.

13. Close the small plastic door by sliding it all the way to the right.

E

Replacing the Battery and Fuses

This appendix contains procedures for replacing the lithium battery in the Main Processor board, the fuse in the Main Power Supply Module, and the fuse in the VME Power Supply.

Battery

The Main Processor board contains a battery that you may need to replace periodically. The Battery Access slot on the rear of the Main Processor board enables you to quickly and conveniently replace the battery. You will need a pair of tweezers to remove the battery.

WARNING

If you use a pair of metal tweezers, then you must power down the S/320 or S/640 before you attempt to replace the battery. If you use a pair of plastic tweezers, you do not need to power down your system.

To properly power down your system, see Chapter 5, "Powering Down and Restarting Your System."

The replacement battery must conform to these specifications:

- lithium flat-pack (manganese dioxide or polycarbon-monoflouride)

- weight: 0.141 ounce (4.0 grams)

- nominal voltage: 3 volts

- nominal capacity: 160-200 m

- temperature range: -14°F to +122°

- maximum current pulse: 15 mA

- initial impedance: 250 ohms

- impedance during discharge: 100 ohms

To replace the battery:

1. Open the rear door.

2. Locate the Battery Access slot on the Main Processor board (see Figure E-1).

3. Insert a pair of tweezers into the Battery Access slot, and grasp the battery.

4. Pull the battery free of the Battery Access slot.

5. Insert the new battery into the Battery Access slot.

Fuses

Both the Main Power Supply and the VME Power Supply contain fuses that you may need to replace. The Main Power Supply (500 watts) requires a 10A fuse, while the VME Power Supply (175 watts) requires a 5A fuse. Both fuses are accessed from the rear of the computer (see Figure E-2).

Battery
Access
Slot
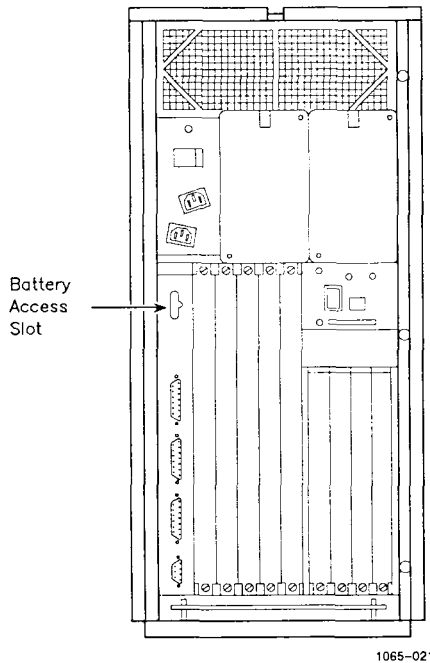
1065-021

Figure E-1.   Battery Access Slot

WARNING

The S/320 or S/640 must *be powered down before you replace either of the two fuses.*

To properly power down your system, see Chapter 5, "Powering Down and Restarting Your System."

Follow this procedure to replace the fuses:

1. Open the rear door.

2. Locate the container that contains the fuse you want to replace.

3. Use a small screwdriver to turn the fuse container counter-clockwise by one-eighth turn.

4. Pull the fuse container free of the power supply.

5. Replace the fuse, and return the fuse container to the power supply.

6. Turn the fuse container clockwise by one-eighth turn to secure it in place.
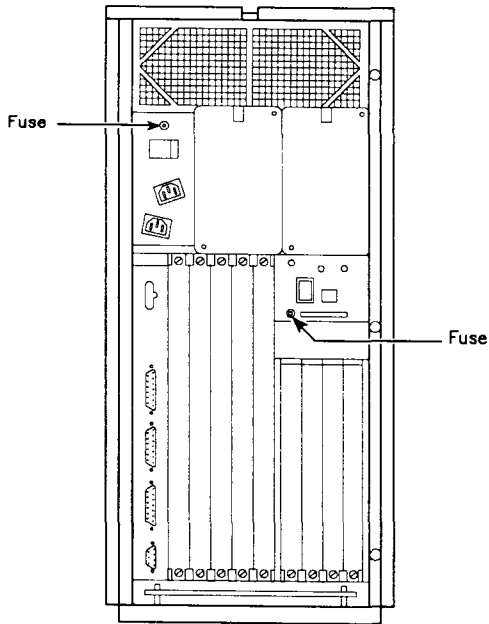
1065-022

Figure E-2.   Fuse Locations

F

Installing the MC68881 Floating-Point Coprocessor in S/320 Systems

This appendix shows you how to install the MC68881 Floating-Point Coprocessor on the Main Processor board in S/320 systems. (S/640 systems are shipped with the coprocessor already installed.) Before you start, make sure that you have the MC68881 Floating-Point Coprocessor and the two plastic jumpers that are shipped with the processor. You will also need a quarter-inch nut driver.

