

Servicing the HP Apollo 9000 Series 400 Workstations

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The Federal Communications Commission of the U.S. government regulates the radio frequency energy emanated by computing devices through published regulations. These regulations specify the limits of radio frequency emission to protect radio and television reception. All HP Apollo nodes and peripherals have been tested and comply with these limits. The FCC regulations also require that computing devices used in the U.S. display the agency's label and that the related documentation include the following statement.

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

Compliance to these regulations requires the use of shielded cables.

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Emissions Regulations Compliance

Any third-party I/O device installed in HP Apollo system(s) must be in accordance with the requirements set forth in the preceding Emissions Regulations statements. In the event that a third-party noncompliant I/O device is installed, the customer assumes all responsibility and liability arising therefrom.

Compliance to these regulations requires the use of shielded cables.

Electrostatic Discharge (ESD) Precautions

Electrostatic charges can damage the integrated circuits on printed circuit boards. To prevent such damage from occurring, observe the following precautions during board unpacking and installation:

- Stand on a static-free mat.
- Wear a static strap to ensure that any accumulated electrostatic charge will be discharged from your body to ground.
- Connect all equipment together, including the static-free mat, static strap, routing nodes, and peripheral units.
- Keep uninstalled printed circuit boards in their protective antistatic bags.
- Handle printed circuit boards by their edges, once you have removed them from their protective antistatic bags.

Preface

Servicing the HP Apollo 9000 Series 400 Workstations contains maintenance information for the Series 400 Model 400t, 400dl, and 400s workstations. The information is intended for Customer Engineers (CEs) and System Builders who perform maintenance on this equipment. The instructions in this manual assume that the workstations have been installed according to the procedures described in the appropriate installation guide:

- *HP Apollo 9000 Series 400 Model 400dl 400t 425t Installation Guide*
- *HP Apollo 9000 Series 400 Model 400s 433s Installation Guide*

We've organized this manual as follows:

| | |
|-------------------|--|
| Chapter 1 | Provides an overview of the Series 400 workstations. |
| Chapter 2 | Describes the operating controls used to isolate system malfunctions. |
| Chapter 3 | Explains the theory of operation at the FRU level. |
| Chapter 4 | Contains troubleshooting flowcharts and test procedures. |
| Chapter 5 | Describes removal/replacement procedures. |
| Appendix A | Provides jumper and switch setting information for various option boards and storage devices. |
| Appendix B | Describes how to select Domain Compatible mode and the primary network for workstations that use Domain Compatible mode. |
| Appendix C | Describes how to use the boot ROM configuration program for workstations that use HP-UX compatible mode. |
| Appendix D | Describes how to connect terminals to workstations that use Domain Compatible mode. |

Audience

This manual is for authorized service representatives who install and maintain HP Apollo workstations and peripherals.

CAUTION: Use of these procedures by nonauthorized personnel could result in personal injury, equipment damage, or jeopardize your warranty or maintenance agreement.

Domain/OS Related Manuals

The file `/install/doc/apollo/os.v.latest software release number_manuals` lists current titles and revisions for all available manuals.

For example, at SR10.2 refer to `/install/doc/apollo/os.v.10.2_manuals` to check that you are using the correct version of manuals. You may also want to use this file to check that you have ordered all of the manuals that you need.

(If you are using the Aegis environment, you can access the same information through the Help system by typing **help manuals**.)

Refer to the *Domain Documentation Quick Reference* (002685) and the *Domain Documentation Master Index* (011242) for a complete list of related documents. For more information about Domain/OS, including Domain/OS related diagnostics, refer to the following documents:

- *Using Domain Diagnostics, Volume 1* (009329)
- *Using Domain Diagnostics, Volume 2* (011775)
- *Domain System Utilities Reference* (014881)
- *Getting Started with Domain/OS* (002348)
- *Installing Software with Apollo's Release and Installation Tools* (008860)
- The appropriate *Using Your Environment*, *Managing System Software*, and *Command Reference* manuals for your Domain/OS operating environment

You can now order Apollo documentation by calling **1-800-225-5290**.

HP-UX Related Manuals

For information about HP-UX and HP-UX related diagnostics, refer to the following documents:

- *HP-UX System Administrator Tasks* (98594-90061)
- *Troubleshooting HP-UX Systems Error Diagnostics and Recovery* (92453-90026)
- *HP 9000 Series 200/300 Computers Test Tools Manual* (09800-90001)
- *HP 9000 Series 300 Computers System Support Tape User's Guide* (98561-90035)

Refer to the *HP-UX Documentation Reference* (98594-90080) for a complete list of HP-UX related documents.

HP Apollo 9000 Series 400 Workstation Related Manuals

For more information about Series 400 workstations and related subjects, refer to the following documents:

- *HP Apollo 9000 Series 400 Model 400dl 400t 425t Installation Guide* (A1630-90001)
- *HP Apollo 9000 Series 400 Model 400s 433s Installation Guide* (A1421-90001)
- *HP Apollo 9000 Model 400dl, 400t, and 425t Technical Reference* (A1630-90002)
- *Installing the Winchester Disk into the HP Apollo 9000 Model 400t and 425t Workstation* (A1630-90003)
- *HP Apollo 9000 Series 400 Workstation Domain/OS Owner's Guide* (A1630-90005)
- *HP Apollo 9000 Series 400 Workstation HP-UX Owner's Guide* (A1630-90006)
- *HP Apollo 9000 Series 400 Workstation Service Handbook* (A1630-90009)
- *HP Apollo 9000 Model 400s and 433s Configuration Worksheet* (A1421-90004)
- *Installing the A1096A VRX Monochrome Graphics Board* (A1096-90000)
- *SR10.2 Product Support Kit Release Document* (017778-A00)
- *HP Apollo 9000 Series 400 Support Matrix* (available at Field Offices)
- *HP Apollo 9000 Workstation Configuration Guide* (available at Field Offices)

Problems, Questions, and Suggestions

If you have any questions or problems with our hardware, software, or documentation, please contact either your HP Response Center or your local HP representative.

Alternatively, you may use the Reader's Response Form at the back of this manual to submit comments about documentation.

Documentation Conventions

Unless otherwise noted in the text, this manual uses the following symbolic conventions.

| | |
|---|---|
| literal values | Bold words or characters in formats and command descriptions represent commands or keywords that you must use literally. Pathnames are also in bold. Bold words in text indicate the first use of a new term. |
| <i>user-supplied values</i> | Italic words or characters in formats and command descriptions represent values that you must supply. |
| sample user input | In samples, information that you enter appears in bold. |
| output | Information that the system displays appears in this typeface. |
| < > | Angle brackets enclose the name of a key on the keyboard. |
| CTRL/ | The notation CTRL/ followed by the name of a key indicates a control character sequence. Hold down < CTRL > while you press the key. |
| ... | Horizontal ellipsis points indicate that you can repeat the preceding item one or more times. |
| | Vertical ellipsis points mean that irrelevant parts of a figure or example have been omitted. |
|  | This symbol indicates the end of a chapter. |

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Chapter 1

Product Overview

This chapter describes the major components, configurations, and specifications for the HP Apollo 9000 Series 400 workstations. The Series 400 workstations consist of three models:

- HP Apollo 9000 Series 400 Model 400t
- HP Apollo 9000 Series 400 Model 400dl
- HP Apollo 9000 Series 400 Model 400s

These workstations share a common core processor, and can run either the HP-UX or Domain/OS operating systems. The Model 400s workstation is also available as a server. In general, we refer to any workstation or server as “the system”; when necessary, however, we refer to specific systems by model (for example, Model 400t). When we discuss a topic that applies to the three systems, we refer to the three systems as “Series 400 systems”.

