S/221™ and S/222™ Installation Manual

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Hardware

S/320 and S/220 Hardware Manual

MightyFrame IOP Expansion Board Hardware Manual

MightyFrame Peripherals Manual

MightyFrame 10-Port and 20-Port RS-232-C I/O Expansion Boards Manual

MightyFrame RS-422 Expansion Board Hardware Manual

MightyFrame VME Ethernet Card Manual

MightyFrame VME Expansion Manual

S/320 VME Half-Inch Tape Controller Card Manual

S/320 VME SMD Controller Card Manual

Installation

Graphics Terminal Installation Manual

Programmable Terminal Installation Manual

S/120 Installation Manual

Software

CTIX Operating System Manual, Version B

MightyFrame Series Administrator's Reference Manual

MightyFrame Diagnostics Manual

Hardware

The *S/320 and S/220 Hardware Manual* (Vols. 1 and 2), provides information on the functional description, software interface, and theory of operation for the S/320 and S/220 computer systems.

The *MightyFrame IOP Expansion Board Hardware Manual* contains a functional and circuitry description of the Input/Output Processor board, and a description of its theory of operation and software interfaces.

The *MightyFrame Peripherals Manual* describes the MightyFrame A-Box and how to install it. The applicable OEM manuals are included.

The *MightyFrame 10-Port and 20-Port RS-232-C I/O Expansion Boards Manual* describes the hardware incorporated on the MightyFrame 10-port and 20-port boards at a functional block and component level, including descriptions of interrupt handling, processor interface, and RS-232-C I/O operations.

The *MightyFrame RS-422 Expansion Board Hardware Manual* describes the hardware on the MightyFrame RS-422 Expansion board including descriptions of clock, bus, and channel control. An onboard line printer interface is also described.

The *MightyFrame VME Ethernet Card Manual* describes the Ethernet card, which is installed in a VME card cage of MightyFrame computer systems. The manual provides a detailed description of the card (and Ethernet network), software interfaces, and the theory of operation.

The *MightyFrame VME Expansion Manual* contains the functional and circuitry description and theory of operation for the MightyFrame VME Interface board.

The *S/320 VME Half-Inch Tape Controller Card Manual* describes the Half-Inch Tape Controller card, which is installed in the VME card cage of a S/320 computer system. The manual provides a detailed description of card installation, theory of operation, and software interfaces.

The *S/320 VME SMD Controller Card Manual* describes the SMD Controller card, which is installed in the VME card cage of an S/320 computer system. The manual provides a detailed description of card installation, theory of operation, and software interfaces.

Installation

The *Graphics Terminal Installation Manual* describes procedures for installing Graphics Terminals and connecting terminals and peripherals. The manual also contains cable specifications and error codes.

The *Programmable Terminal Installation Manual* describes procedures for installing, powering up, and testing the Programmable Terminal, and connecting it to a MegaFrame system. The manual also describes how to connect peripherals and how to connect terminals in a cluster.

The *S/120 Installation Manual* describes the procedures for locating, inspecting, and booting the S/120 system, and for attaching peripherals and installing expansion boards and hard disk drives. It also includes a summary of system status codes and instructions for building required cables.

Software

The *CTIX Operating System Manual, Version B*, describes the CTIX operating system, which is derived from the UNIX System V operating system. This manual describes CTIX commands, application programs, system calls, library subroutines, special files, file formats, games, miscellaneous facilities, and system maintenance procedures. The manual is 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.

The *MightyFrame Diagnostics Manual* describes the tests and subtests used to verify proper MightyFrame operation and identify problems when they occur.

1
Overview

Introduction to the S/221 and S/222

The S/221 and S/222 (shown in Figure 1-1) are compact, versatile, multiuser computer systems intended for office applications. Built around the MC68020 32-bit microprocessor, the S/221 and S/222 are designed to run the CTIX operating system.

BASIC CONFIGURATIONS

This manual shows you how to install the S/221 and S/222, which come fully assembled.
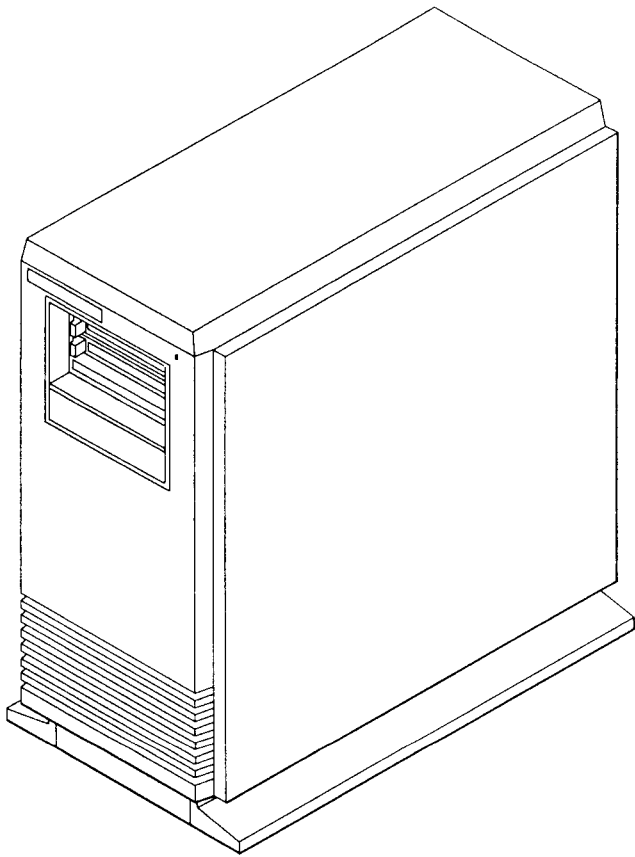
273A-001

Figure 1-1. The S/221 and S/222 Computer System

S/221 Configuration

The S/221 includes the following:

- four-slot card cage, which holds one Memory Expansion board and up to three I/O Expansion boards

- 500W power supply

- QIC tape drive

- up to three hard disk drives

S/222 Configuration

The S/222 includes the following:

- six-slot card cage, which holds one Memory Expansion board, up to three I/O Expansion boards, and up to two VME Expansion Cards

- 500W power supply

- QIC tape drive

- up to three hard disk drives

EXPANSION BOARDS

There are three types of expansion boards available for S/221 and S/222 systems.

Memory Expansion boards are installed in slot 1 of the I/O card cage and are available in 2M-byte and 4M-byte sizes.

I/O Expansion boards are installed in the I/O card cage. I/O Expansion boards provide additional I/O ports, and they can enhance system performance. The following I/O Expansion boards are available (consult the current sales guide for a complete list):

- RS-232-C (10-channel or 20-channel)
- RS-422
- IOP (enhances RS-232-C performance)
- Ethernet Combo

VME Expansion cards are installed in the VME card cage in the S/222 configuration only. The following VME expansion cards are available (consult the current sales guide for a complete list):

- Ethernet Controller

- SMD Controller

- Half-Inch Tape Controller

Purpose of This Manual

This manual has several purposes:

- to aid you in installing your S/221 or S/222 system

- to aid you in installing expansion boards, terminals, and disk drives

- to direct you to related documentation

INTENDED AUDIENCE

This manual is written for the person who needs to install an S/221 or S/222 system. It 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

The seven chapters in this manual are organized to guide you through the installation process.

- This chapter, "Overview," contains an introduction to the S/221 and S/222 systems and this manual.

- Chapter 2, "Getting Started," contains information on locating, unpacking, and inspecting the systems.

- Chapter 3, "Attaching Terminals, Printers, and Modems," describes where and how to attach additional terminals, printers, and modems.

- Chapter 4, "Booting Your System," presents information on how to power on the system and install the CTIX operating system.

- Chapter 5, "Powering Down and Restarting Your System," contains instructions for properly powering down and restarting the S/221 and S/222.

- Chapter 6, "Installing Expansion Boards," contains information on installing and removing Memory and I/O Expansion boards, and VME Expansion cards.

- Chapter 7, "Installing Hard Disk Drives," contains instructions for installing and removing Winchester 5-1/4-inch hard disk drives.

In addition, the following appendixes are included:

- Appendix A, "System Status Codes," lists the status codes used during system boot operations.

- Appendix B, "S/221 and S/222 Specifications," presents the physical dimensions and environmental limitations of the S/221 and S/222.

- Appendix C, "Cable Specifications," presents information on constructing the cables required for this system.

- Appendix D, "QIC Maintenance," contains procedures for cleaning the QIC tape drive.

- Appendix E, "Replacing the Battery and Fuse," describes how to replace the battery and fuse.

A glossary of technical terms is located after the appendixes.

2
Getting Started

This chapter contains information on how to prepare for installing the S/221 and S/222. Preparation includes:

- checking that you have the proper tools

- checking that you have selected the best location for your system

- unpacking and checking that you have all necessary equipment

- inspecting your system

Required Tools

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

- 1/4-inch hex nutdriver

- 11/32-inch hex nutdriver

- phillips screwdriver

- small flathead screwdriver

Choosing a Location

By now you should have selected a location in which to install your system. Before installing the system, however, you should verify that this location meets all of the requirements summarized in the paragraphs below.

FLOOR PLAN

The S/221 and S/222 are designed to operate in any typical office environment. Any floor plan that provides adequate ventilation and clearance is acceptable.

Floor

The floor should be a firm foundation, free from abrupt movement. The floor can be carpeted, but it is recommended that the carpeting be antistatically treated (or that an antistatic mat be placed directly under and around the enclosure).

Clearance

Leave at least 30 inches of space on both sides of the enclosure to allow a technician to access internal hardware (or leave enough slack in the cables to allow the system to be moved to such a location without disconnecting cables). Allow at least 4 inches of clearance at the rear of the enclosure for cooling and cable routing.

Power Outlets

A grounded electrical outlet conforming to electrical code requirements should be located near your system. It is recommended that this outlet not be on the same circuit as any other high-wattage electrical system (such as lights or air conditioning).

The following power requirements must be met:

- applicable 110V or 230V independent power source (not shared with any other system)

- proper grounding

Appendix B, "S/221 and S/222 Specifications," contains power specifications for your system.

Cabling

All cables should be routed from the bottom rear of the cabinet (as described in Chapter 3, "Attaching Terminals, Printers, and Modems") so that airflow is not impeded. 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 electrostatic discharge and electromagnetic interference (ESD/EMI) specifications, it is recommended that only shielded cables be used to connect the S/221 and S/222 to other devices (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)*

ENVIRONMENTAL REQUIREMENTS

The room in which the system is to be installed should be relatively dust-free. Keep the system fully assembled during normal operation.

Heat

Environmental temperature operating limits for the S/221 and S/222 are

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

If recommended operating conditions are exceeded, shut the system down. Placing the unit in direct sunlight is not recommended but will not harm system performance so long as the temperature is within ambient specifications (higher temperatures will overheat internal electrical components). You should not place external peripherals, especially printers, in direct sunlight.

Air Conditioning

A fully configured S/221 or S/222 dissipates 700W (2390 BTU/hr). Be sure that your air conditioning system can handle this increase in cooling load.

If your system has been delivered from an environment with either an ambient temperature significantly lower than room ambient or a high relative humidity, let it warm up gradually (for several hours) to room ambient conditions before turning power on to minimize the harmful effects of condensation. Condensation can occur when a cold device is subjected to a warmer environment. Condensation can cause corrosion of plated surfaces and/or severe disk drive damage.

Airflow

The S/221 and S/222 are cooled by a small fan inside each unit. This fan circulates air throughout the enclosure. Therefore, you do not need to set the system directly under an air conditioning vent. You may need such vents for external peripherals (such as printers) which may not have internal air circulation fans.

Do not block the input and output vents with chairs, cables, or other equipment.

Unpacking the S/221 and S/222

Once you have determined a location for your system, you are ready to unpack it from its shipping container (if you have not already done so). The Installation Sheet shipped with the system contains unpacking instructions.

After you have unpacked the system use the following checklist to make sure that you have the standard equipment:

Equipment from the Shipping Container

☐ S/221 or S/222

☐ Power cable

☐ QIC tape

Next, you should unpack all terminals you want to attach to your system. The S/221 and S/222 require at least one terminal and one terminal cable for proper operation. 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 cables
(one per terminal, RS-232-C and/or RS-422)

☐ RS-422 terminators

The system is shipped fully equipped with whatever expansion equipment you ordered. The S/221 and S/222 can contain some or all of the following:

Expansion Equipment

☐ one Memory Expansion board

☐ up to three I/O Expansion boards

☐ up to two VME Expansion cards
(S/222 only)

☐ up to three hard disk drives

Inspecting Your System

Next, inspect your system to make sure that it has sustained no visible damage during shipping and that all of the equipment has been properly installed. Follow these steps to inspect the S/221 or S/222:

1. Move to the rear of your system and examine the I/O card cage. (Figures 2-1 and 2-2 show the location of the card cage for each configuration.) Examine the connectors on the CPU board and the power connector for any visible signs of damage.

   If you have an S/222, also inspect the VME card cage (see Figure 2-2) for any visible signs of damage.

Power Switch ——————————————— ▶☐☐◀—————— Power Connector

CPU Board ——————————▶

4—Slot I/O
Card Cage ——————————▶

Slot 1 ——————————

Slot 2 ——————————

Slot 3 ——————————

Slot 4 ——————————
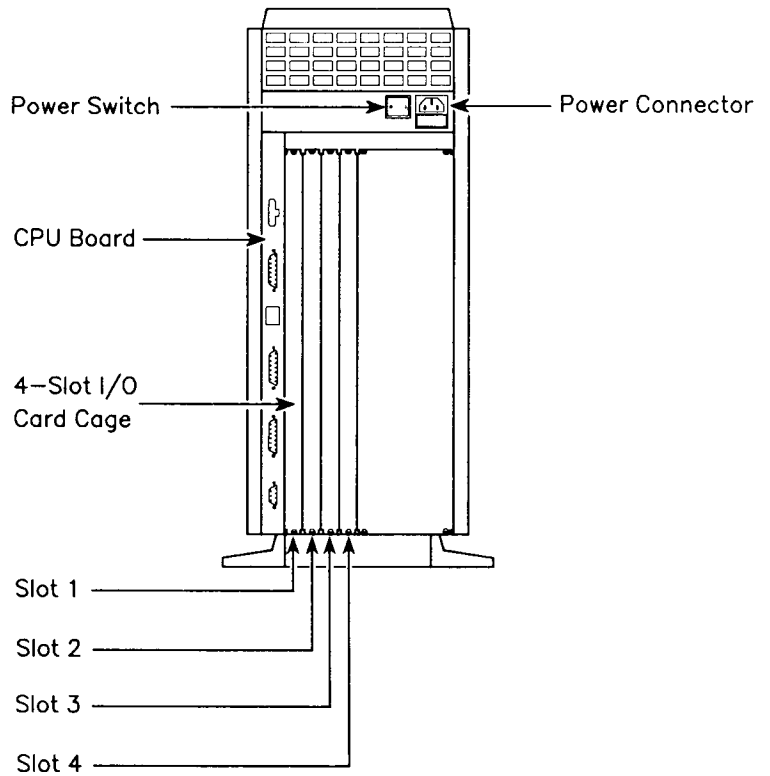
273A-003

Figure 2-1.   S/221 Configuration Components (Rear View)

Power Switch ——————→ ☐ ▣ ←—————— Power Connector

CPU Board ——————————→ ←—————— VME Interface Board

4—Slot I/O Card Cage ——→ ←—————— 2—Slot VME Card Cage

Slot 1 ———————————— Slot P7

Slot 2 ———————————— Slot P6

Slot 3 ———————————— VME I/F Slot

Slot 4 ————————————
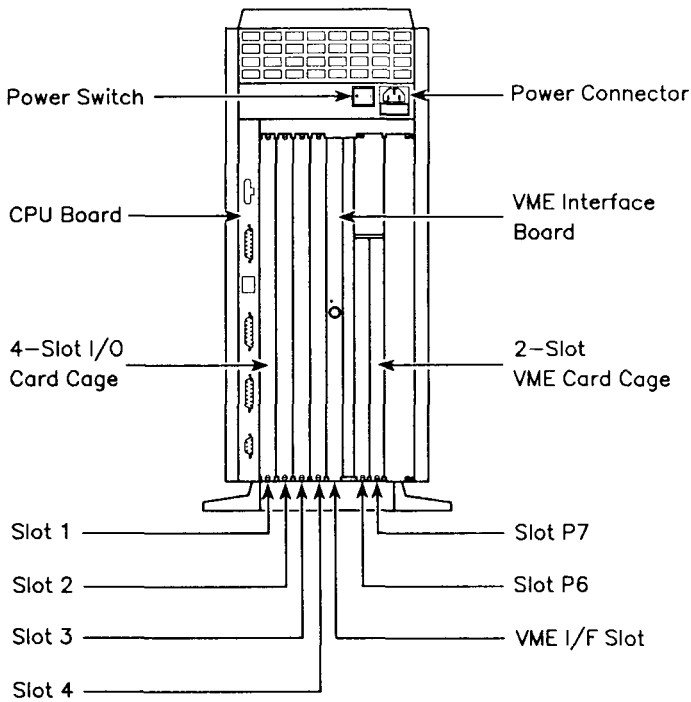
273A-004

Figure 2-2.   S/222 Configuration Components (Rear View)

2. Make sure that the boards you ordered are installed in the correct slots of the card cage.

   a. The Memory Expansion board is installed in slot 1.

   b. I/O Expansion boards are installed in slots 2 through 4. Slot 4 usually contains an RS-422 or IOP Expansion board.

   c. Figure 2-3 shows you what each Memory and I/O Expansion board looks like. If any board is incorrectly installed, see Chapter 6, "Installing Expansion Boards."