1. Power down the S/320 (see Chapter 5).

2. Disconnect the terminal, printer, and UPS cables from the Main Processor board.

3. Remove the top panel and the outer side panel that is nearest the QIC tape drive. Chapters 7 and 8 contain more specific instructions for doing so.

4. Remove the inner side panel nearest the QIC tape drive. Chapters 7 and 8 contain more specific instructions for doing so.

5. Disconnect the six cables located along the top of the Main Processor board.

6. Loosen but do not remove the six screws on the three brackets that hold the Main Processor board to the frame, and slide the brackets towards the center of the machine.
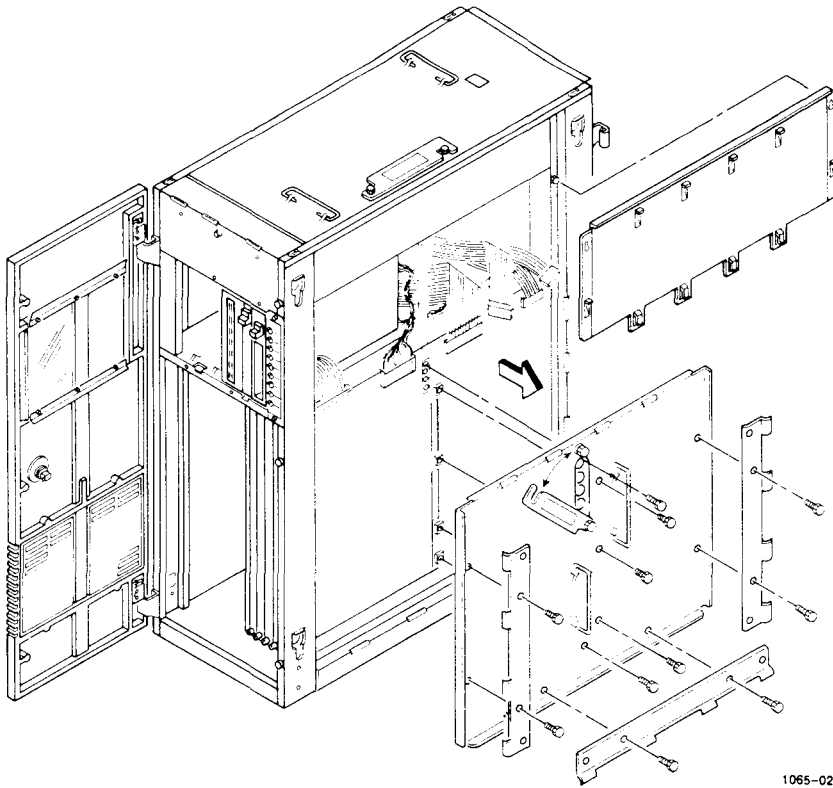
1065-023

Figure F-1.   Accessing the Main Processor Board

7. Remove the four screws located down the middle of the Main Processor board that hold the Main Processor board to the frame, as shown in Figure F-1.

8. Loosen the two screws that secure the Warning plate to the frame; then slide the plate counterclockwise to reveal four screws.

9. Remove the four screws located behind the Warning plate. These screws must be reinstalled in the same location they were removed from.

10. Grasp the two handles on the Main Processor board, and gently pull it free from the S/320. Lay the Main Processor board aside on an antistatic surface.

    Locate the empty socket at location 21E on the Main Processor board. (It is next to the MC68020 located at 24D.)

11. Position the MC68881 so that the arrow on the chip corresponds to the intersection of pin A and pin 1 at location 21E. Gently push the MC68881 into place.

There are two sets of pins that you need to jumper at locations W3 and W4 on the Main Processor board. W3 (located at 23A) consists of two pins. W4 (located between rows C and D and 25 and 26) consists of three pins. When pin 1 is jumpered to pin 2, the processor operates at 12.5 MHz. When pin 2 is jumpered to pin 3, the processor operates at 16.67 MHz. Choose the correct jumpering position based on the floating-point coprocessor used.

1. At location W3, use a jumper to connect pin 1 to pin 2.

2. At location W4, use a jumper to connect the proper set of pins (pin 1 to pin 2, or pin 2 to pin 3).

The MC68881 Floating-Point Coprocessor is now in place. You can replace the Main Processor board. To do so, begin with step 9 (above) and work backwards. If you encounter difficulty at any point during this procedure, contact the Customer Response Center at 800/858-TALK.

G
Configuration Limitations

This appendix describes VME configuration limitations in S/320 and S/640 systems. The information here applies to the VME card cage in the A-Box (there are no limitations for the V-Box).

The VME power supply in the A-Box supplies 23A of +5V power. The VME Interface Adapter board draws 4A, leaving 19A for VME expansion cards. Therefore, the total power consumption of the installed VME expansion cards (obtained by adding the power consumption of each VME expansion card in your system) cannot exceed 19A.