Part 1 of this chapter describes the Model 400t and 400dl systems.

Part 2 describes the Model 400s system.

Part 1 **Model 400t and Model 400dl Product Overview**

1.1 Introduction

The Model 400t and 400dl systems are identical except for the (Central Processing Unit) CPU boards. The Model 400dl CPU board does not have some of the connectors and logic that are available for the Model 400t. This limited CPU board restricts the configurations of the Model 400dl to a subset of the Model 400t configurations.

1.1.1 Model 400t Overview

The Model 400t uses the MC68030 microprocessor and the MC68882 floating-point coprocessor on an emulator board attached to the CPU board. The system includes one interface slot for DIO II or SGC graphics interface boards and one interface slot for a network controller board (either an 802.5 or an Apollo Token Ring network controller) or an HP-IB interface board.

Model 400t systems that are running Domain/OS use the network controllers and the Domain low-profile keyboard. Model 400t systems that are running HP-UX use the HP-IB interface board and the HP 46021A keyboard and other HP-HIL (Human Interface Loop) devices. The system can also include one or two 200-MB Winchester disk drives. The display options are a

- Monochrome 19-inch, 1280 x 1024, bit-mapped monitor and graphics controller
- Color 16-inch, 1280 x 1024, bit-mapped monitor and graphics controller
- Color 19-inch, 1280 x 1024, bit-mapped monitor and graphics controller

A Model 400t base system uses 8 MB of main memory. Model 400t systems use a 2- or 4-MB memory board in sets of two, which allows for system configurations of 8 MB to 32 MB of main memory, in 4- or 8-MB increments.

The CPU board contains the following built-in I/O interfaces:

- Domain keyboard
- HP-HIL keyboard and input device
- RS-232 (expandable with the optional 3-port adapter for Domain/OS systems)
- 802.3 network (AUI or ThinLAN, jumper selectable on the CPU board)

- Audio output for optional external speaker
- Centronics parallel input/output
- SCSI (Small Computer Systems Interface)

Options include a 3-port Serial Input/Output (SIO) adapter for Domain/OS systems and an HP-IB interface board for HP-UX systems. For systems that run HP-UX, you can configure parameters for the RS-232, 802.3 network, Centronics parallel, and SCSI interfaces by using the Boot ROM I/O configuration program. (Refer to Appendix C for information about using the configuration program.)

1.1.2 Model 400dl Overview

The Model 400dl is identical to the Model 400t with the exception of the CPU board. The Model 400dl CPU board doesn't have the connectors necessary for internal or external disk drives and some I/O interfaces and memory. As a result, the Model 400dl consists of the following configuration:

- A monochrome 19-inch, 1280 x 1024, bit-mapped monitor and graphics controller
- Eight- or 16-MB of memory, by using two or four 4-MB memory boards.
- 802.3 network (AUI or ThinLAN, jumper selectable on the CPU board)
- RS-232 (expandable with the optional 3-port adapter for Domain/OS systems)
- Domain keyboard
- HP-HIL keyboard and input device
- Audio output for optional external speaker

Note that the Model 400dl does not have SCSI or Centronics parallel external interfaces, and has only two memory configurations. In addition, the system does not use the single interface slot for a network controller board or an HP-IB interface board.

Figure 1-1 shows a typical Model 400t or 400dl system.

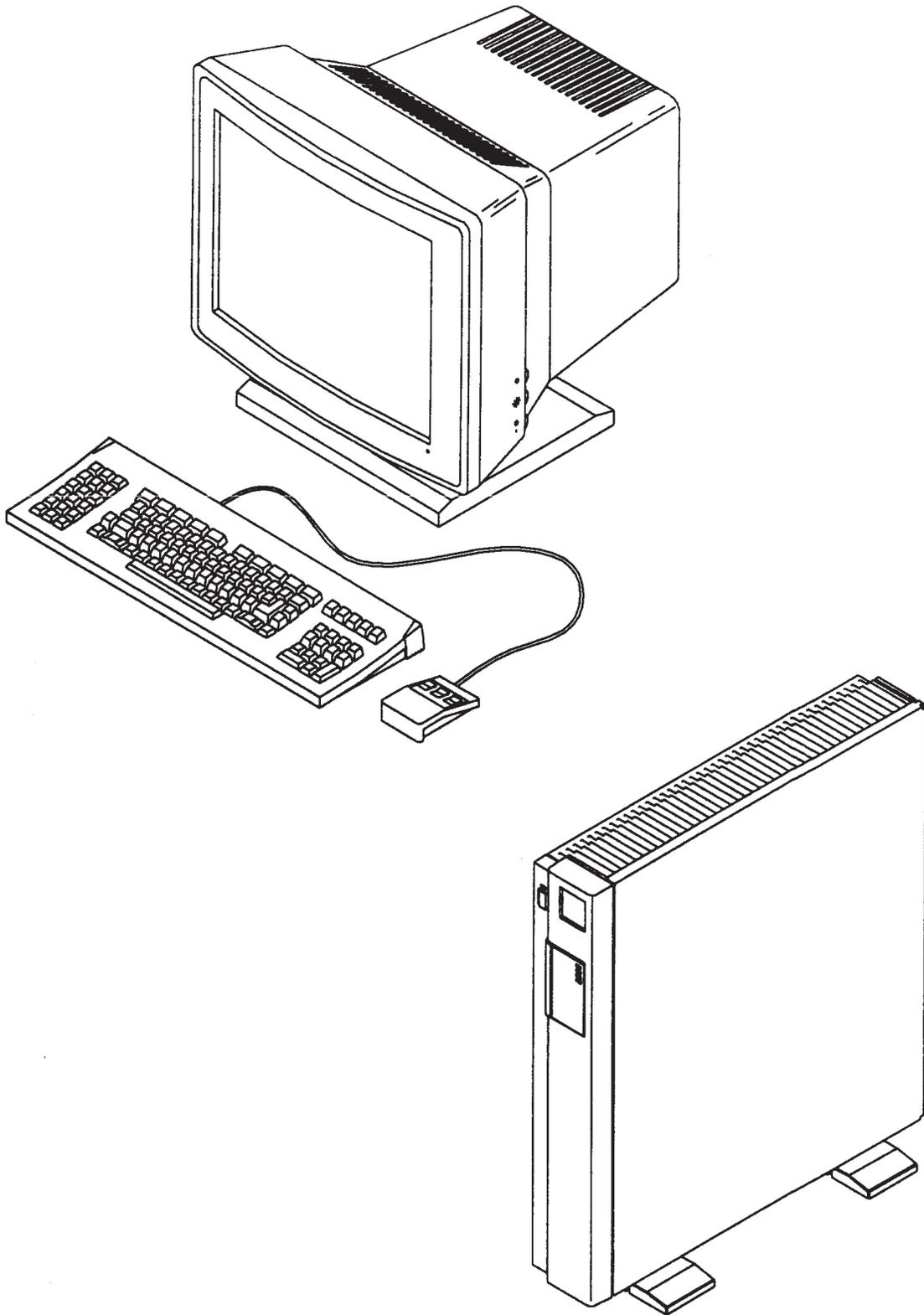


Figure 1-1. HP Apollo Model 400t or Model 400dl Workstation

1.2 Physical Configuration

Model 400t and 400dl systems consist of three physical units:

- System unit
- Monitor
- Keyboard

This section describes each of the major units and lists the components present in the system unit. (See Chapter 5 for the Field Replaceable Units (FRUs) that make up these units and the FRU part numbers, and a description of the removal and replacement procedures for these FRUs.)

1.2.1 System Unit

The Model 400t system unit contains the following components:

- CPU board
- Memory boards
- Winchester disk drive(s)
- Graphics controller board
- Optional network or HP-IB interface board
- Power supply

The Model 400dl system unit contains the following components:

- CPU board
- Memory boards
- Graphics controller board
- Power supply

The power cable used by the system unit differs depending on the country of installation.

1.2.2 Monitors

The Model 400t system can be configured with the following monitors:

- 19-inch, 1280 x 1024 monochrome monitor
- 16-inch, 1280 x 1024 color monitor
- 19-inch, 1280 x 1024 color monitor

The Model 400dl system can only use the 19-inch, 1280 x 1024 monochrome monitor.

1.2.3 Keyboards

Model 400t or 400dl systems that run the Domain/OS operating system use the Domain low-profile keyboard.

Model 400t or 400dl systems that run the HP-UX operating system use the HP ITF keyboard.

The Domain keyboard connects to the rear of the system unit via a coiled cord that is permanently attached to the keyboard.

The ITR HP 46021A keyboard connects to the system unit via a detachable cord that is labeled at either end. One end of the cord is labeled with a single dot, which connects to the HP-HIL port at the rear of the system unit (also labeled with a single dot). The other end of the cord is labeled with two dots, which connects to the port at the rear of the keyboard (also labeled with two dots). The keyboard also has a connector for HP-HIL devices, such as a mouse.

1.3 Winchester Disk Drive Specifications

Table 1-1 lists the specifications for the Model 400t internal 200-MB Winchester disk drive(s).

Table 1-1. 200-MB Winchester Disk Drive Specifications

| Characteristic | Specification |
|-----------------------|----------------------|
| Capacity (formatted) | 200 MB minimum |
| Single cylinder seek | 5 msec minimum |
| Average seek time | 18 msec |
| Maximum stroke | 40 msec |
| Rotational speed | 3600 rpm |

1.4 Model 400t and 400dl System Configurations

Table 1-2 lists the components available with each Model 400t or 400dl workstation, and the operating system required for each component.

Table 1-2. System Configurations

| Component Location | Component (Initial) | Operating System | | Component (Subsequent) |
|--|--|------------------|-------|------------------------------------|
| | | Domain/OS | HP-UX | |
| DIO-II slot (one slot) | VRX Monochrome Graphics Controller (A1096A) | √ | √ | Monitor Monochrome, 19-Inch |
| | VRX Color Graphics Controller (A1416A) ¹ | √ | √ | Monitor: Color, 16-Inch or 19-Inch |
| | Interface Board for Personal VRX Color Graphics Processor ¹ | √ | √ | Monitor: Color, 16-Inch or 19-Inch |
| HP-IB or AT Compatible Bus Slot (one slot) | HP-IB Interface Port ^{1 2} | | √ | External Storage |
| | Apollo Token Ring Controller ^{1 2} | √ | | N/A |
| | 802.5 Controller ^{1 2} | √ | | N/A |
| CPU Board | EtherLAN (AUI or ThinLAN) | √ | √ | N/A |
| | RS-232 Serial Port | √ | √ | Peripheral Devices |
| | Audio Port | | √ | External Speaker |
| | SCSI Port ¹ | √ | √ | External Storage |
| | Centronics Parallel Port ¹ | √ | √ | Peripheral Devices |
| | Domain keyboard Connector | √ | | Domain keyboard |
| | HP-HIL Interface Port | | √ | HP ITF Keyboard, HIL Devices |
| ¹ Not available on Model 400dl systems. ² The HP-IB board and the Apollo or 802.5 network boards cannot exist simultaneously in the system since they occupy the same slot. | | | | |

1.5 Introduction

The Model 400s system uses the MC68030 microprocessor and the MC68882 floating-point coprocessor on an emulator board attached to the CPU board. The base system unit uses 8 MB of main memory, expandable in 4 MB increments to a total of 128 MB. The system unit is available in three main configurations:

- Standard configuration, which includes two DIO-II interface slots (one slot is for the graphics controller board or graphics processor interface board).
- ISA configuration
 - Two DIO-II interface slots, one of which has the graphics controller board or graphics processor interface board.
 - Four-slot personal computer backplane for ISA interface boards. (A Token Ring Network controller may be used in an ISA slot.)
- DIO-II configuration
 - Two DIO-II interface slots, one of which has the graphics controller board or graphics processor interface board.
 - Three-slot DIO-II backplane is included for DIO-II accessory boards.

Model 400s systems that are running Domain/OS use the network controllers and the Domain low-profile keyboard. Model 400s systems that are running HP-UX use the HP-IB interface board and the HP 46021A keyboard and other HP-HIL (Human Interface Loop) devices. The system also can include one to four disk drives. The display options are a

- Monochrome 19-inch, 1280 x 1024, bit-mapped monitor and graphics controller
- Color 16-inch, 1280 x 1024, bit-mapped monitor and graphics controller
- Color 19-inch, 1280 x 1024, bit-mapped monitor and graphics controller

Model 400s systems use 4- or 16-MB memory modules. They are used in sets of two, allowing for system configurations of 8 MB to 128 MB of main memory.

Built-in interfaces on the CPU board include

- HP-HIL keyboard and input device interface
- Audio output jack for optional external speaker
- Domain keyboard connector
- RS-232 (expandable with the optional 3-port adapter for Domain/OS systems)
- 802.3 network (AUI or ThinLAN, jumper selectable on the CPU board)
- Centronics Parallel Input/Output
- SCSI

For systems that run HP-UX, you can configure parameters for the RS-232, 802.3 network, Centronics parallel, and SCSI interfaces by using the Boot ROM I/O configuration program. (Refer to Appendix C for information about using the configuration program.)

Figure 1-2 shows a typical Model 400s system.