3. In S/222 systems, check the additional slots of the VME card cage.

   a. A VME Interface board is installed in slot VME/IF.

   b. VME Expansion cards are installed in slots P6 and P7.

   c. Figure 2-4 shows you what VME Expansion cards look like (for a complete list of available cards, consult the current sales guide). If any card is incorrectly installed, see Chapter 6, "Installing Expansion Boards."

4. Move to the front of your system and inspect the QIC tape drive for any visible signs of damage.

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	Memory Expansion Board
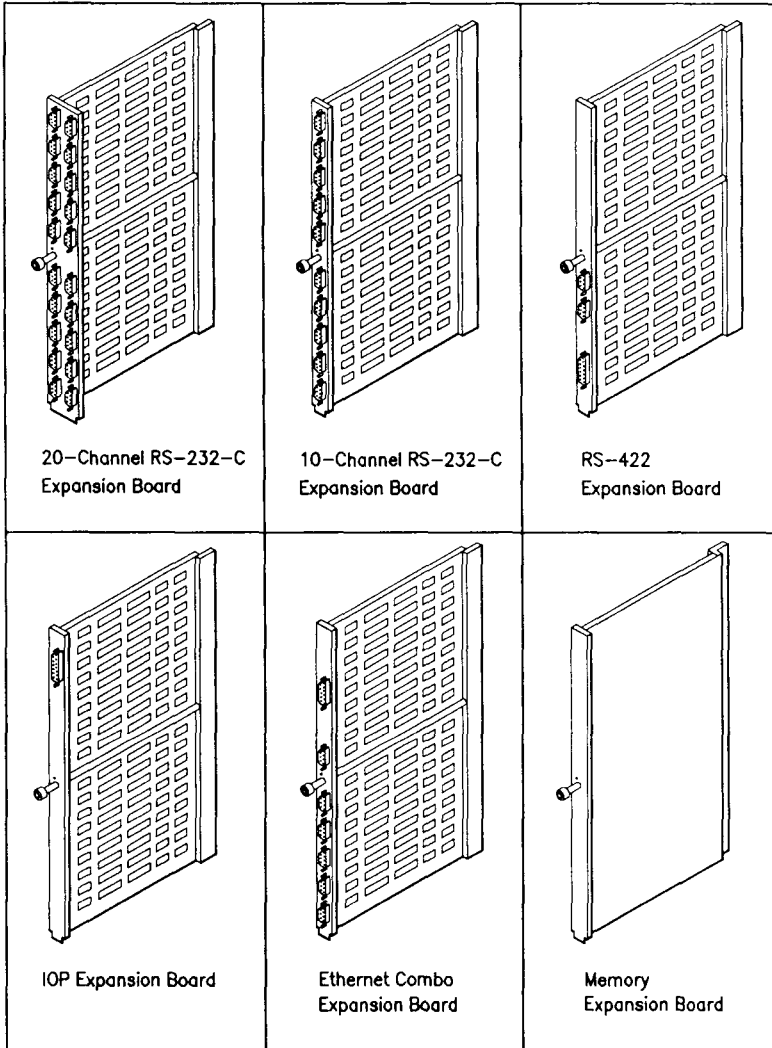
273A-005

Figure 2-3. Memory and I/O Expansion Boards

VME Interface
Board

VME SMD Controller
Card

VME Half—Inch Tape
Controller Card

VME Ethernet
Controller Card

273A-006
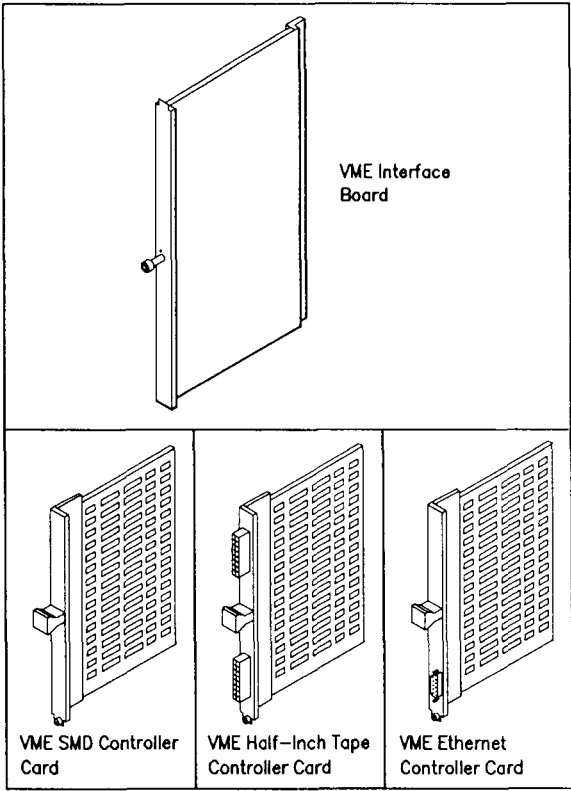
Figure 2-4.   VME Interface Board and VME Expansion Cards

3
Attaching Terminals, Printers, and Modems

This chapter presents information on attaching peripheral devices to your system. The following procedures are described:

- unpacking all equipment you plan to attach

- attaching additional terminals

- attaching parallel printers

- attaching serial printers and modems

Unpacking Peripherals

Unpack each peripheral when you are ready to attach it to your system. Before you install a device, be sure to read the manual shipped with the device. The manual will usually (but not always) contain information on installing and configuring the device.

Attaching Terminals

You can attach two types of terminals to the S/221 and S/222. RS-232-C terminals are connected to the two RS-232-C channels on the CPU board or to any of the channels on the RS-232-C Expansion boards or Ethernet Combo board. RS-422 terminals are connected to the two cluster channels of the RS-422 Expansion board. Figure 3-1 shows the location of these channels.

20-Channel RS-232-C Expansion Board

CPU Board RS-232-C Channel 1

CPU Board RS-232-C Channel 0

RS-422 Expansion Board

273A-007

Figure 3-1. Location of Terminal Ports

ATTACHING RS-232-C TERMINALS

RS-232-C terminals can be connected to the S/221 and S/222 in these locations:

- two RS-232-C channels on the CPU board

- any of the channels on an RS-232-C Expansion board

- six RS-232-C channels on the Ethernet Combo board

Attaching Terminals to the CPU Board

The CPU board contains two 25-pin RS-232-C channels designed specifically to connect terminals. These channels are labeled channel 0 and channel 1. You must attach a terminal to channel 0 when you initially boot the system.
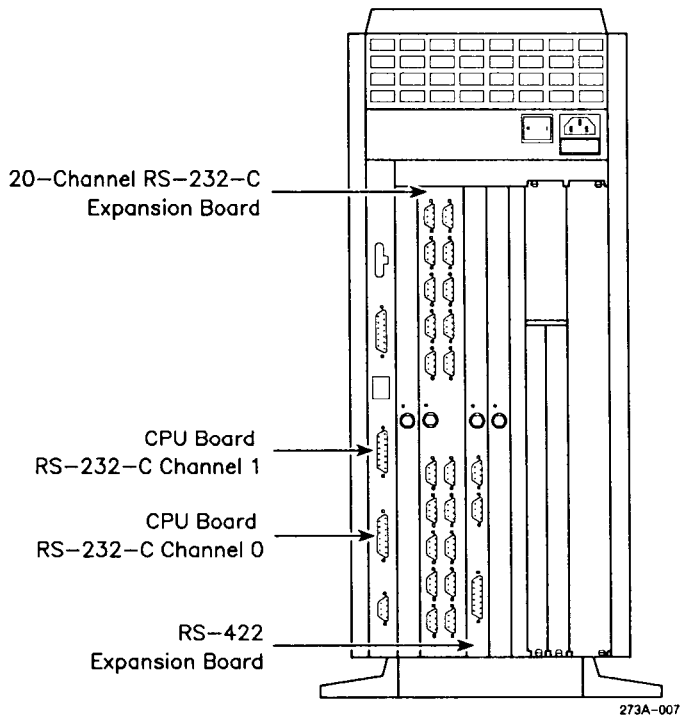
An RS-232-C channel requires an RS-232-C crossed cable with 25-pin connectors on both ends. See Appendix C, "Cable Specifications," for cable information and pin assignments.

To connect a terminal an RS-232-C channel on the CPU board,

1. Insert one 25-pin connector into the proper channel on the CPU board (see Figure 3-2).

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

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

Attaching Terminals to an Ethernet Combo Board or
RS-232-C Expansion Board

RS-232-C terminals can also be attached to the six RS-232-C channels on an Ethernet Combo board, or to any of the channels on a 10-channel or 20-channel RS-232-C Expansion board. These expansion boards can be located in slots 2, 3, and 4 of the card cage.

An RS-232-C channel requires an RS-232-C crossed cable with a 25-pin connector on one end and a 9-pin connector on the other end. See Appendix C for cable information and pin assignments.
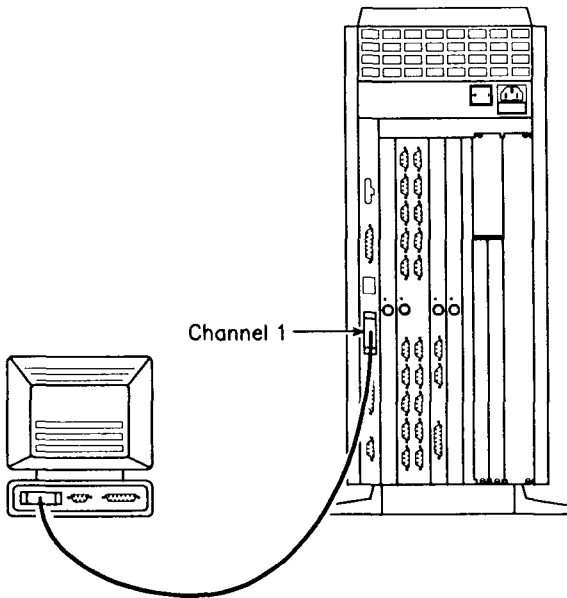
273A-008

Figure 3-2.   Attaching a Terminal to Channel 1 of the CPU Board

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

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

    2. Insert the 25-pin connector into the RS-232-C port on the
        terminal.

    3. Tighten the jackscrews that secure the connectors in place.
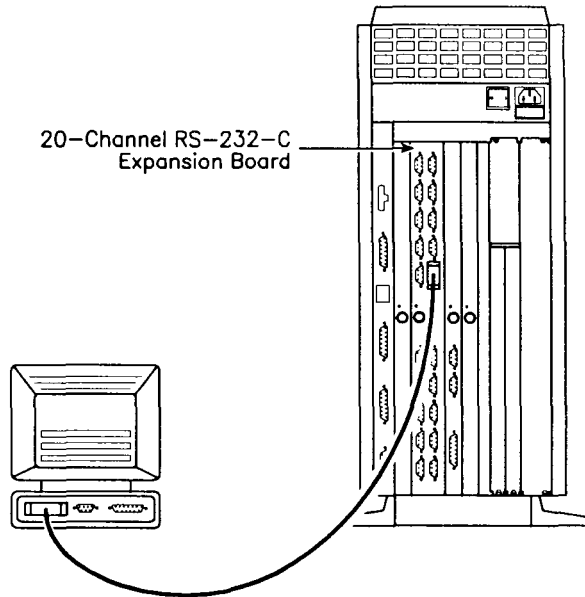
Figure 3-3. **Attaching a Terminal to a 20-Channel RS-232-C Expansion Board**

ATTACHING RS-422 TERMINALS

The RS-422 Expansion board contains two cluster channels; each cluster channel can support up to eight RS-422 terminals. This board can be installed in slot 4 of the I/O card cage.

NOTE: If you have an IOP Expansion board installed in your system, you cannot install an RS-422 Expansion board.

An RS-422 cluster channel requires an RS-422 cable with 9-pin connectors on each end. See Appendix C for cable information and pin assignments.

To connect a terminal to an RS-422 Expansion board,

1. Insert one 9-pin connector into the connector labeled Cluster Channel on the RS-422 Expansion board (see Figure 3-4).

2. Insert the other 9-pin connector into one of the two RS-422 plugs on the first cluster terminal.

3. If no other terminals are to be connected on this line, insert an RS-422 terminator into the unused plug. (See Appendix C for terminator information.)

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

To connect several RS-422 terminals to one RS-422 cluster channel after the first terminal has been connected,

1. Insert one 9-pin connector into the available RS-422 cluster channel on the first terminal.

2. Insert the other 9-pin connector into one of the two RS-422 ports on the second terminal.

3. Continue this procedure until all terminals are connected (see Figure 3-4).

   NOTE: The maximum cluster length for each cluster communications channel is 1,200 feet.

4. Insert an RS-422 terminator into the unused plug of the last cluster terminal on the line. (See Appendix C for terminator information.)

5. Tighten the jackscrews that secure the connectors in place.
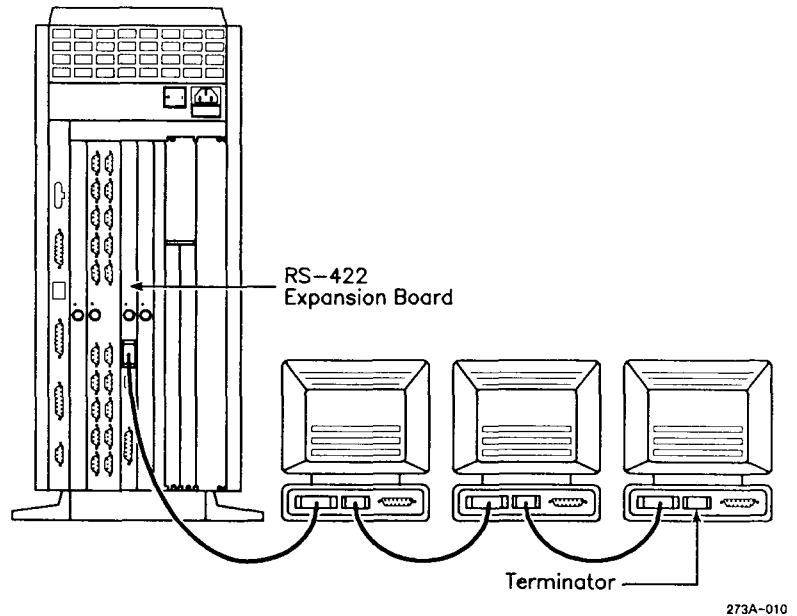
Figure 3-4. Attaching RS-422 Terminals to an RS-422 Expansion Board

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

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

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

1. Insert the 25-pin connector into the parallel printer channel. (See Figure 3-5, which shows connection to an RS-422 Expansion board.)