The power consumption for each VME expansion card is:

VME Ethernet card	3.0A
VME Half-Inch Tape Controller card (Interphase)	4.5A
VME SMD Controller card (Interphase)	3.0A
VME MPCC card	9.5A

The most serious limitation is that two MPCC cards will fully load the VME power supply. Steps are being taken to resolve this problem for future VME MPCC card releases.

A-Box. The S/320 and S/640 base enclosure.

baud. Communications measure of serial data transmission rate. Loosely, it means bits per second, including characteristic framing and stop bits.

board. See **VME Interface Adapter board** or **Main Processor board**.

boot. To boot is to start up a computer by loading a program into memory from an external storage medium, such as a QIC tape.

byte. Unit of information, often amounting to a single text character. A byte most commonly consists of 8 bits.

card cage. Structure that contains the printed circuit boards.

character. Letter, digit, punctuation mark, or other symbol used to organize, control, or represent data.

code. Number or symbol used to represent information in a compact or easily processed form.

command. Communication from the user to a computer system (usually typed from the keyboard) directing it to perform an action.

computer. Electronic device for performing predefined (programmed) data computation or manipulation at high speed and with great accuracy.

computer system. Consists of a computer and its associated hardware and software.

configuration. Refers to the arrangement and interrelationships of the hardware and software elements within a computer system.

configuring. Act of determining software or hardware actions by manipulating their physical or logical relationships.

connector. Physical device, such as a plug, socket, or jack, used to connect one hardware component of a system to another.

default. Value, action, or setting that is automatically used by a computer system when no other explicit information has been given.

disk. Information storage medium consisting of a flat, circular magnetic surface on which information can be recorded in the form of small magnetized spots.

disk drive. Peripheral device that writes and reads data on the surface of a magnetic disk.

display. To exhibit information visually, as on the screen of a display device, such as a video monitor.

display screen. Glass or plastic panel on the front of a display device on which images are displayed.

emulate. Process by which one device or system (such as a terminal) is made to function like another in order to accept the same data, to execute the same programs, and to achieve the same results.

error message. Message displayed or printed to notify the user of an error or problem in the execution of a program.

execute. To perform or carry out a specified action or sequence of actions, such as those described by a program.

expansion slot. Connector inside the enclosure into which an expansion card can be installed.

gigabyte. Equals about 1.07 billion bytes.

hardware. Term for those components of a computer system consisting of physical devices. Contrast with **software.**

input. Term for data transferred into a computer from some external source, such as the keyboard, a disk drive, or a QIC tape.

input/output (I/O). General term for the techniques, devices, and media used to communicate with the processor in a computer and the data involved in such communications.

load. To transfer information from a peripheral storage medium (such as a QIC tape) into main memory for use, for example, to transfer a program into memory for execution.

log in. Term used for entering your login name and password to the CTIX operating system.

login name. Name assigned to you by your system administrator, by which you are known to the operating system.

Main Processor board. Large printed circuit board in the S/320 and S/640, to which the computer's processor, memory, and other important components are connected.

megabyte. Equals about 1.05 million bytes.

memory. Term for a hardware component of a computer system that can store information for later retrieval.

microprocessor. See **processor.**

mode. State of a computer or system that determines its behavior.

operating system. Software system that organizes the computer's resources and capabilities and makes them available to the user or to application programs running on the computer.

peripheral. Device located outside the processing unit itself that supports or assists in its communication, for example, a terminal or a buffer.

processor. Hardware component of a computer that interprets and executes instructions, which are represented in machine language and stored in main memory.

program. Set of instructions, conforming to the rules and conventions of a particular programming language, describing actions for a computer to perform in order to accomplish some task.

prompt. To remind or signal the user that some action is expected, typically by displaying a distinctive symbol, a reminder message, or a menu of choices on the display screen.

prompt character. Text character displayed on the screen to prompt the user for some action. It often also identifies the program or component of the system that is doing the prompting.

shielded cable. Cable with a special metallic wrapping around its wires. The wrapping reduces radio frequency interference.

SMD. See **Storage Module Drive.**

software. Term used for those programs that determine or control the behavior of the computer.

stabilizer bar. Long, oval-shaped piece of metal attached to the bottom of the enclosure, used to secure the computer in its permanent location.

Storage Module Drive. A high-speed disk controller employing caching and interleaving, installed in a V-Box or an X-Box.

system administrator. The person responsible for maintaining the computer system.

V-Box. Expansion cabinet that contains a 10-slot VME card cage and room for two SMDs.

VME Interface Adapter board. Printed circuit board that enables the local card to communicate with the VME card cage.

X-Box. Expansion cabinet that can contain up to four SMDs.