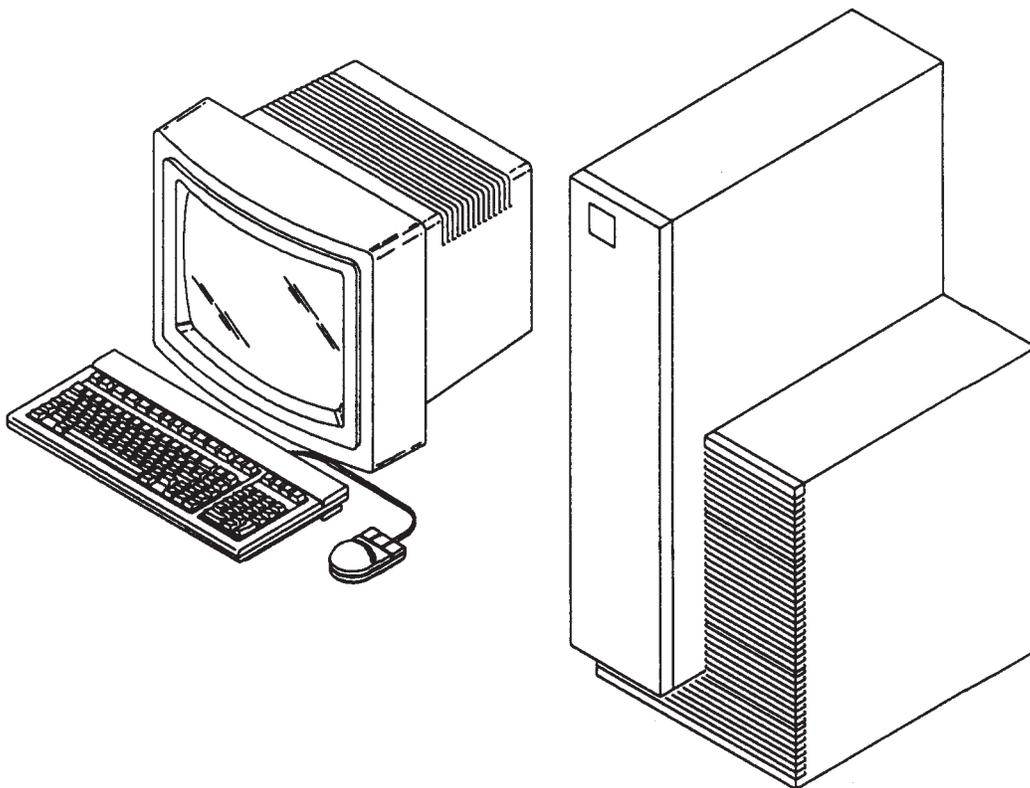


Figure 1-2. Model 400s System

1.6 Physical Configuration

A Model 400s system consists of three physical units:

- System unit
- Monitor
- Keyboard

This section describes each of the major units and lists the components present in the system unit. (See Chapter 5 for the FRUs that make up these units and the FRU part numbers, and a description of the removal and replacement procedures for these FRUs.)

1.6.1 System Units

The system unit is available in three versions:

- Standard Model 400s systems have the following components:
 - Power supply
 - Motherboard with two DIO-II slots
 - CPU board with attached emulator board and memory modules
 - Graphics controller or interface board
 - Mass storage devices

An optional HP-IB interface board may also be included.

- DIO-II Model 400s systems have the following components:
 - Power supply
 - Motherboard with two DIO-II slots
 - Additional 3-slot DIO-II backplane
 - CPU board with attached emulator board and memory modules
 - Graphics controller or interface board
 - Mass storage devices

An optional HP-IB interface board may also be included.

- ISA Model 400s systems have the following components:
 - Power supply
 - Motherboard with two DIO-II slots
 - Additional 4-slot ISA backplane that includes support for the Apollo Token Ring network board
 - CPU board with attached emulator board and memory modules
 - Graphics board
 - Mass storage devices

An optional HP-IB interface board may also be included.

1.6.2 Supported DIO Accessory Boards

DIO-II accessory boards supported in Model 400s systems are listed in Table 1-3.

Table 1-3. Model 400s Supported DIO-II Accessory Boards

| DIO-II Accessory Board | Domain OS | HP-UX |
|-----------------------------------|-----------|-------|
| HP 36941A X.25/300 Link | | √ |
| HP 91225A HP-HIL/Audio Interface | | √ |
| HP 98286A HP-UX DOS Coprocessor | | √ |
| HP 98622A 16-Bit Parallel | | √ |
| HP 98624A HP-IB Interface | | √ |
| HP 98628A Datacomm Interface | | √ |
| HP 98638A 8-Port Multiplexer | | √ |
| HP 98642A 4-Port Multiplexer | | √ |
| HP 98643A LAN Interface | √ | √ |
| HP 98644A RS-232 Interface | | √ |
| HP 98646A VMEbus 16-Bit Interface | | √ |
| HP 98649A SDLC Interface | | √ |
| HP 98658A SCSI Interface | | √ |
| HP 50692A SRM Interface | | √ |

1.6.3 Supported AT-Compatible Accessory Boards

AT-compatible accessory boards supported in Model 400s systems are listed in Table 1-4.

Table 1-4. Model 400s Supported AT-Compatible Accessory Boards

| AT-Compatible Accessory Boards | Domain | HP-UX |
|-------------------------------------|--------|-------|
| A-ADD-PCC Domain DOS Co-processor | √ | |
| A-ADD-SPE Serial/Parallel Interface | √ | |
| A-NET-ATR Apollo Token Ring | √ | |
| A-NET-ITR IBM Token Ring | √ | |
| KIT-ATBUS-CENT Centronics Interface | √ | |
| A-ADD-SCAT X.25 Serial Interface | √ | |

1.6.4 Monitors and Graphics Controllers

Model 400s systems can be configured with one of several monitors. They can also be configured with one of several graphics processors connected to a graphics interface board in the system unit instead of a graphics controller board.

Monitors

Supported monitors on Model 400s workstations include

- HP 98754A High-Resolution 19-in. Color Monitor
- HP 98789A High-Resolution 16-in. Color Monitor
- HP 98774A High-Resolution 19-in. Monochrome Monitor

Graphics Processors

Supported graphics processors on Model 400s workstations include

- HP 98705A/B/C 3-D Graphics Processor
- HP 98735A/B 2-D Graphics Processor

1.6.5 Keyboards

Model 400s systems that run the Domain/OS operating system use the Domain low-profile keyboard.

Systems that run the HP-UX operating system use the HP 46021B keyboard.

The Domain keyboard connects to the rear of the system unit via a coiled cord that is permanently attached to the keyboard.

The HP 46021A keyboard connects to the system unit via a detachable cord that is labeled at either end. One end of the cord is labeled with a single dot, which connects to the HP-HIL port at the rear of the system unit (also labeled with a single dot). The other end of the cord is labeled with two dots, which connects to the port at the rear of the keyboard (also labeled with two dots). The keyboard also has a connector for HP-HIL devices, such as a mouse.

1.7 Model 400s System Unit Configurations

Table 1-5 lists the initial and subsequent components available with each Model 400s system, and the operating system required for each component.