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

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

RS—422 Expansion Board
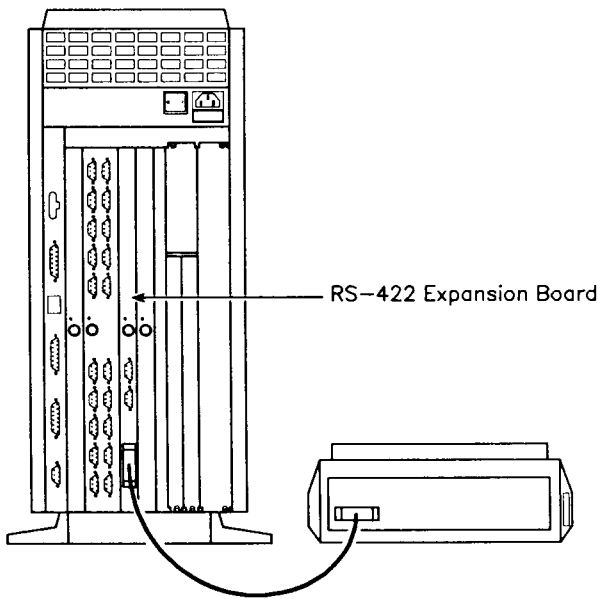
273A-011

Figure 3-5. 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. Insert the 9-pin connector into the channel on the Ethernet Combo board or RS-232-C Expansion board (see Figure 3-6).

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

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

20-Channel RS-232-C Expansion Board
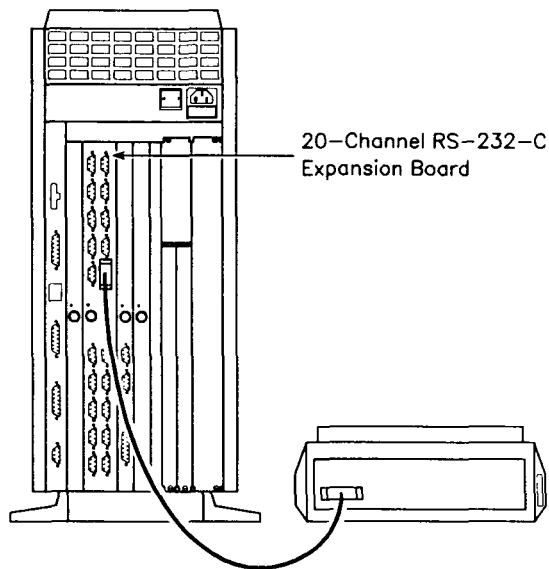
273A-012

Figure 3-6. Attaching a Serial Printer

4

Booting Your System

This chapter presents information on initially booting your system so that you can install the CTIX operating system. To boot your system,

- attach an RS-232-C terminal to channel 0 on the CPU board
- attach the power cord
- turn on the power
- insert the QIC (software) Installation tape
- refer to the current Release Notice to properly install the CTIX operating system

Attaching an RS-232-C Terminal to Channel 0 on the CPU Board

In order to initially boot the S/221 or S/222, you must connect an RS-232-C terminal to channel 0 on the CPU board. This will require an RS-232-C crossed cable with 25-pin connectors on both ends (see Appendix C, "Cable Specifications," for more information on cables).

See Chapter 3, "Attaching Terminals, Printers, and Modems," if you have not attached a terminal to this channel.

Powering Up the S/221 and S/222

To power up your system, you need to connect the power cable, and then turn on the power.

Caution: *Before you begin these procedures, check that the power switch (shown in Figure 4-1) is in the off (0) position.*

ATTACHING THE POWER CORD

Before attaching the power cord, check that the outlet into which you are plugging your system supplies the proper voltage and that it is not shared by any other high-current system (such as air conditioning). The voltage needed for your system is listed on a serial label near the power cord outlet.

To connect the 6-foot ac power cord to the S/221 or S/222,

1. Insert the ac cable connector into the mating connector on the power supply (see Figure 4-1).

2. Insert the other end of the cable into the ac power outlet.
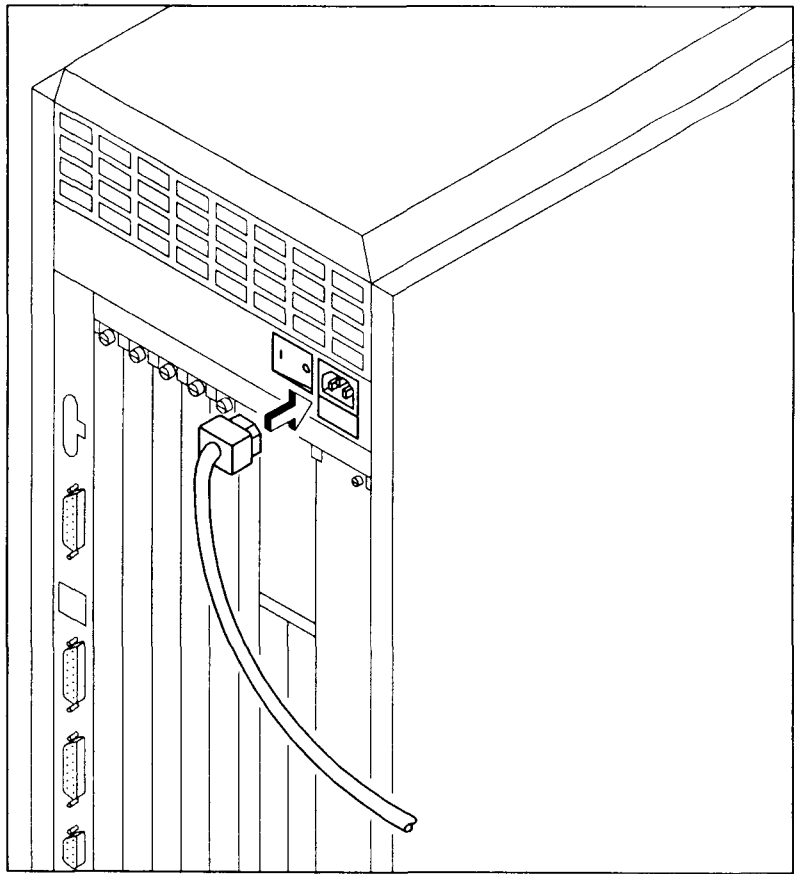
273A-013

Figure 4-1. Attaching the Power Cord

LOADING THE QIC INSTALLATION TAPE

Before you can use the S/221 or S/222, you must install the CTIX operating system. The QIC Installation tape (needed to begin the installation) is shipped with the S/221 and S/222.

Unpack the QIC Installation tape, then insert it into the QIC tape drive as shown in Figure 4-2.
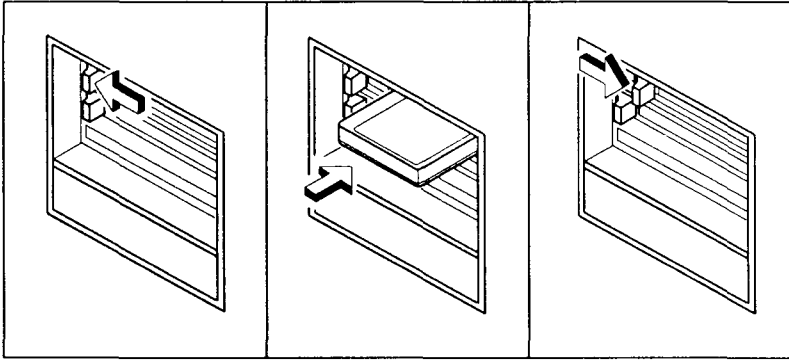
273A-014

Figure 4-2.   Inserting a QIC Tape

TURNING ON THE POWER

When the QIC tape is in the tape drive, you can turn on the power. To turn on the power,

1. Locate the power switch (see Figure 4-3).

2. Press the left side of the switch (marked with a 1) until it clicks over.
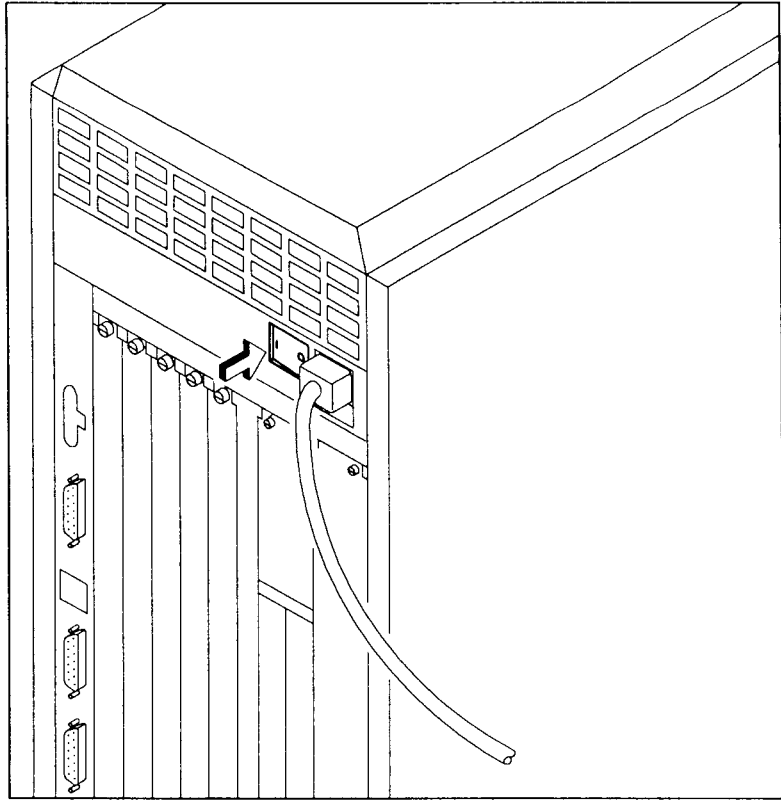
273A-016

Figure 4-3. Turning On the Power

The fan immediately comes up to speed. The activity indicator on the front panel should blink intermittently. It takes the S/221 and S/222 about 2 minutes to complete the power-up sequence.

NOTE: During the boot sequence, LEDs located on the CPU board (and visible only by removing the right side panel) will indicate boot status. These are documented in Appendix A, "System Status Codes."

The following boot ROM message appears on the screen of the terminal that is connected to channel 0 on the CPU board:

```
WELCOME TO S/MT SERIES CTIX
Do you wish to continue and install
the CTIX software on drive 0 ('yes' or 'no')?
```

Once you receive this prompt you are ready to install the CTIX operating system. Refer to the current Release Notice for instructions. If you do not receive this prompt, you must start up the terminal connected to channel 0 in Emulate mode. See the discussion below for more information.

STARTING TERMINALS IN EMULATE MODE

If you connected a programmable terminal (PT) or graphics terminal (GT) to channel 0 on the CPU board, that terminal must be started in Emulate mode. If you do not, this error message is continually displayed on the terminal screen:

```
E:AB
```

Emulate mode causes the terminal to function as though it were communicating with the S/221 or S/222 on an RS-232-C cable.

To start your PT or GT in Emulate mode:

1. Turn the terminal off.

2. Hold the space bar down while you turn the terminal on. Continue to hold the space bar down until the boot ROM prompt appears. The boot ROM prompt does not appear if you release the space bar before the prompt appears.

   The prompt from a GT with Version 1.0 or 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:
   ```

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 PT with Version 2.0 boot ROM looks like this:

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

3. Press **E** (for Emulate).

4. After several minutes, the following prompt appears on the screen:

```
login:
```

If your PT or GT contains a boot ROM version below 2.0, this prompt will be garbled. If so, you must download additional information by typing

PTDL for PTs

GTDL for GTs

Then press **Return**.

The correct prompt will appear after a few minutes.

The terminal now functions like an RS-232-C terminal. You can proceed to install the CTIX operating system as described in the current Release Notice.

5

Powering Down and Restarting Your System

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

Information on properly restarting the S/221 and S/222 can be found at the end of this chapter.

To correctly power down your system,

- log in as root (see below) and find out who is using the system
- instruct everyone using the system to log out
- shut down the CTIX operating system
- power down the S/221 or S/222

Shutting Down the Operating System

Before you power down your system you must shut down the operating system. If you do not follow these procedures, you may damage the file system when you turn the power off.

To properly shut down the CTIX operating system,

1. Log in as root by typing **root**, pressing **Return**, typing the appropriate password, then pressing **Return.**

2. Type **who** and press **Return.**

   A list of logged-in users appears on the screen. Instruct these users to log off before proceeding to step 3. When you (root) are the only user left on the system, proceed to step 3.

3. 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?:

4. Type **y** (for yes) or **n** (for no) and press **Return.** (If you are unfamiliar with this procedure, type **n.**) The shutdown program terminates all processes.

5. Other messages and prompts appear. When this message appears, you can turn the power off:

   **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. To turn off the power,

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

2. Press the right side of the switch (marked with a 0) until it clicks over.

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

Restarting Your System

When you are ready to turn the power back on to your system, simply press the left side of the power switch (marked with a 1) until it clicks over. The fan will immediately come up to speed, and the activity indicator on the front panel will intermittently blink. After about 2 minutes, your system is ready for normal operation.
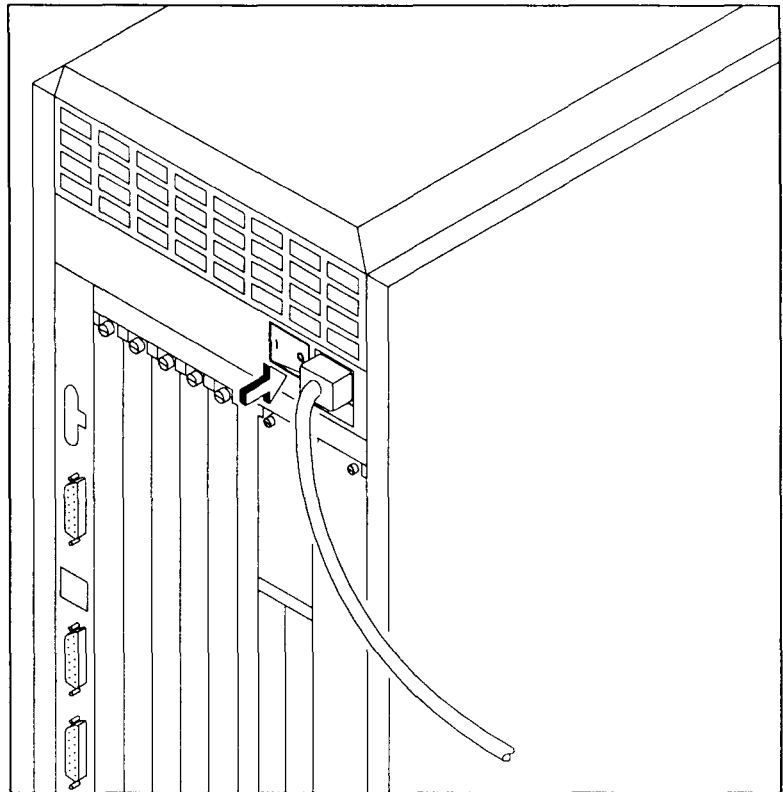
273A-015

Figure 5—1. Powering Down the S/221 and S/222

6

Installing Expansion Boards

This chapter presents information on removing and installing expansion boards in the S/221 and S/222. Expansion boards are installed in the I/O card cage and, in the S/222 configuration, in the VME card cage.

This chapter covers the following procedures for installing expansion boards in the I/O card cage:

- determining the location for the expansion board

- powering down the system

- removing an existing expansion board

- removing a blank panel

- installing an expansion board

This chapter also describes the following procedures for installing VME expansion cards (including single-height cards) in the VME card cage (S/222 only):

- powering down the system

- removing an existing VME Expansion card

- removing a blank panel

- installing a standard VME Expansion card

- installing a single-height VME Expansion card

Installing an Expansion Board in the I/O Card Cage

DETERMINING THE LOCATION OF AN EXPANSION BOARD

You can expand your system by adding or exchanging expansion boards in the I/O card cage (located in the rear of the S/221 and S/222). Several expansion boards are available for the S/221 and S/222, including the following:

- Memory Expansion

- RS-232-C Expansion (10-channel and 20-channel)

- Ethernet Combo

- RS-422 Expansion

- IOP Expansion

Before you install an expansion board, you need to determine the slot in which to install it.

Memory Expansion Board

Memory Expansion boards are installed only in slot 1 of the I/O card cage, and are installed with the components facing towards the CPU board. They are available in 2M-byte and 4M-byte increments. Only one Memory Expansion board can be installed per system.

RS-232-C Expansion Boards

There are two types of RS-232-C Expansion boards available for your system: 10-channel and 20-channel. The 10-channel board supports up to 10 RS-232-C terminals and/or serial peripherals (for example, serial printers and modems). The 20-channel board supports up to 20 RS-232-C terminals and/or serial peripherals.

The 10-channel RS-232-C Expansion board is installed in slots 2, 3, and 4 of the S/221 and S/222. The 20-channel RS-232-C Expansion board can only be installed in slots 2 or 3, because it will take up two slots. Each RS-232-C Expansion board is installed with the components facing away from the CPU board.

NOTE: When you attach a serial peripheral to an RS-232-C channel, you need to configure that channel to support the peripheral. See the MightyFrame Series Administrator's Reference Manual *for more information.*

Ethernet Combo Board

The Ethernet Combo board contains one Ethernet channel and six RS-232-C channels. It is installed slots 2 or 3 with the components facing away from the CPU board. Note that due to slot designations, the Ethernet Combo board cannot be installed in the S/222 if an RS-422 or IOP Expansion board is installed in slot 4.

RS-422 and IOP Expansion Boards

The RS-422 or IOP Expansion boards are installed in slot 4 with the components facing away from the CPU board. You can install only one of these boards per system.

The RS-422 Expansion board contains two RS-422 channels and supports up to eight RS-422 terminals (four per channel). The board also contains a parallel printer channel.

The IOP Expansion board expands the system by upgrading the performance of the RS-232-C channels. The board also contains a parallel printer channel.

POWERING DOWN THE S/221 AND S/222

You need to power down your system before you can install or remove an expansion board. See Chapter 5, "Powering Down and Restarting Your System," for instructions.

REMOVING AN EXPANSION BOARD

If you are replacing an expansion board, you may need to remove a board from the I/O card cage. To remove an expansion board from the I/O card cage,

1. Disconnect all peripheral cables from the expansion board.

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

3. Slide the board out of the card cage (see Figure 6-1).

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

    a. Insert the tab at the top of the blank panel into the opening at the top of the card cage.

    b. Seat the panel into the slot with firm pressure.

    c. Tighten the captive screw with a flathead screwdriver.

NOTE: Blank panels must be installed in all vacant slots to assure proper ESD/EMI protection and cooling performance.
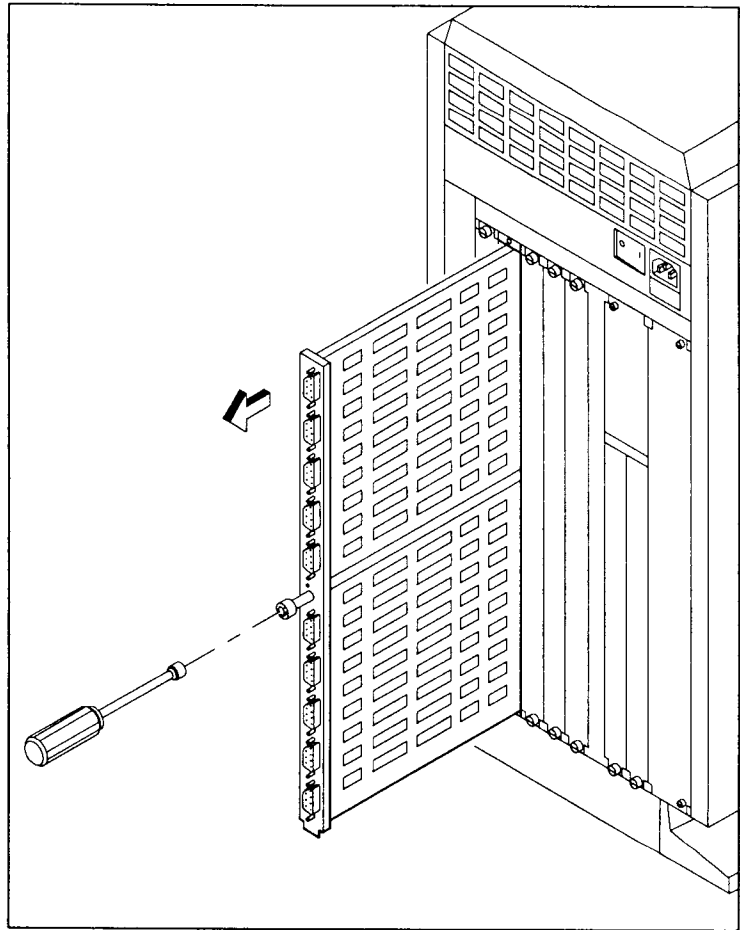
273A-017

Figure 6-1. Removing an Expansion Board

REMOVING A BLANK PANEL

If you are installing an expansion board in a slot that does not currently hold an expansion board, you must remove the blank panel from the slot before you can install the expansion board. Save the blank panel for future use.

Two captive screws secure each blank panel to the card cage. To remove blank panels,

1. Loosen the captive screws with a flathead screwdriver. (They remain attached to the blank panel.)

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

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

INSTALLING AN EXPANSION BOARD

Each expansion board is installed the same way. To install an expansion board,

1. Position the board so that the power LED is above the jackscrew.

2. Carefully slide the board into the guides in the I/O card cage until the board meets a solid resistance (see Figure 6-3).

3. Slowly push the board inwards and, at the same time, turn the jackscrew knob clockwise (using an 11/32-inch hex nutdriver) until it meets a solid resistance (approximately 12 full rotations). The board should be almost flush with the front surface of the card cage.

RESTARTING YOUR SYSTEM

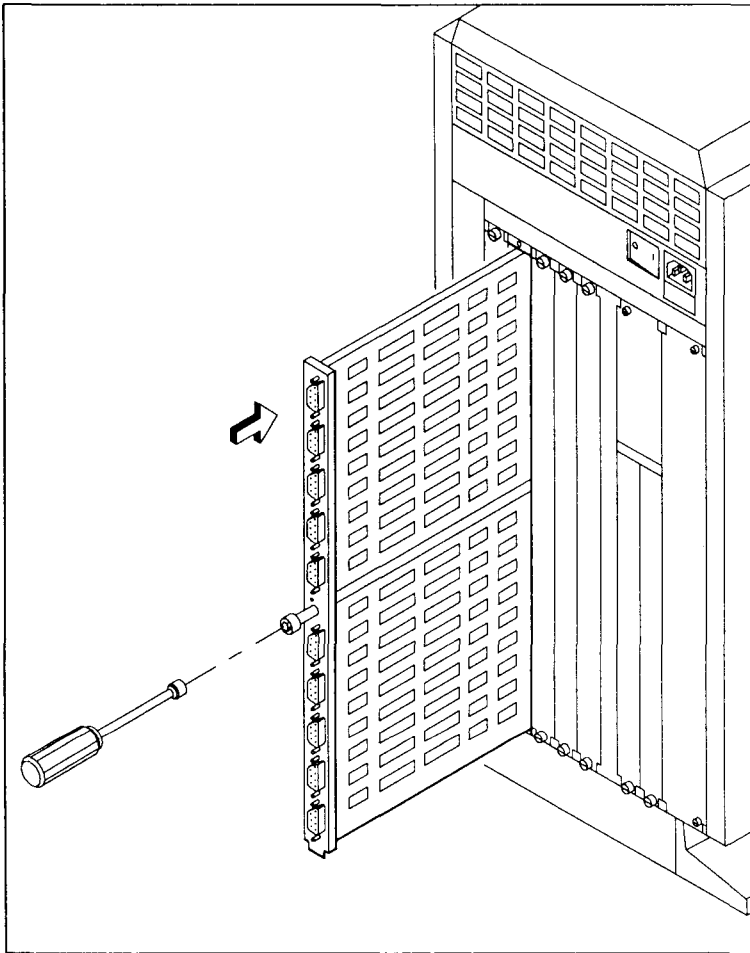See "Restarting Your System" in Chapter 5 for instructions.

ATTACHING PERIPHERALS

To attach peripherals to the expansion board you just installed, see Chapter 3, "Attaching Terminals, Printers, and Modems."
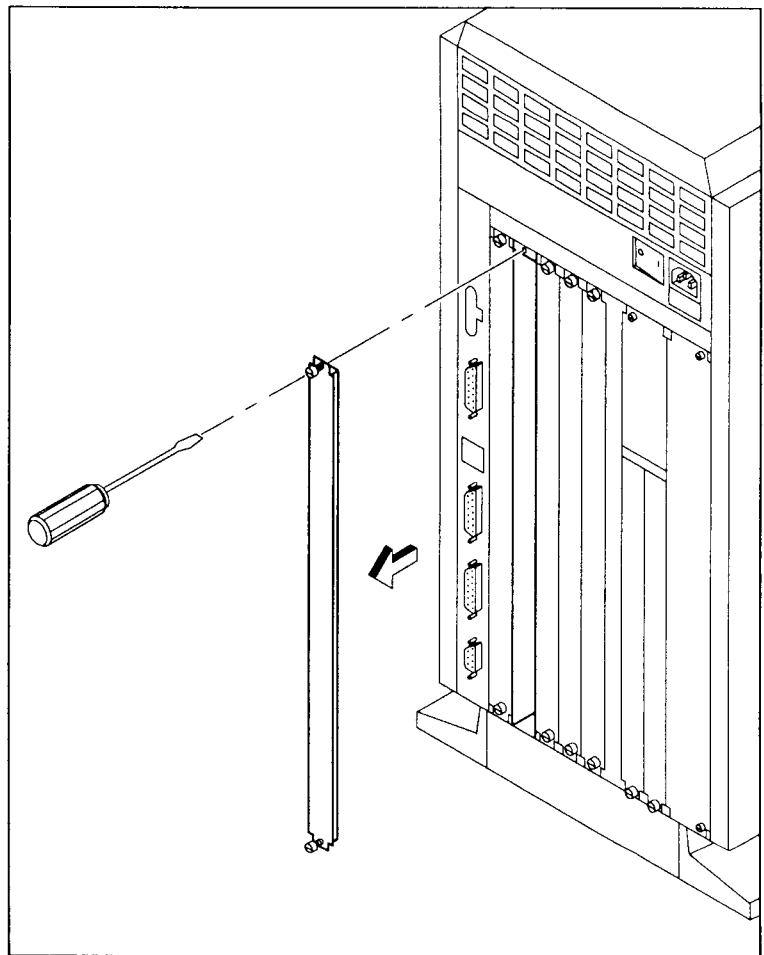
273A-018

Figure 6-2. Removing a Blank Panel

273A-019

Figure 6-3.   Installing an Expansion Board in the I/O Card Cage

Installing a VME Expansion Card in the VME Card Cage

VME Expansion cards (standard and single-height) can be installed only in the S/222. The cards are installed in slots P6 and P7 of the VME card cage (see Figure 6-4) with the components facing away from the CPU board.

There are several VME Expansion cards available for your system (consult the current sales guide for a complete list):