Table 1-5. Model 400s System Configurations

| Component Location | Component (Initial) | Operating System | | Component (Subsequent) | |
|-------------------------|---------------------------------------|-----------------------------|--------------------------------|--------------------------------|--------------------------------|
| | | Domain | HP-UX | | |
| DIO-II 2-Slot Backplane | VRX Color Graphics Cont. Bd. (A1416A) | √ | √ | HP 98789A 16-in. Color Monitor | |
| | | √ | √ | HP 98754A 19-in. Color Monitor | |
| | VRX Mono. Graphics Cont. Bd. (A1096A) | √ | √ | HP 98774A 19-in. Mono. Monitor | |
| | | HP 98702A GAD Bus Interface | √ | √ | HP 98705A Graphics Processor |
| | | | √ | √ | HP 98574A 19-in. Color Monitor |
| | | | √ | √ | HP 98705B Graphics Processor |
| | | | √ | √ | HP 98574A 19-in. Color Monitor |
| | | | √ | √ | HP 98705C Graphics Processor |
| | √ | √ | HP 98574A 19-in. Color Monitor | | |
| | PDMA Interface Board | √ | √ | HP 98735A Graphics Processor | |
| | | √ | √ | HP 98574A 19-in. Color Monitor | |
| | VDMA Interface Board | √ | √ | HP 98736A Graphics Processor | |
| | | √ | √ | HP 98574A 19-in. Color Monitor | |
| | | √ | HP 98736B Graphics Processor | | |
| | | √ | HP 98574A 19-in. Color Monitor | | |
| DIO-II Accessory Board | | √ | Application Dependent | | |
| DIO-II 3-Slot | DIO-II Accessory Boards | | √ | Application Dependent | |
| AT-Compatible Backplane | Apollo Token Ring Controller | √ | | Network | |
| | 802.3 Controller | √ | | Network | |
| | AT Compatible Boards | √ | | Application Dependent | |

(continued)

Table 1-5. Model 400s System Configurations (Cont.)

| Component Location | Component (Initial) | Operating System | | Component (Subsequent) |
|-----------------------|---------------------------------|------------------|-------|---------------------------------|
| | | Domain | HP-UX | |
| CPU Board | EtherLAN (AUI or ThinLAN) | √ | √ | Network |
| | Audio Port | √ | √ | External Speaker |
| | SCSI Port | √ | √ | SCSI Devices |
| | HP Parallel Port | √ | √ | Centronics Devices |
| | Domain keyboard Connector | √ | | Domain keyboard |
| | HP-HIL Connector | | √ | HP 46021A Keyboard |
| | HP-IB Interface | | √ | HP-HIL Devices HP-IB Devices |
| Built-in Mass Storage | 330 MB 5.25-in. Hard Disk Drive | √ | √ | |
| | 660 MB 5.25-in. Hard Disk Drive | √ | √ | |
| | 60 MB QIC Tape Drive | √ | | |
| | 650 MB CD ROM Drive | | √ | |

1.8 Mass Storage Device Specifications

Refer to Table 1-6 for specifications of the storage device components for the Model 400s system unit. Mass storage devices include

- HP A1442A 330 MB Hard Disk Drive
- HP A1443A 660 MB Hard Disk Drive for HP-UX
- HP A1444A 660 MB Hard Disk Drive for Domain
- HP A1448A CD ROM Disk Drive
- HP A1449A QIC Tape Drive

Table 1-6. Model 400s Workstation Internal Mass Storage Devices

| Specification | HPA1442A 330 MB | HPA1443/4A 660 MB | HPA1448A CD ROM | HPA1449A QIC Tape |
|----------------------|----------------------------|------------------------------|----------------------------|------------------------------|
| Media Rate | 1.6 M/sec | 1.6 M/sec | 175 K/sec | 90 K/sec |
| SCSI Burst | 5.0 M/sec | 5.0 M/sec | 1.5 M/sec | 1.5 M/sec |
| Capacity | 330 MB | 660 MB | 650 MB | 60 MB |



Chapter 2

System Controls

This chapter describes the system unit controls, monitor controls, and LED indicator lights for the Series 400 systems.

2.1 System Unit Controls

This section describes the controls for the Series 400 system units.

2.1.1 System Unit Controls for the Model 400t and 400dl

Figure 2-1 shows the locations of the following switches on the Model 400t and 400dl system units:

- The Power switch controls the supply of dc power to the system unit.
- The SERVICE Mode switch, when pressed, toggles the operating mode of the system between NORMAL and SERVICE mode. When the system is in SERVICE Mode, the LED labeled “Service” on the front panel is on.
- The Reset switch invokes a system reset.

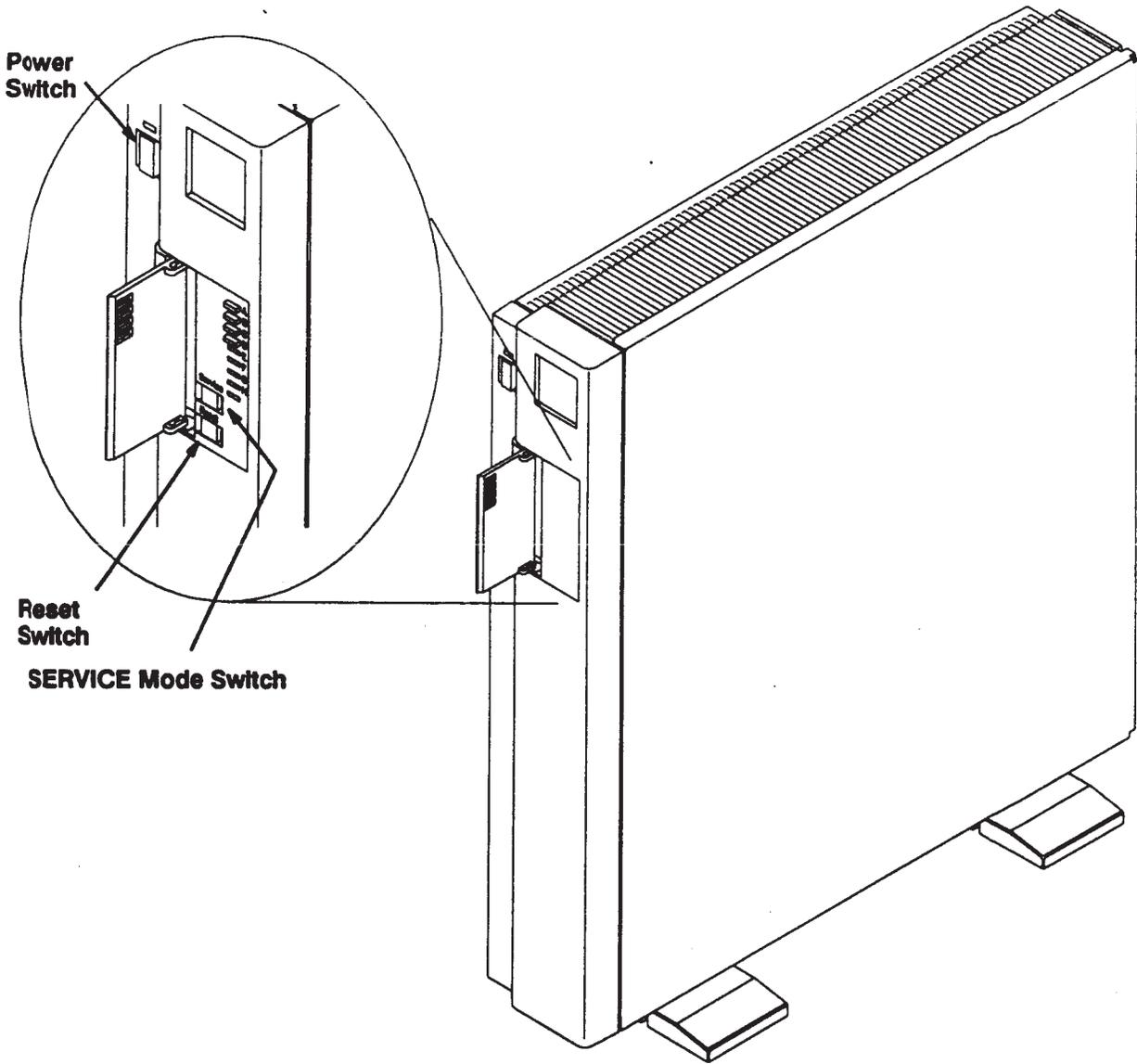
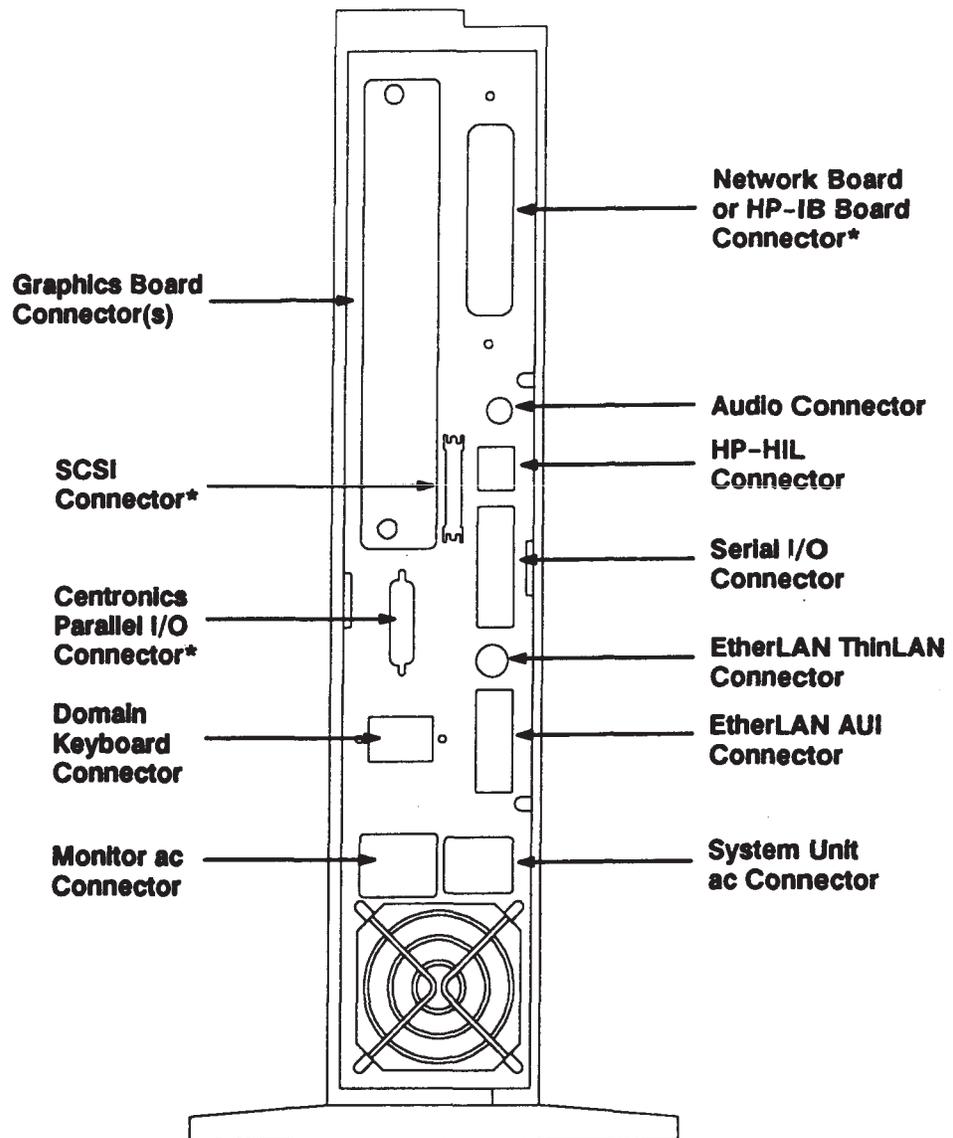


Figure 2-1. Model 400t and 400dl System

Figure 2-2 shows the locations of the system connectors on the rear of the Model 400t and 400dl system units.



*** Not available on Model 400dl workstations.**

Figure 2-2. Model 400t and 400dl System Connectors

2.1.2 System Unit Controls for the Model 400s

Figure 2-3 shows the locations of the

- Power switch, which controls the supply of dc power to the system unit
- Top five LED indicators
- Mass storage devices on the front of the Model 400s system unit