- Ethernet

- SMD Controller

- Half-Inch Tape Controller

POWERING DOWN YOUR SYSTEM

You need to power down your system before you can install or remove a VME Expansion board. See Chapter 5 for instructions.

THE VME INTERFACE BOARD

The S/222 is shipped with the VME Interface board installed in the VME I/F slot of the I/O card cage. If you need to remove and reinstall a VME Interface board, follow the instructions in "Installing an Expansion Board in the I/O Card Cage," earlier in this chapter.

REMOVING AN EXISTING VME EXPANSION CARD

If you are replacing a VME Expansion card, you need to remove an existing card from the VME card cage. To remove a VME expansion card from the VME card cage,

1. Disconnect all peripheral cables from the expansion card.

2. Using a flathead screwdriver, loosen the captive screw at the bottom of the front panel of the card you are removing.

VME Card Cage ————————→

Slot P6 ————————→

Slot P7 ————————→
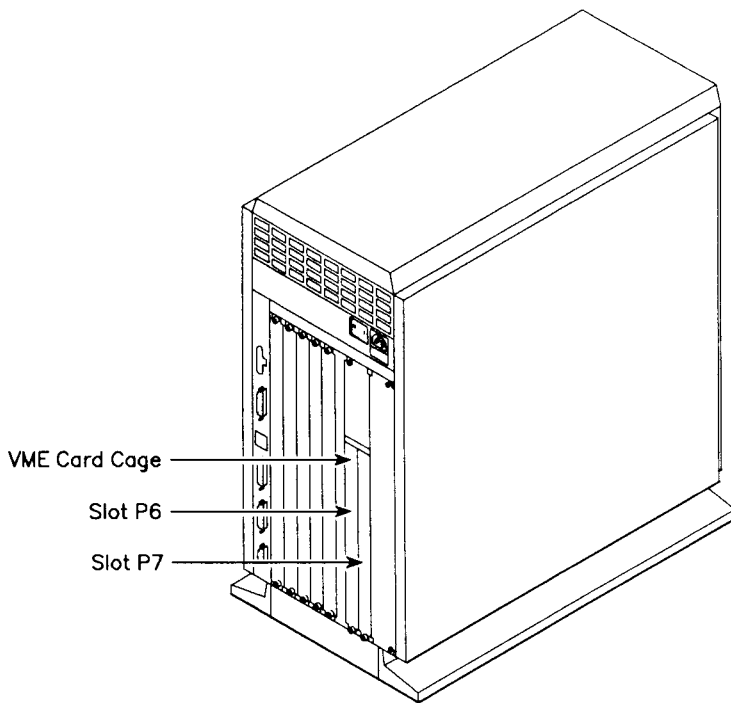
273A-020

Figure 6-4.   VME Card Cage (S/222 Only)

3. Grasp the handle on the card, give it a vertical tug to loosen it from the backplane, and slide the card out of the card cage.

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

   a. Insert the tab at the top of the blank panel into the opening at the top of the card cage.

   b. Seat the panel into the slot with firm pressure.

   c. Tighten the captive screw with a flathead screwdriver.

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

REMOVING A BLANK PANEL

If you are installing a VME Expansion card into a slot that does not hold an expansion card, you must remove the blank panel from the slot before you can install the expansion card. Save the blank panel for future use.

One captive screw secures each blank panel to the local card cage. To remove blank panels:

1. Loosen the captive screw with a flathead screwdriver. (It remains attached to the blank panel.)

2. Remove the blank panel.

NOTE: Remember to leave blank panels in slots that do not contain VME Expansion cards.

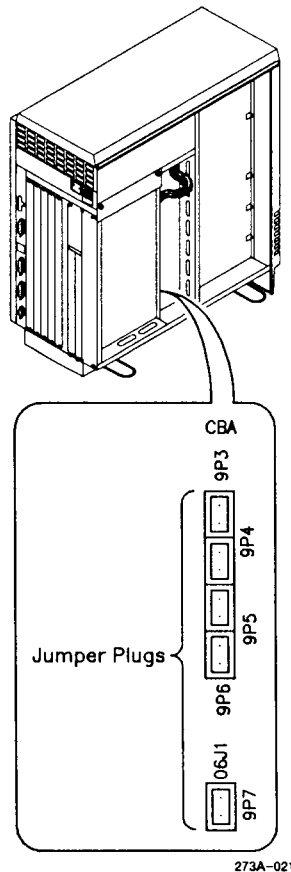## INSTALLING A VME EXPANSION CARD

VME Expansion cards are installed in slots P6 and P7 of the VME card cage. There are two types of VME Expansion cards, standard and single-height. Installation instructions for single-height cards are given in "Installing a Single-Height VME Expansion Card," later in this chapter.

In addition, there are two types of standard cards: those installed with and without bulkheads. There is a slight difference in the way each is installed (as noted in the steps below).

To install a VME Expansion card,

1. Slide the VME Expansion card into the VME card cage slot.

2. Tighten the screw at the bottom of the card to secure it to the card cage.

3. Replace the blank panel in the same position it was in before you removed it. If the VME Expansion card contains a bulkhead (connectors), do not replace the blank panel.

4. If you are installing the card in slot P6, you must remove the VME jumpers from the backplane (you do not need to remove jumpers for cards installed in slot P7).

   a. To access the VME card cage jumpers, you must remove the panel on the right side (as viewed from the rear). See "Removing and Reinstalling Side Panels" in Chapter 7 for instructions.

   b. Locate and remove the VME jumpers (see Figure 6-5).

   c. Replace the side panel and secure it in place by tightening the captive screws.

273A-021

Figure 6-5. Location of VME Card Cage Jumpers

INSTALLING A SINGLE-HEIGHT VME EXPANSION CARD

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 in each VME slot.

Single-Card Adapter

To install the single-card adapter,

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. Place the single-card adapter against the backplane in the VME card cage (see Figure 6-6). You can properly locate the adapter by matching the two protrusions on the sheet metal with the offsetting holes on the backplane.

3. Use the screw that was supplied with the single-card adapter to secure it to the rear of the VME card cage backplane.
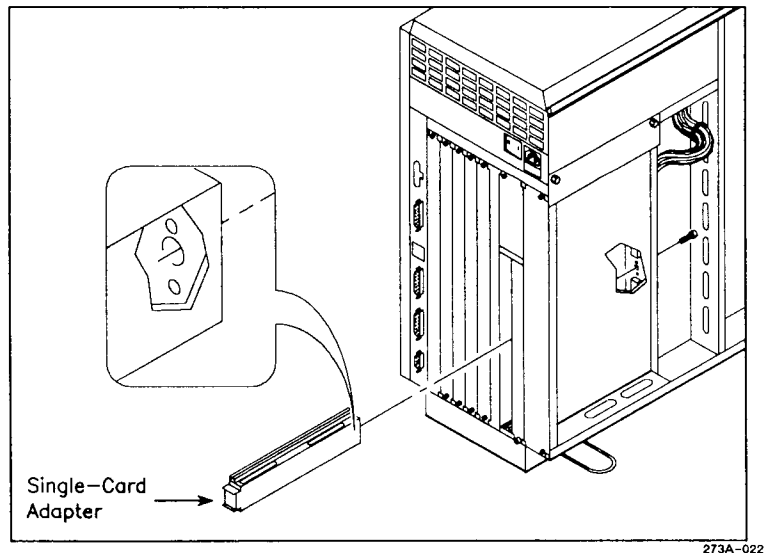

Single—Card Adapter

273A-022

Figure 6-6. Installing the Single-Card Adapter

Single-Height VME Expansion Cards

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.

To install a single-height card,

1. Grasp the single-height VME Expansion card and insert it into the card slot (see Figure 6-7).

2. Tighten the captive screw on the expansion card.

3. Reinstall the blank panel. This will maintain proper airflow throughout the card cage.

RESTARTING YOUR SYSTEM

See "Restarting Your System" in Chapter 5 for instructions.

ATTACHING PERIPHERALS

Refer to the manual for the VME Expansion card for instructions on attaching peripherals to the card.
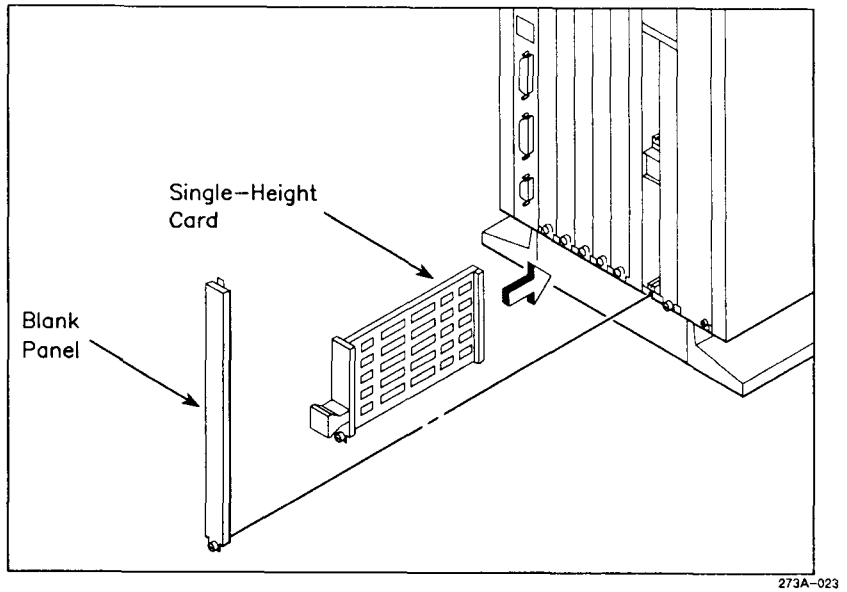
Figure 6-7. Installing Single-Height VME Expansion Cards

7
Installing Hard Disk Drives

This chapter presents information on removing and installing hard disk drives. The S/221 and S/222 are shipped with one QIC tape drive mounted in the Tape slot and up to three hard disk drives in slots D0 through D2.

To install additional drives, you will need to

- power down your system

- partially disassemble the S/221 or S/222 by removing the side and front panels

- remove an existing drive (if you are upgrading the drive)

- install the drive

- reassemble and power up your system

Powering Down Your System

You need to power down your system before you can expand it. See
Chapter 5, "Powering Down and Restarting Your System," for instructions.

Disassembling the S/221 and S/222

In order to install or remove hard disk drives from the S/221 and S/222,
you must partially disassemble it. Two steps are required to partially
disassemble your system: removing both side panels and removing the
front panel.

REMOVING AND REINSTALLING SIDE PANELS

To remove the side panels,

1. Using a 1/4-inch hex nutdriver, loosen the two captive screws
    located above the base plate (about five turns counter-
    clockwise), as shown in Figure 7-1.

    The screws are located between thin strips of plastic (webs).
    To find the screws, move the nutdriver horizontally in the gap
    until you hit the web. Move the nutdriver over the web; it will
   drop in directly over the screw.
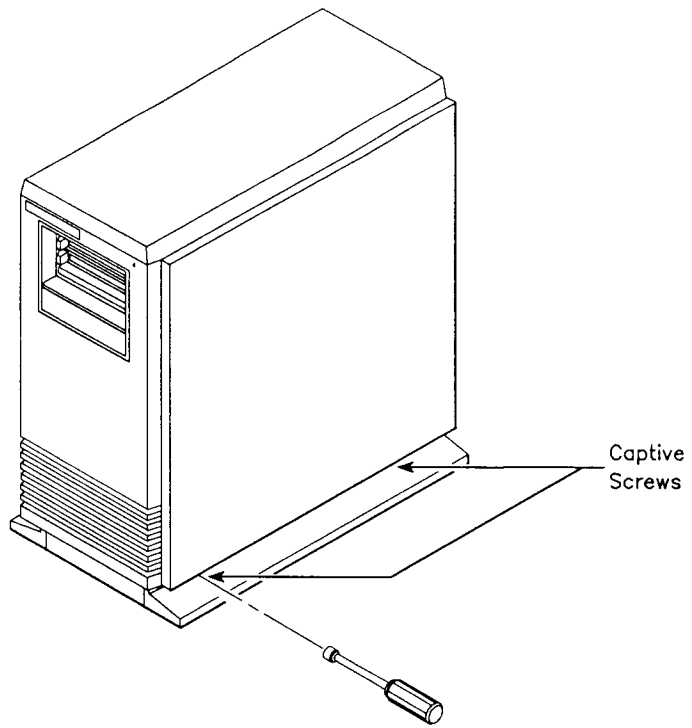
Captive
Screws

273A-024

Figure 7-1. Captive Screw Locations

2. Pull the bottom of the side panel toward you about 2 inches (pulling the panel too far may damage the upper hooks on the panel). Then lift the side panel up, unhooking it from the top panel (see Figure 7-2).

3. Set the side panel aside in a safe place.

Reverse the above steps to reinstall the side panels.
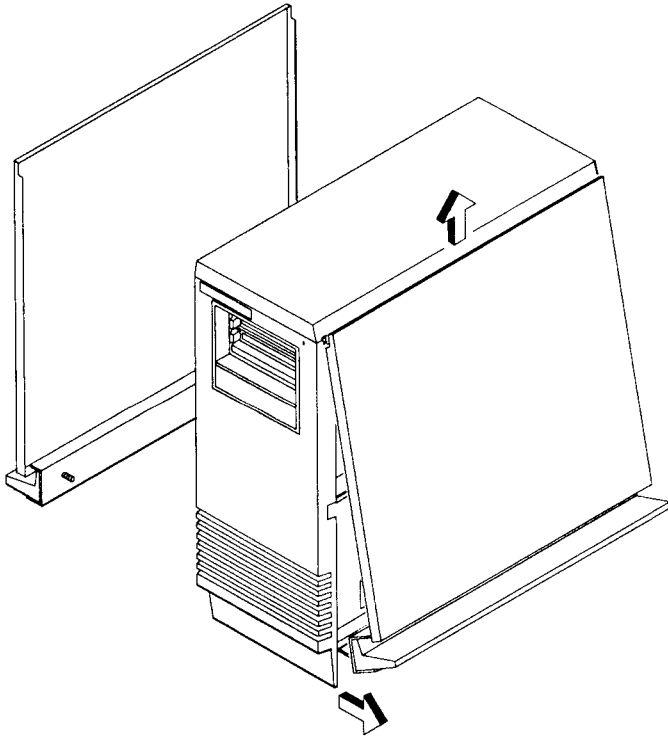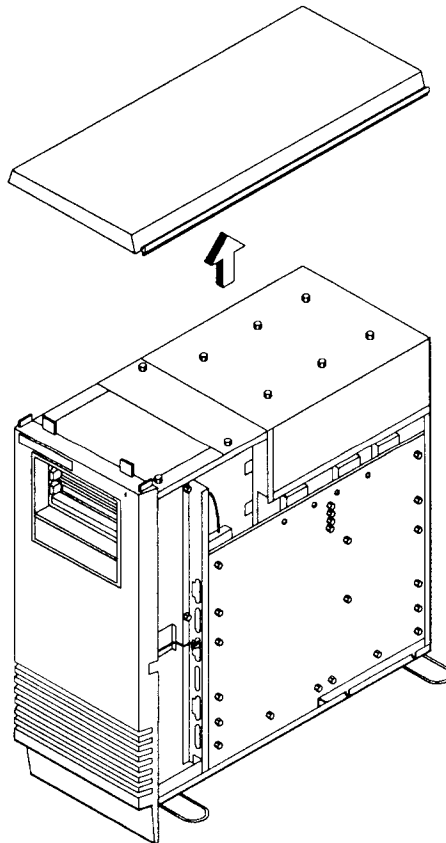

273A-025

Figure 7-2.   Removing the Side Panels

REMOVING THE TOP PANEL

The top panel is removed after the side panels are removed. The top panel should be removed *only* when you want to access the power supply module or the card cage.

NOTE: You do not need to remove the top panel to complete the procedures in this chapter.

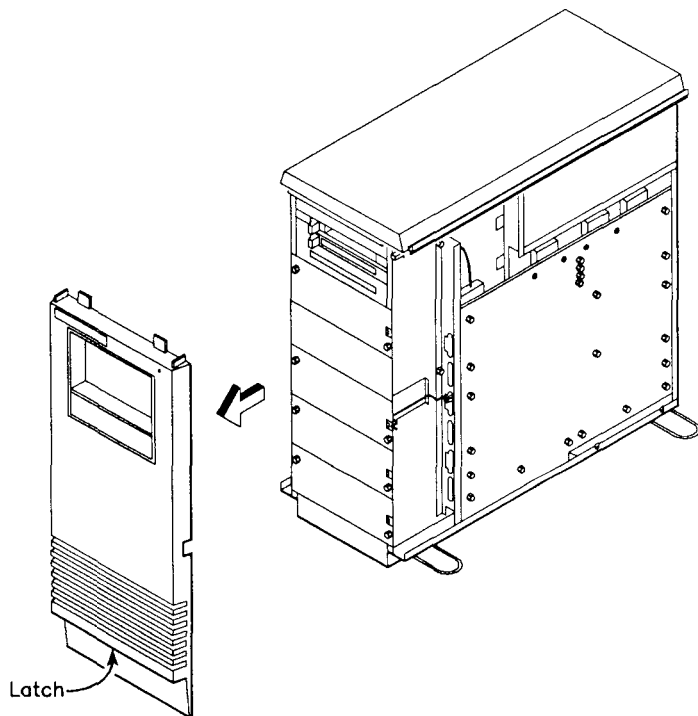To remove the top panel, grasp it on both sides and lift it up (see Figure 7-3).

273A-026

Figure 7-3. Removing the Top Panel

REMOVING AND REINSTALLING THE FRONT PANEL

To remove the front panel,

1. Using your index finger (with the fingernail facing the ground), reach under the bottom of the center of the front panel and push upwards on the release latch (see Figure 7-4).

Latch

273A-027

Figure 7-4. Removing the Front Panel

2. While holding the release latch up, pull the panel toward you until it begins to pull away from the enclosure.

NOTE: There are recessed areas on both sides under the grill where the panel can be gripped.

3. Grasp the panel on either side and pull it down and toward you, freeing it from the enclosure.

4. Set the front panel aside in a safe place.

Figure 7-5 shows the drive locations you should see when you remove the front panel.
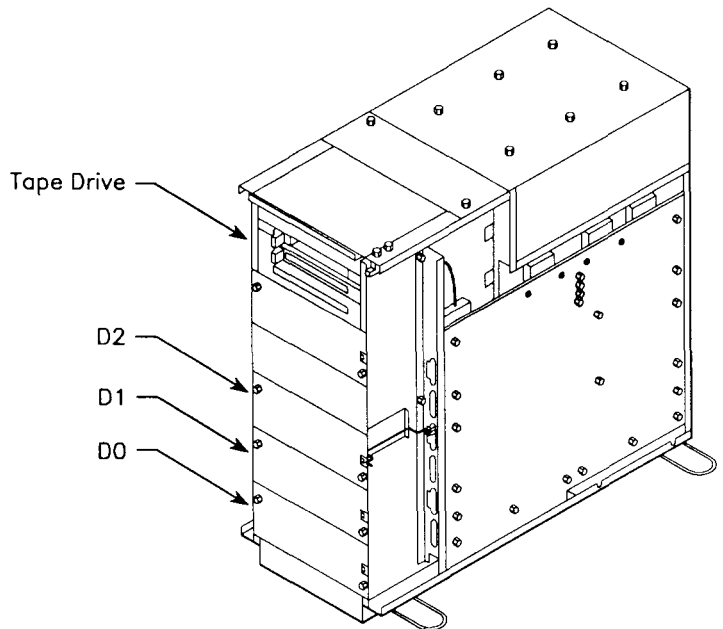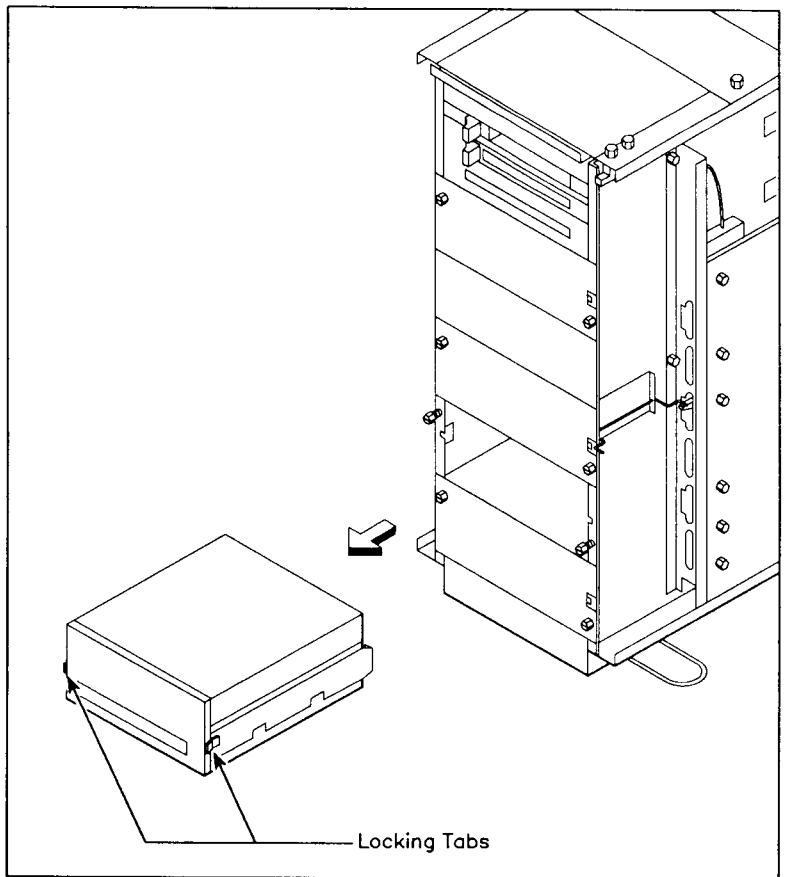

273A-028

Figure 7-5.   Drive Locations

To reinstall the front panel, reverse the above steps. Note that the panel needs to be properly positioned over the activity indicator. Before the panel is fully seated, be sure to push it inward and upward while holding the release latch up with your finger. When the front panel is fully seated, the alignment tabs molded into the lower part of the panel will meet with mating slots at the base of the enclosure.

Removing Existing Drives

If you are upgrading one of the hard disk drives in your system, you will need to remove that existing drive. The side and front panels must be removed so that you can access the drive.

To remove an existing drive,

1. Disconnect the three cables attached to the rear of the drive.