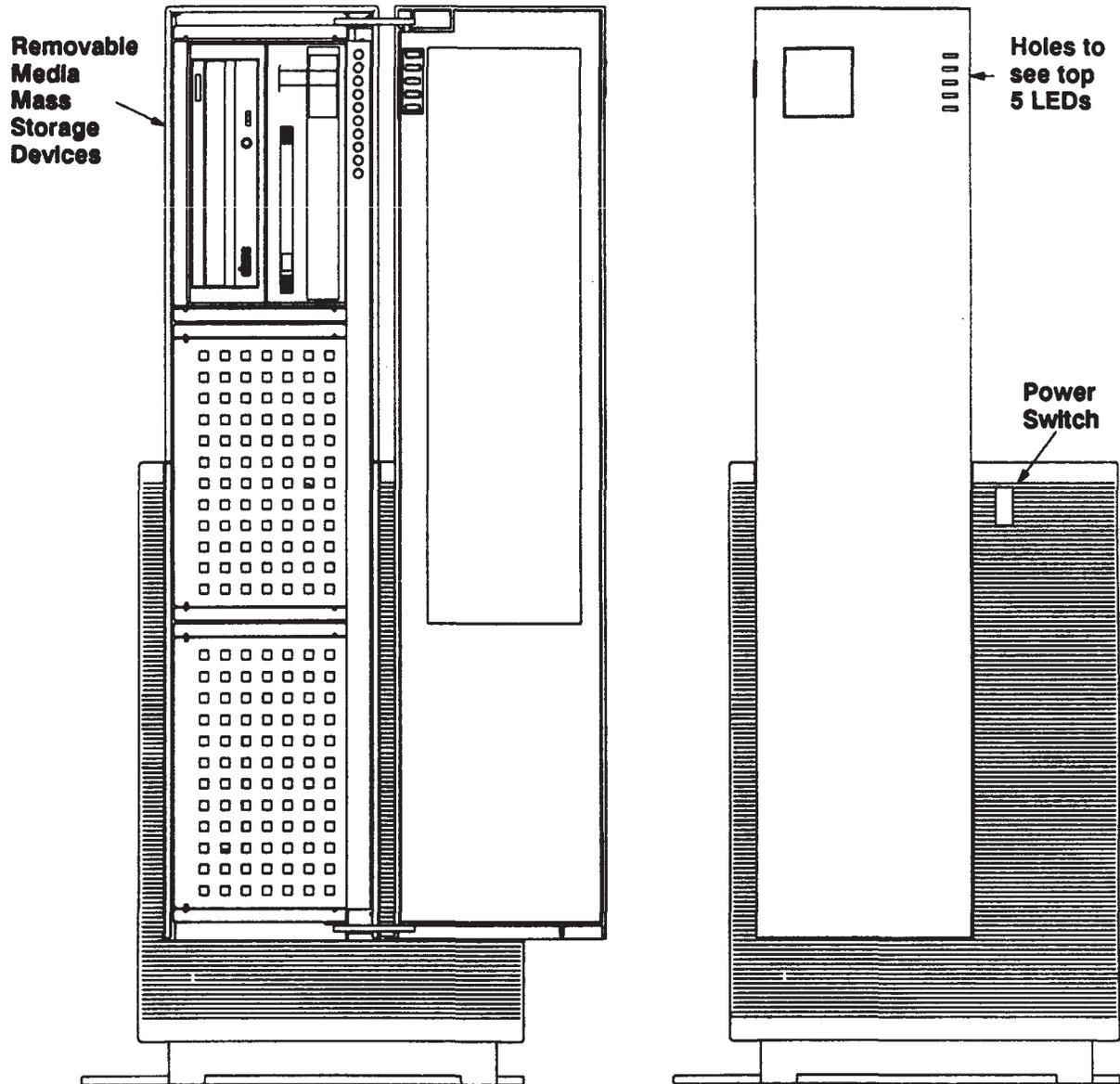


Figure 2-3. Model 400s System Unit Operational Controls

Figure 2-4 shows the location of the following switches and connectors on the rear of the system units:

- The SERVICE Mode switch is a two position slide switch that selects NORMAL or SERVICE mode according to its position. When the workstation is in SERVICE mode, the LED labeled “S” on the front panel is on.
- The Reset switch invokes a system reset.
- The system connectors for graphics, networks, keyboards, and other applications.

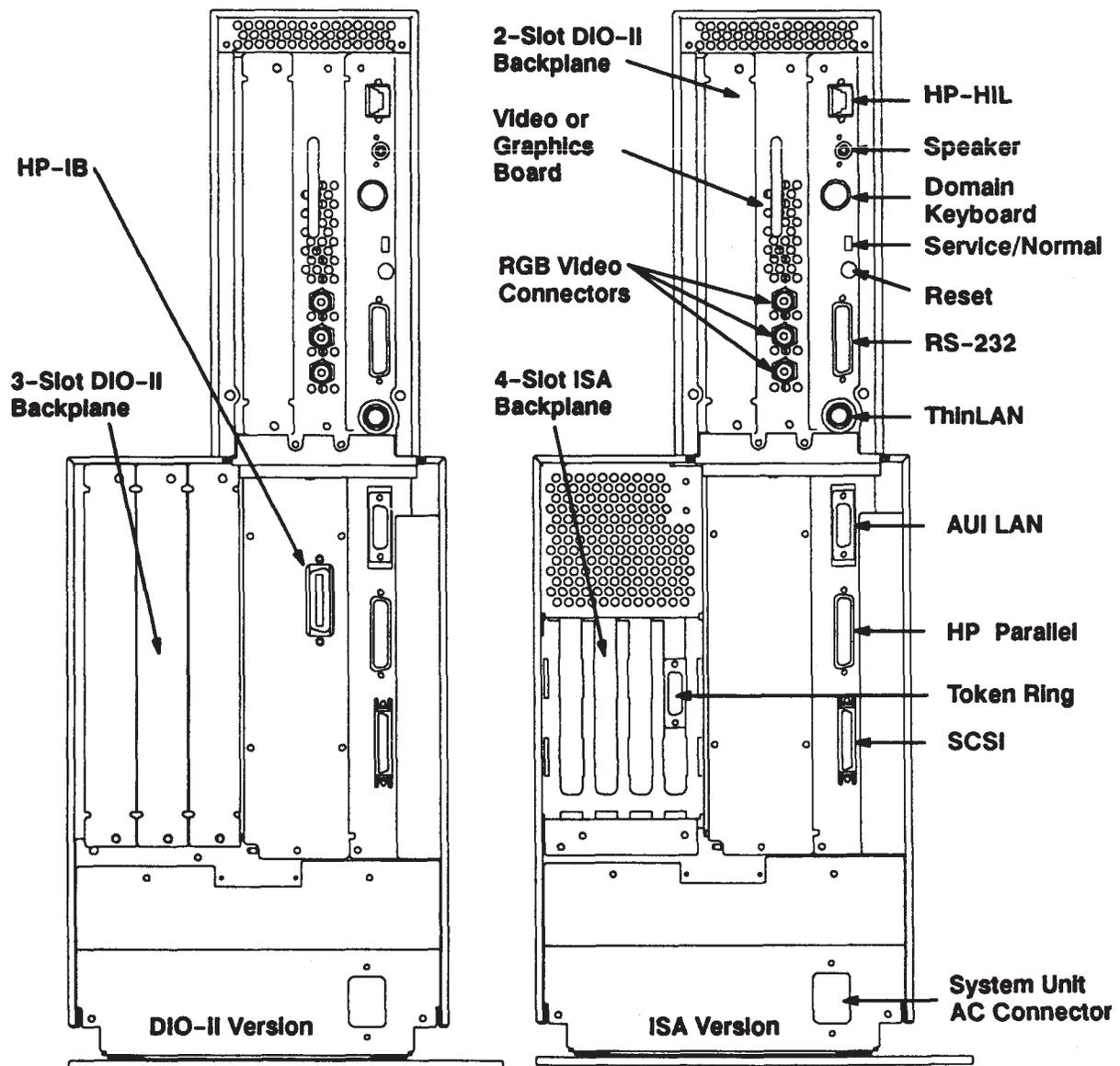
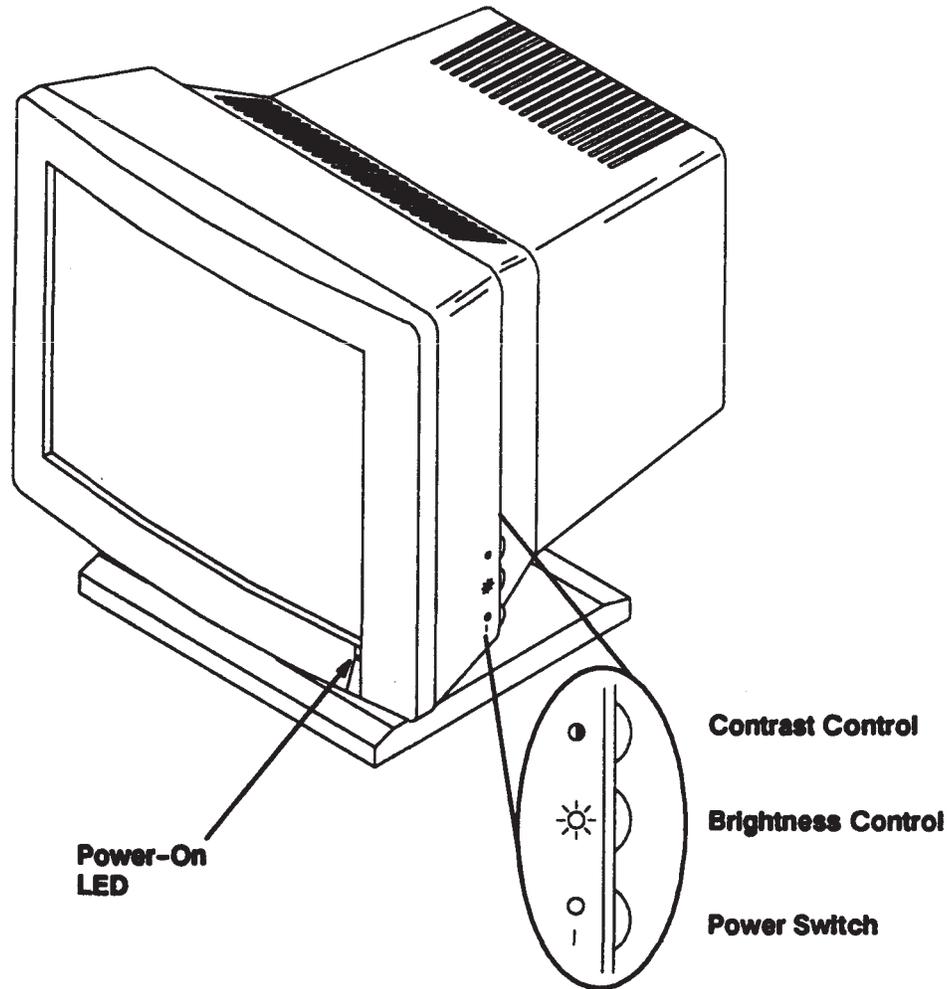