2. Using your thumbs, gently push the drive inwards (see Figure 7-6).

3. Using your index fingers, reach around to the sides of the drives and push the two locking tabs towards each other (inwards).

4. While pushing the tabs inward, remove your thumbs from the drive. The drive will slide slightly forward and release the locking tabs.

5. Remove your index fingers from the tabs.

6. Reach around to the back of the drive and push it slightly forward. Then grasp the drive on both sides and gently pull it out of the drive slot.

Locking Tabs

273A-029

Figure 7-6.   Removing a Hard Disk Drive

Installing a New Drive

Drives must be installed sequentially: first D0 (the bottom drive), then D1 (the middle drive), then D2 (the top drive).

If you are installing a drive in a previously unoccupied slot, you must remove the cover plate covering the drive slot. To do so, loosen the two screws that hold the plate in place, using a 1/4-inch hex nutdriver, and then remove the plate (see Figure 7-7). The cover plate must be installed in empty drive slots to assure proper cooling.

To install a new disk drive,

1. Slide the drive into the drive slot (as shown in Figure 7-8) until the locking tabs snap, indicating the drive is securely in place.

2. Attach the cables to the drive as shown in Figure 7-9 The 4-pin power cable attaches to the 4-pin connector. The 34-pin daisy-chain cable attaches to the 34-pin connector. The 20-pin radial cable attaches to the 20-pin connector.

> *NOTE: Drive D0 is referenced as A6 on drive cables. Drive D1 is referenced as A7 on drive cables. Drive D2 is referenced as A8 on drive cables.*

Reassembling the S/221 and S/222

The S/221 and S/222 must be reassembled for normal operation. To reassemble your system, replace the front panel and then the side panels. Follow the directions for reinstalling these panels given earlier in this chapter.

Powering Up Your System

See Chapter 5 for information on restarting your system.
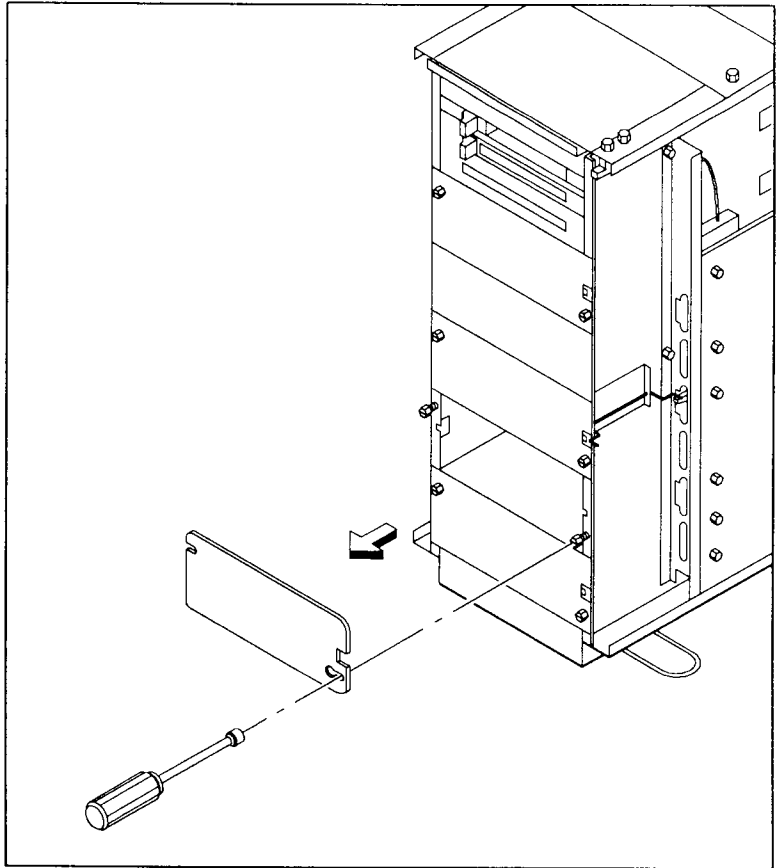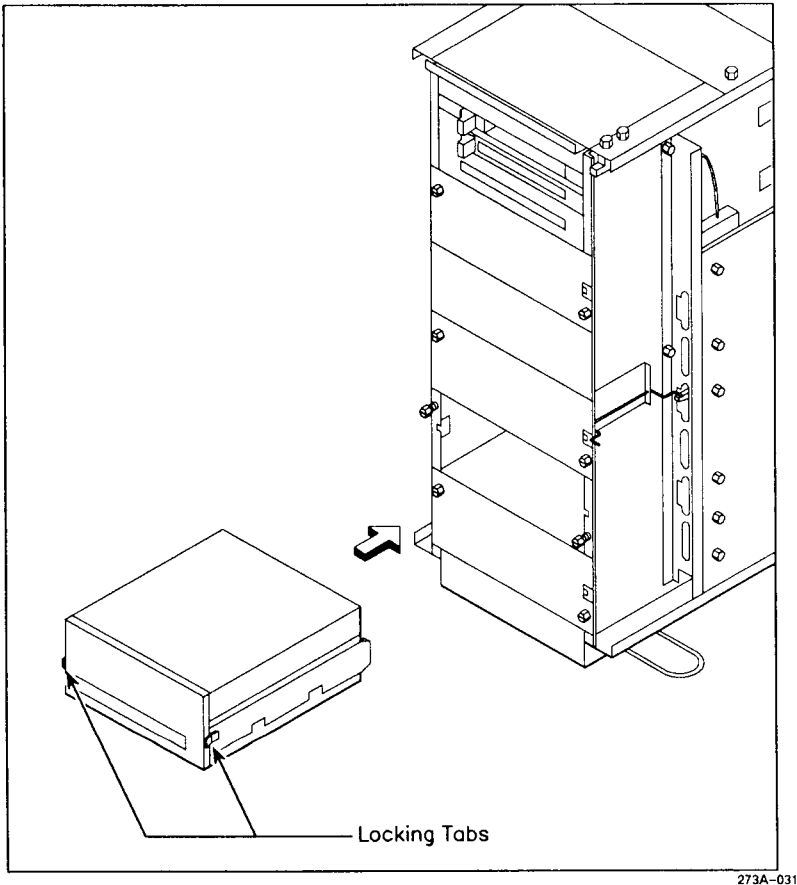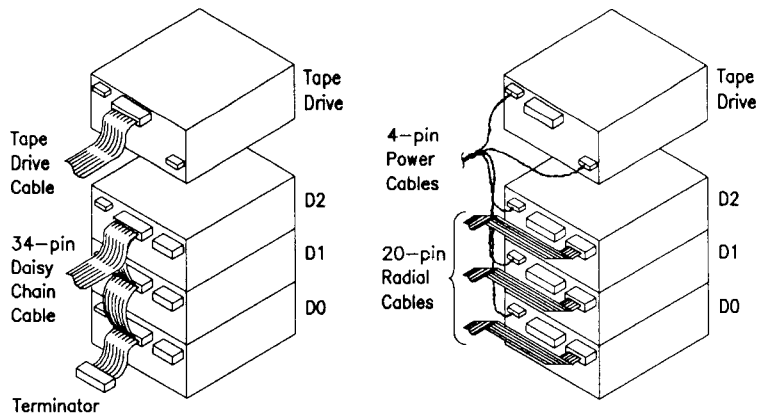
273A-030

Figure 7-7. Removing the Cover Plate

Locking Tabs

273A-031

Figure 7-8.   Installing a Hard Disk Drive

Figure 7-9. Attaching Drive Cables

Appendixes

A
System Status Codes

This appendix contains a summary of the S/221 and S/222 bootstrap sequence. A detailed discussion of the bootstrap sequence can be found in the *S/320 and S/222 Hardware Manual.*

Led Status Display

The S/221 and S/222 LED status display, shown in Figure A-1, is located on the CPU board and can be accessed only by removing the right side panel. The LED status display contains the power and eight status LEDs.

LEDs 4 through 0 illustrate the boot sequence error and status codes. LED4 is the most significant bit; LED0 is the least significant bit.

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 LEDs 4 through 0 display an error code; LED7 is off when LEDs 4 through 0 display a status code.

Boot Sequence

The boot sequence occurs whenever the S/221 and S/222 is powered up or reset. During the 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).
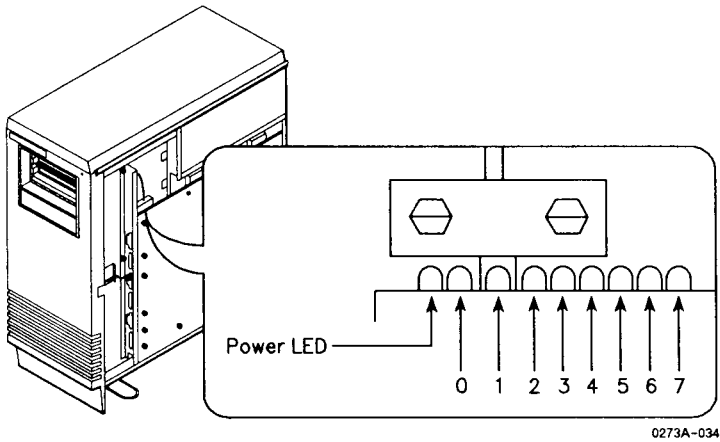

0273A-034

Figure A-1. LED Status Display

Error And Status Codes

Tables A-1 and A-2 list the bootstrap sequence status and error codes, respectively.

Table A-1

BOOTSTRAP ROM SEQUENCE STATUS CODES
(Page 1 of 3)

LED4	LED3	LED2	LED1	LED0	Code/Status
Off	Off	Off	Off	Off	**00h.** Reset LEDs. Open page 00h. Save CPU registers and memory map.
Off	Off	Off	Off	On	**01h.** Unused.
Off	Off	Off	On	Off	**02h.** Page RAM address pattern test, read/write.
Off	Off	Off	On	On	**03h.** Page RAM inverse address pattern test, read/write.
Off	Off	On	Off	Off	**04h.** Page RAM 0B pattern test, read/write.
Off	Off	On	Off	On	**05h.** Page RAM 1B pattern test, read/write.
Off	Off	On	On	Off	**06h.** Save BSS.
Off	Off	On	On	On	**07h.** Enter C. Disable interrupts.
Off	On	Off	Off	Off	**08h.** Save crash dump table.
Off	On	Off	Off	On	**09h.** Sizing memory.
Off	On	Off	On	Off	**0Ah.** Attempt once to initialize tape controller. Go to 0Dh if successful.
Off	On	Off	On	On	**0Bh.** Reload EEPROM. Call VME initialization area. Make one attempt each to recalibrate all drives.
Off	On	On	Off	Off	**0Ch.** Continue attempting to recalibrate drives. Will hang here if the QIC tape drive is nonoperational. Will go to 0Eh when successful.

Table A-1

BOOTSTRAP ROM SEQUENCE STATUS CODES
(Page 2 of 3)

LED4	LED3	LED2	LED1	LED0	Code/Status
Off	On	On	Off	On	**0Dh.** Dump from memory to tape, then go to 10h.
Off	On	On	On	Off	**0Eh.** Search once for dump area on disks. If unsuccessful, go to 10h.
Off	On	On	On	On	**0Fh.** Dump physical memory to disk.
On	Off	Off	Off	Off	**10h.** Base RAM address pattern test. Read/write without parity.
On	Off	Off	Off	On	**11h.** Base RAM inverse address pattern test. Read/write without parity.
On	Off	Off	On	Off	**12h.** Base RAM address pattern test. Read/write with parity.
On	Off	Off	On	On	**13h.** Base RAM inverse address pattern test. Read/write with parity.
On	Off	On	Off	Off	**14h.** Base RAM address pattern with 0x1000000 test. Read/write with parity.
On	Off	On	Off	On	**15h.** Expansion memory address pattern test. Read/write with parity.
On	Off	On	On	Off	**16h.** Expansion memory inverse address pattern test. Read/write with parity.
On	Off	On	On	On	**17h.** Expansion memory address pattern with ORed bit test. Read/write with parity.
On	On	Off	Off	Off	**18h.** Search QIC and onboard disks once for Loader. Go to 1Eh if successful.

LED4	LED3	LED2	LED1	LED0	Code/Status
On	On	Off	Off	On	**19h.** Rewrite EEPROM to memory. Attempt once each to recalibrate all drives. Go to 1C if successful.
On	On	Off	On	Off	**1Ah.** Continue attempting to recalibrate all drives.
On	On	Off	On	On	**1Bh.** Unused.
On	On	On	Off	Off	**1Ch.** Search for Loader on all disks. Go to 1E when successful.
On	On	On	Off	On	**1Dh.** Unused.
On	On	On	On	Off	**1Eh.** Load Loader.
On	On	On	On	On	**1Fh.** Executing Loader (from QIC).

Table A-2

BOOTSTRAP ROM SEQUENCE ERROR CODES
(Page 1 of 2)

LED4	LED3	LED2	LED1	LED0	Code/Status
Off	Off	Off	Off	On	**01h.** 8259 read-back error.
Off	Off	Off	On	Off	**02h.** Base RAM read/write 0Bs and 1Bs at 0xFF0 failed.
Off	Off	Off	On	On	**03h.** Unexpected NMI during memory sizing.
Off	Off	On	Off	Off	**04h.** QIC tape status shows fatal error.
Off	Off	On	Off	On	**05h.** Not enough good physical memory to map Loader (128K byte required).
Off	Off	On	On	Off	**06h.** NMI page frame number does not match expected number during memory sizing.
Off	Off	On	On	On	**07h.** Parity error during sizing on any memory board.
On	Off	Off	Off	Off	**10h.** Error during base RAM address pattern test. Read/write without parity.
On	Off	Off	Off	On	**11h.** Error during base RAM inverse address pattern test. Read/write without parity.
On	Off	Off	On	Off	**12h.** Error during base RAM address pattern test. Read/write with parity.
On	Off	Off	On	On	**13h.** Error during base RAM inverse address pattern test. Read/write with parity.
On	Off	On	Off	Off	**14h.** Error during page RAM address pattern read/write test.

Table A-2

BOOTSTRAP ROM SEQUENCE ERROR CODES
(Page 2 of 2)

LED4	LED3	LED2	LED1	LED0	Code/Status
On	Off	On	Off	On	**15h.** Error during page RAM inverse address pattern read/write test.
On	Off	On	On	Off	**16h.** Error during page RAM address test.
On	Off	On	On	On	**17h.** Error during page RAM 0B pattern read/write test.
On	On	Off	Off	Off	**18h.** Error during page RAM 1B pattern read/write test.
On	On	Off	Off	On	**19h.** Error during RAM address stack and BSS (b000 through 16000) read/write without parity test.
On	On	Off	On	Off	**1Ah.** Error during RAM inverse address stack and BSS (b000 through 16000) read/write without parity test.
On	On	Off	On	On	**1Bh.** Error during RAM address and ORed 1B read/write without parity test.

B

S/221 and S/222 Specifications

Table B-1

DIMENSIONS AND WEIGHT

	Unpackaged	Packaged
Height	25 inches	36 inches
Width	9.75 inches (tower) 12.50 inches (base)	21 inches
Depth	24 inches	37 inches
Weight*	80 to 120 lbs	95 to 135 lbs

*depending on system configuration

Table B-2
POWER SPECIFICATIONS

Condition	Requirement
Input voltage	115V nominal (85 to 139V ac RMS) 230V nominal (180 to 260V ac RMS)
Input voltage	115/230V ac 47 to 63Hz frequency (continuous)
Surge current	115V ac: 20A (for 2 cycles) 230V ac: 40A (for 2 cycles)
Operating current	115V ac: 4A max (230W) 230V ac: 2A max (230W)
Heat dissipation*	to 700W (2390 BTU/hr)

*depending on system configuration

Table B-3
ENVIRONMENTAL LIMITS

Condition	Status	Limit
Temperature	Operating Nonoperating	10° to 40° C 0° to 60° C
Humidity*	Operating Nonoperating	10% to 80% 5% to 95%
Altitude	Operating Nonoperating	Sea level to 10,000 feet Sea level to 30,000 feet

*relative humidity, noncondensing

C
Cable Specifications

This appendix defines specific hardware and software characteristics applicable to the S/221 and S/222 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/221 and S/222 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/221 or S/222 to the printer
LPTSTROBE-	Handshake line from the S/221 or S/222 to the printer
LPTACK-	Acknowledge signal from the printer to the S/221 or S/222 indicating that a character has been accepted and that another one can be sent
LPTBUSY+	Status line to the S/221 or S/222 indicating that the printer cannot currently accept data
LPTNOPAPER+	Status line to the S/221 or S/222 indicating that the printer is out of paper
LPTSELECT+	Status line to the S/221 or S/222 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/221 and S/222

Pin Assignments:

A S/221 or S/222 (plug)	B Printer (plug)	Assignment
1 ————⟶	2	LPT0+
2 ————⟶	3	PT1+
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, 13, 15 ⟵——⟶	24, 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)

273A-035

Parallel Printer Cable Construction:
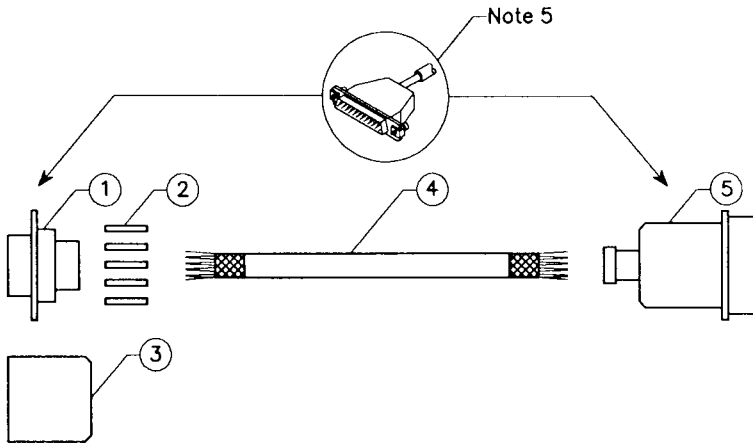
273A-036

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 10-channel RS-232-C Expansion board contains ten 9-pin channels that allow asynchronous and synchronous communications at 9600 baud. The Ethernet Combo board contains six 9-pin channels that allow asynchronous and synchronous 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/221 and S/222: straight and crossed.

Straight cables Connect DCE to the S/221 and S/222. 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/221 and S/222.

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:

A S/221 or S/222 (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
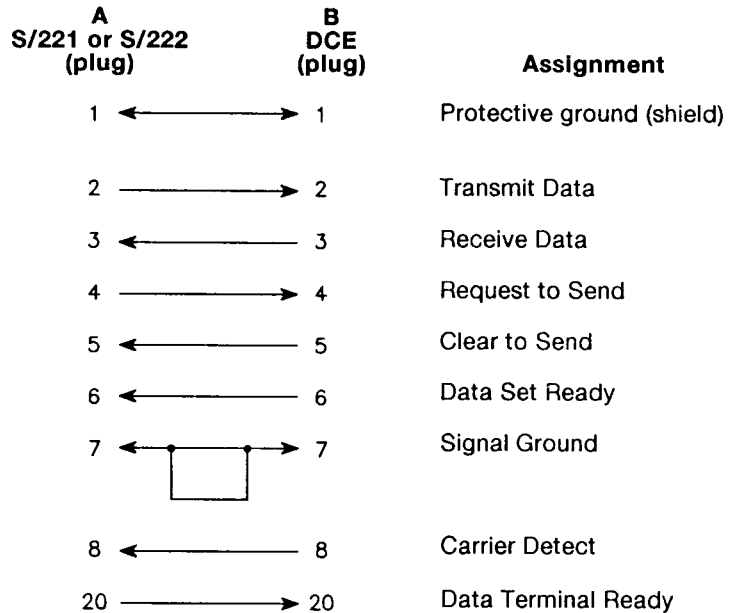
273A-037

Straight Cable (25-pin to 25-pin) Construction:
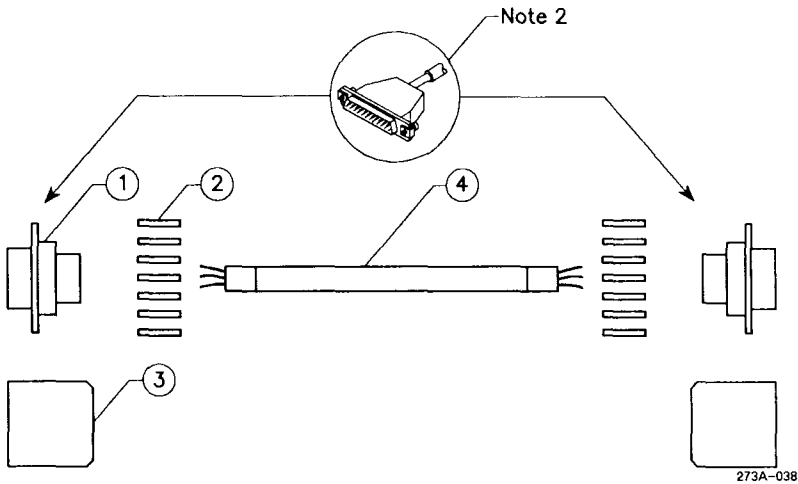
Item	Quantity	Description
1	1	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	18	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	1	Connector shell, strain reliefs, and grounding. Use AMP part number 745173-3 or equivalent.
4	25 feet	10-conductor shielded 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/221 or S/222 (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:

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
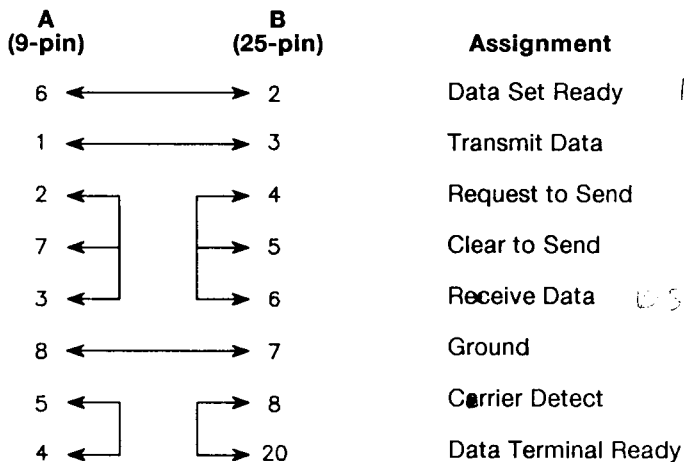
273A-041

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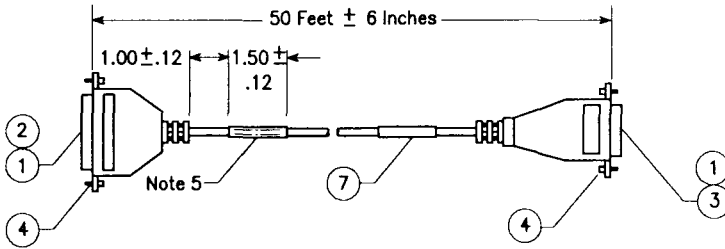
Crimp Style Ferrule or Solder Flow for 360°
Connection Between Braid and Metallic Shield and
Between Connector and Metallic Shield

Note 2 Both Ends

Note 3

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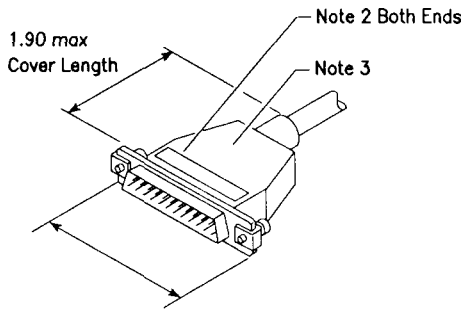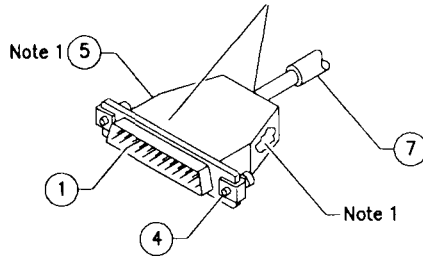
1.250 max (9pos)/2.125 max (25 pos)
Cover Overlap to Connector Shell (if Used)

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

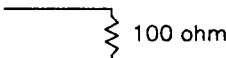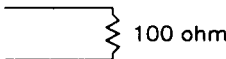**Notes:**

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/221 or S/222 (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
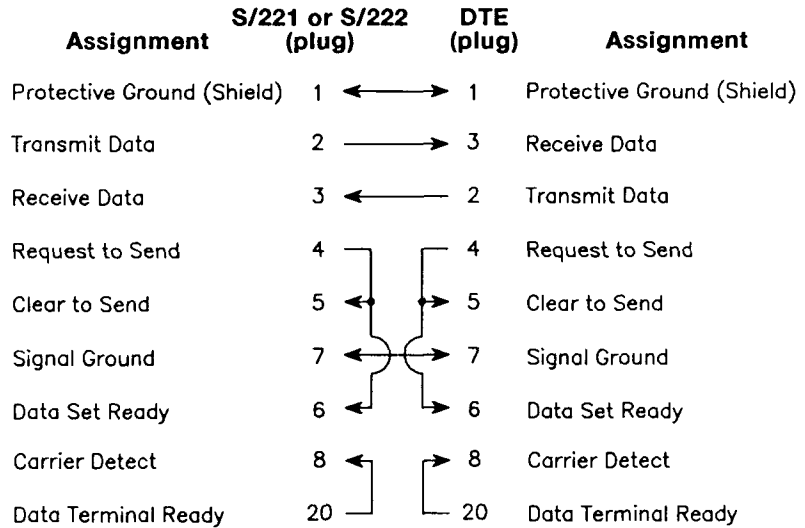
273A–043

Crossed Cable Construction:
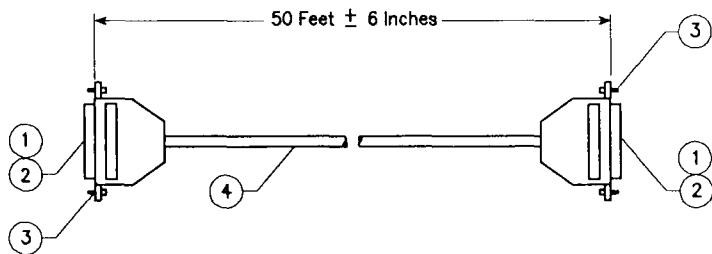
50 Feet ± 6 Inches

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

Note 1 (6)

(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:
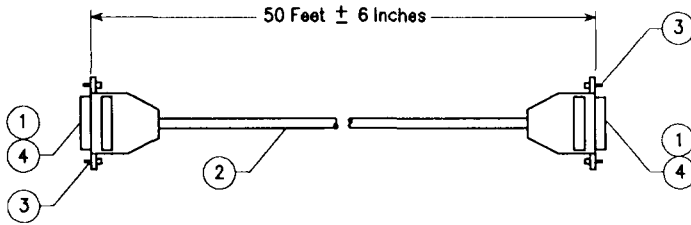
50 Feet ± 6 Inches

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

Note 1 Inner Mold

1.40 max
Cover Length

Note 3

.800 max Cover Width

.620 max Cover Width

Note 2 Both Ends
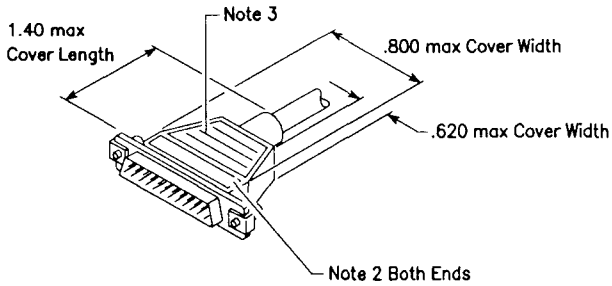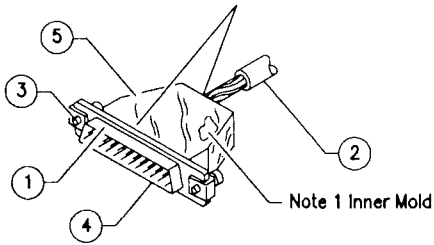
273A-046

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	─────┐	CLK+
	⧘ 100 ohm	
7	─────┘	CLK-
8	─────┐	DATA+
	⧘ 100 ohm	
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

Pin 1

1.25 max

.90 max
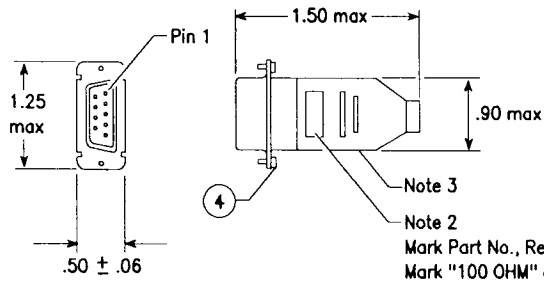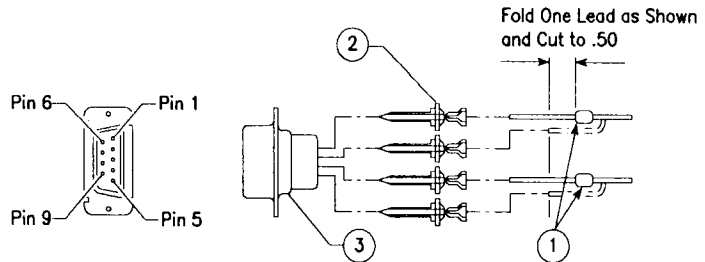
Note 3
Note 2
Mark Part No., Rev Level on Near Side
Mark "100 OHM" on Opposite Side

.50 ± .06

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:

273A-050
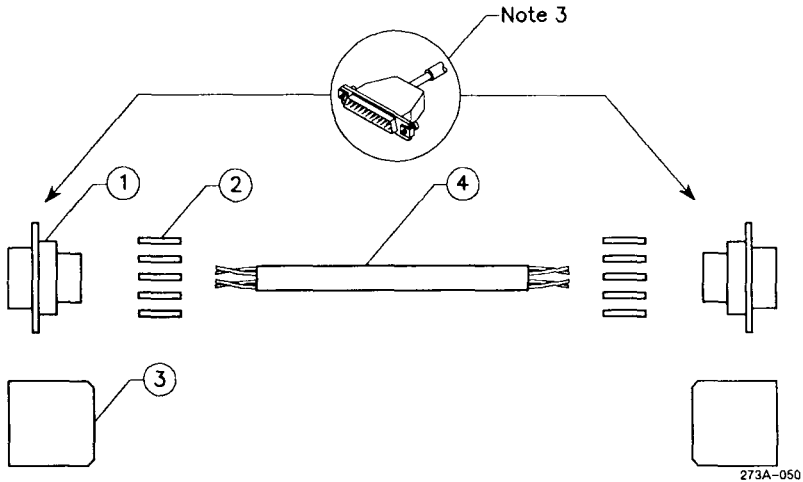
Item	Quantity	Description
1	2	9-pin, D-type, socket assembly (female). Use AMP part number 205203-4 or equivalent.
2	10	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	2	Connector shell and strain relief. Use AMP part number 745171-5 or equivalent.
4	0.5 feet	4-conductor, twisted-pair, 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

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

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

Belden Corp.
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Richmond, IN 47374
(317) 983-5200

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

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

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

D

QIC Maintenance

This appendix describes the QIC tape drive and its correct cleaning procedure.

QIC Tape Drive

The tape drive uses a QIC tape of 600 feet. It is recommended that you use 3M DC-600A tape cartridges.

The QIC tape drive has a mean time between failures (MTBF) of 5000 power-hours and a mean time to repair (MTTR) of 1/2 hour. Recommended full service life is 5 years.

Tape Drive Head Maintenance Procedure

If you are using new tape cartridges, the heads must be cleaned after every 2 hours of actual use and after each initial pass with a new tape. For other cartridge conditions, cleaning should be performed at 8-hour intervals during normal use. Normal use is defined as 2 to 3 hours of actual drive use in a regular 8-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 4 to 6 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 light the inside of the tape drive.

Caution: *Do not use a QIC 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. If necessary, remove the QIC tape from the tape drive by firmly pushing the slide lever left 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.

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

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

273A-051
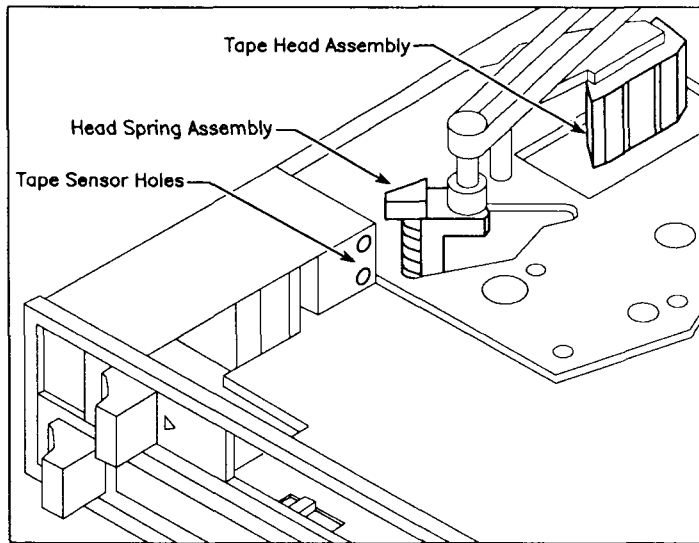
Figure D-1.   Cleaning the QIC Tape Drive

3. 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.*

4. Insert the swab, spade-end first, through the cartridge access slot until you touch the head.

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

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

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

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

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

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

10. 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.

11. Push the upper lever left to move the head assembly back into the retract position.

E

This chapter contains information on replacing the lithium battery on the CPU board and the fuse in the main power supply module.

Battery

The CPU board contains a battery that you may need to replace periodically. The battery access slot on the rear of the CPU board enables you to quickly and conveniently replace the battery.

You will need a pair of tweezers or needlenose pliers to remove the battery. You will use your hands to install the new battery (metal tweezers or pliers can damage a new battery).

Caution: *If you use a pair of metal tweezers or needlenose pliers, then you must power down your system before you attempt to replace the battery. 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 polycarbonmonoflouride)

- weight: 0.141 ounce (4.0 grams)

- nominal voltage: 3V

- nominal capacity: 160-200 mA

- temperature range: -14° F to +122° F

- maximum current pulse: 15 mA

- initial impedance: 250 ohms

- impedance during discharge: 100 ohms

To replace the battery,

1. Locate the battery access slot on the CPU board (see Figure E-1).

2. Insert a pair of tweezers or needlenose pliers into the battery access slot and grasp the battery by slipping one leg of the tool between the battery and the plastic battery retainer.

3. Pull the battery free of the battery access slot.

4. Position the battery so the polarity is correct. Insert the new battery by hand into the battery access slot. Be sure the battery is fully seated in its retainer.

Fuse

The main power supply contains a fuse you may need to replace. The fuse is accessed from the rear of the S/221 and S/222.

Caution: *Before replacing the fuse, be sure that the cause of the malfunction has been corrected.*
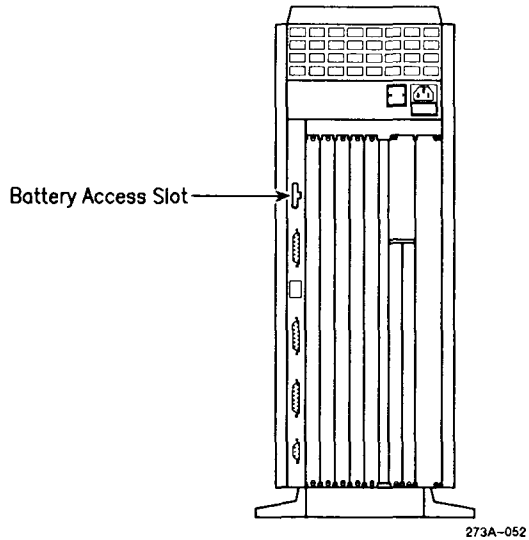
Figure E-1. Battery Access Slot

The replacement fuse must meet the following specifications:

- 7A/250V normal blow, North American (1-1/4-inch by 1/4-inch) fuse for 115V systems

- 4A/250V fast blow, European (5 mm by 20 mm) fuse for 230V systems

To replace the fuse,

1. Turn your system off by pressing the right side of the switch (marked with a 0) until it clicks over (see Figure E-2).

2. Unplug the ac power cord from the power connector.

3. Find the fuse cover at location F1 on the power connector (see Figure E-3). Insert a small screwdriver under the flange on the fuse cover and pry the cover out.
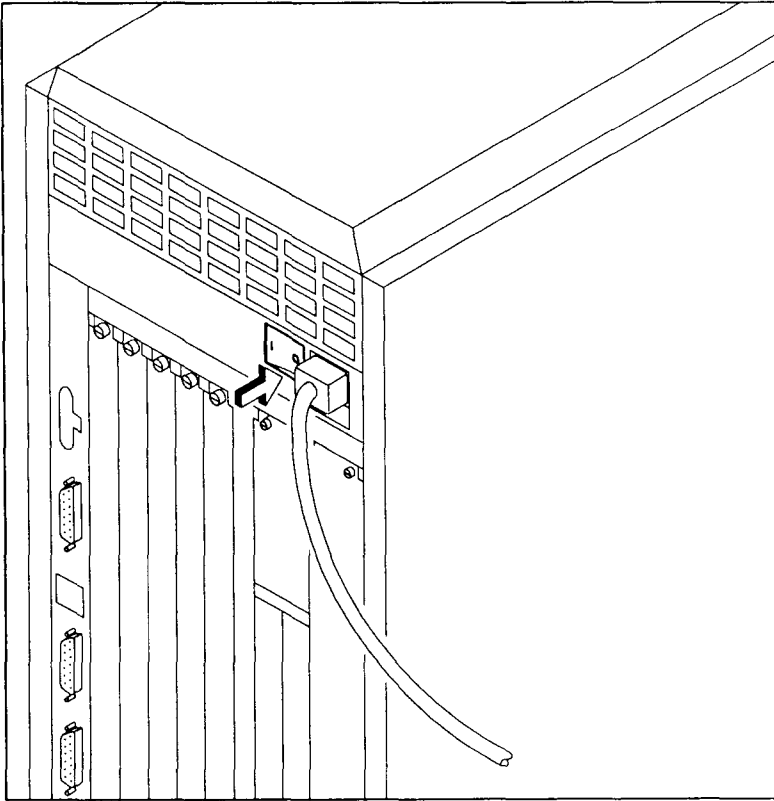
273A−015

Figure E-2. Turning Off the Power

4. Release the fuse tray by lifting the top center locking tab of the housing. Slide the tray out of the housing.

5. Remove the fuse from its clamps.

6. Install a new fuse of the type and rating specified earlier in this chapter.

Caution: *Be sure to replace the fuse with one of the same size and rating to assure proper protection.*
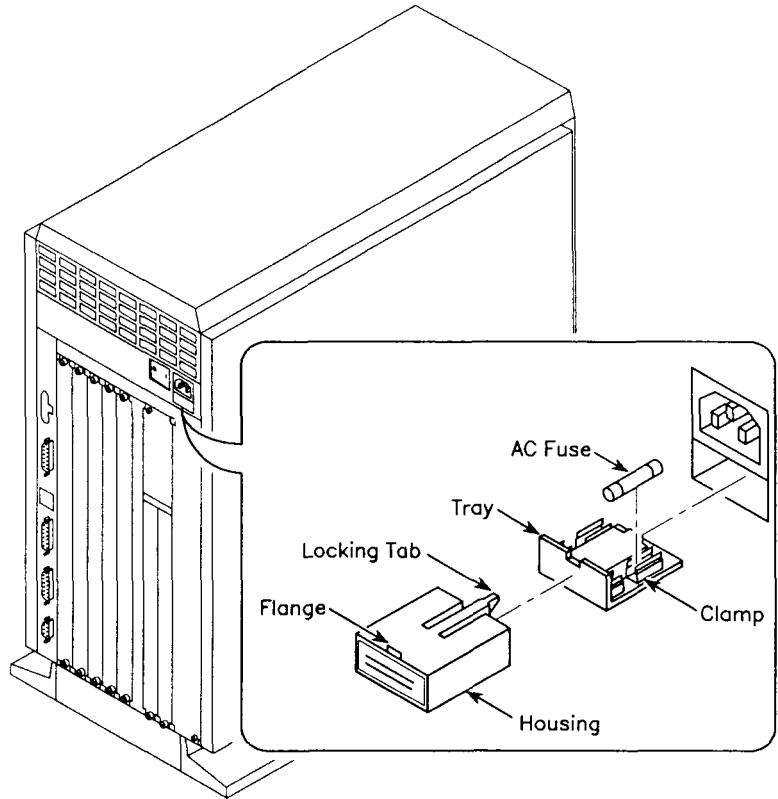
273A-053

Figure E-3.   Replacing the Fuse

7. Replace the tray, then the cover.

8. Plug the ac power cord back into the power connector.

9. Power up the system by pressing the left side of the power switch (marked with a 1) until it clicks over.

    The fan will immediately come up to speed and the activity indicator on the front panel will intermittently flash.   After about 2 minutes, your system is ready for normal operation.

NOTE: If the fuse blows again, call Customer Service.

ambient room temperature. Temperature of the room surrounding the S/120 equipment.

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

bit. A binary digit (either a 0 or a 1).

boot. To start up a computer by loading a program into memory from an external storage medium such as a QIC tape or a hard disk drive.

byte. A unit of information, often amounting to a single text character. A byte usually consists of 8 bits.

card cage. See **I/O card cage** and **VME card cage**.

central processing unit. See **CPU**.

character. Letter, digit, punctuation mark, or other written symbol used in printing or displaying information in a readable form.

code. Number or symbol used to represent some piece of 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 system. A computer and its associated hardware and software.

configuration. Includes the hardware and software elements that constitute a computer system.

configure. To change software or hardware actions by changing settings.

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

CPU. The central processing unit of the S/221 and S/222. It contains the main storage, arithmetic unit, and special register groups.

CPU board. The large printed circuit board in the S/221 and S/222 that contains the computer's processor, memory, and other important components.

daisy-chain. To daisy-chain terminals on an RS-422 line is to connect them so that the signal comes out of the computer, goes into the first terminal, comes out of the first terminal, goes into the second terminal, etc.

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

demodulate. To demodulate a signal is to retrieve data from a modulated signal. See also **modem** and **modulation.**

disk. An 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. A peripheral device that writes and reads information on the surface of a magnetic disk.

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

EEPROM. Electrically erasable programmable read-only memory.

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

error message. A 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 board. Board inserted into the I/O card cage to provide I/O ports or to enhance system performance. See also **I/O Expansion board** and **Memory Expansion board**.

graphics terminal (GT). An intelligent, bit-mapped display terminal (microprocessor-based) that locally performs graphic and textual display operations. Compare with **programmable terminal (PT)**.

hard disk drive. See **disk drive**.

hardware. Those components of a computer system that consist of physical devices. Compare with **software.**

interface. A common boundary between two systems or devices.

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

I/O card cage. Structure that holds Memory Expansion boards and I/O Expansion boards.

I/O Expansion board. Board installed in the I/O card cage that provide I/O ports and enhance system performance. Compare with **Memory Expansion board**.

input. Information transferred into a computer from some external source, such as keyboard, a disk drive, or a QIC tape.

input/output. See **I/O**.

LED. Light-emitting diode.

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.

login. The term used for entering the CTIX operating system.

login name. The name (assigned to you by your system administrator) by which you are known to the operating system.

megabyte (M byte). One megabyte equals 1,048,576 bytes.

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

Memory Expansion board. Board installed in the I/O card cage that provides additional memory (2M or 4M bytes) for a system. Compare with **I/O Expansion board**.

microprocessor. See **processor**.

mode. A state of a computer or system that determines its behavior.

modem. An external device that modulates and demodulates signals transmitted over data communications facilities.

modulate. To vary a signal's characteristic (such as amplitude) so that it is compatible with communications facilities (such as a telephone line). See also **demodulate** and **modem.**

operating system. A 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.

output. Information transferred to any device exterior to the S/221 and S/222.

parallel printer. A peripheral that receives or transmits data bits simultaneously. Compare with **serial printer.**

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

printer. An external device that writes output data to paper or other media. See also **parallel printer** and **serial printer.**

processor. The hardware component of a computer that performs the actual computation by directly executing instructions represented in machine language and stored in main memory.

program. A 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.

programmable terminal (PT). An intelligent (microprocessor-based), multiwindow terminal that runs office automation software, data entry, and other applications that require rapid, efficient keystrokes. Compare with **graphics terminal (GT).**

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. A text character displayed on the screen to prompt the user to carry out some action. Often also identifies the program or components of the system that is doing the prompting.

QIC tape drive. A peripheral device that writes and reads information on the surface of a quarter-inch cartridge (QIC) tape.

RAM. Random-access memory. Information can be written into or read from these memory locations at any time during system operation.

ROM. Read-only memory. Information stored in these memory locations can be read out at any time but not changed during system operation.

RS-232-C cable. Industry-standard cable used to carry data at high speeds of 0 to 19.2K bits per second by serial binary data transmission.

RS-422 cable. Industry-standard cable used to carry data at high speeds by serial binary data transmission.

S/221. System that includes one Memory Expansion board, up to three I/O Expansion boards, and up to three hard disk drives.

S/222. System that includes one Memory Expansion board, up to three I/O Expansion boards, up to two VME cards, and up to three hard disk drives.

serial printer. A device that sends or receives data bits one at a time. Compare with **parallel printer**.

shielded cable. A cable with a special metallic wrapping around its wires, usually directly attached to ac ground. The wrapping reduces radio frequency interference.

software. Components of a computer system that consist of programs that determine or control the behavior of the computer.

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

terminal. A device equipped with a keyboard and video display screen that is capable of transmitting and receiving information over a line. See also **graphics terminal (GT)** and **programmable terminal (PT)**.

uninterruptable power supply (UPS). Power source used as a backup during power failures.

upgrade. To replace or expand existing hardware or software components with larger or improved versions. (For example, to upgrade a hard disk is to replace an existing one with a disk containing a larger memory capacity.)

VME card cage. Structure found on the S/222 that contains VME Expansion cards.

VME Expansion card. Card installed in the VME card cage that provides I/O ports or enhances system performance.

VME Interface board. The printed circuit board that enables the I/O card cage to communicate with the VME card cage.

I/O Expansion boards (con't)
   See also **Ethernet Combo board,**
      IOP Expansion board,
      RS-232-C Expansion
      boards, RS-422 Expansion
      board.
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