Figure 2-4. Model 400 System Unit System Connectors

2.2 Monitor Controls

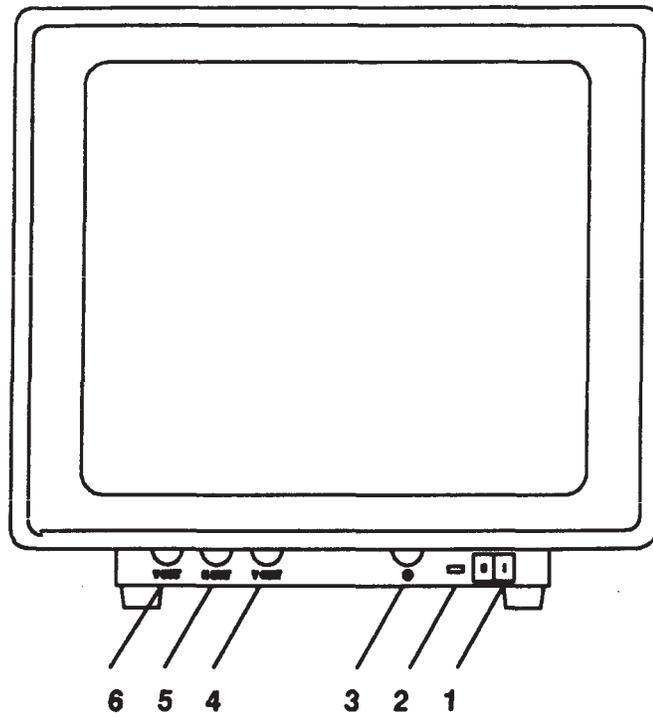
Figure 2-5 shows the operating controls and their functions for the 19-inch, 1280 x 1024 72-Hz monochrome monitor (part number 98774A).



| Control | Function |
|--------------------|---|
| Power-On LED | Light is lit when monitor is on. |
| Contrast Control | Adjusts the light-to-dark and dark-to-light contrast. |
| Brightness Control | Adjusts the brightness of the display. |
| Power Switch | Turns the monitor power on or off. |

Figure 2-5. 19-Inch Monochrome Monitor Controls

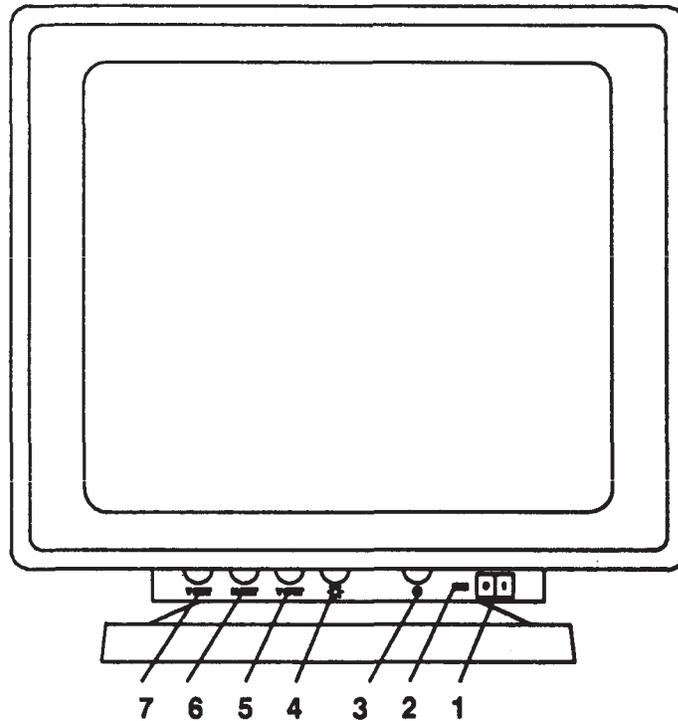
Figure 2-6 shows the operating controls and their functions for the 16-inch, 1280 x 1024 60-Hz color monitor (part number 98789A).



| Item | Control | Function |
|------|-------------------------------|--|
| 1 | Power Switch | Turns the monitor power on or off. |
| 2 | Power Indicator | Light is lit when monitor is on. |
| 3 | Contrast | Adjusts the light-to-dark and dark-to-light contrast. |
| 4 | Vertical Centering | Positions the image vertically. |
| 5 | Horizontal Static Convergence | Separates or merges the red, green, and blue colors in the horizontal direction. |
| 6 | Vertical Static Convergence | Separates or merges the red, green, and blue colors in the vertical direction. |

Figure 2-6. 16-Inch Color Monitor Controls

Figure 2-7 shows the operating controls and their functions for the 19-inch, 1280 x 1024 60-Hz color monitor (part number 98754A).



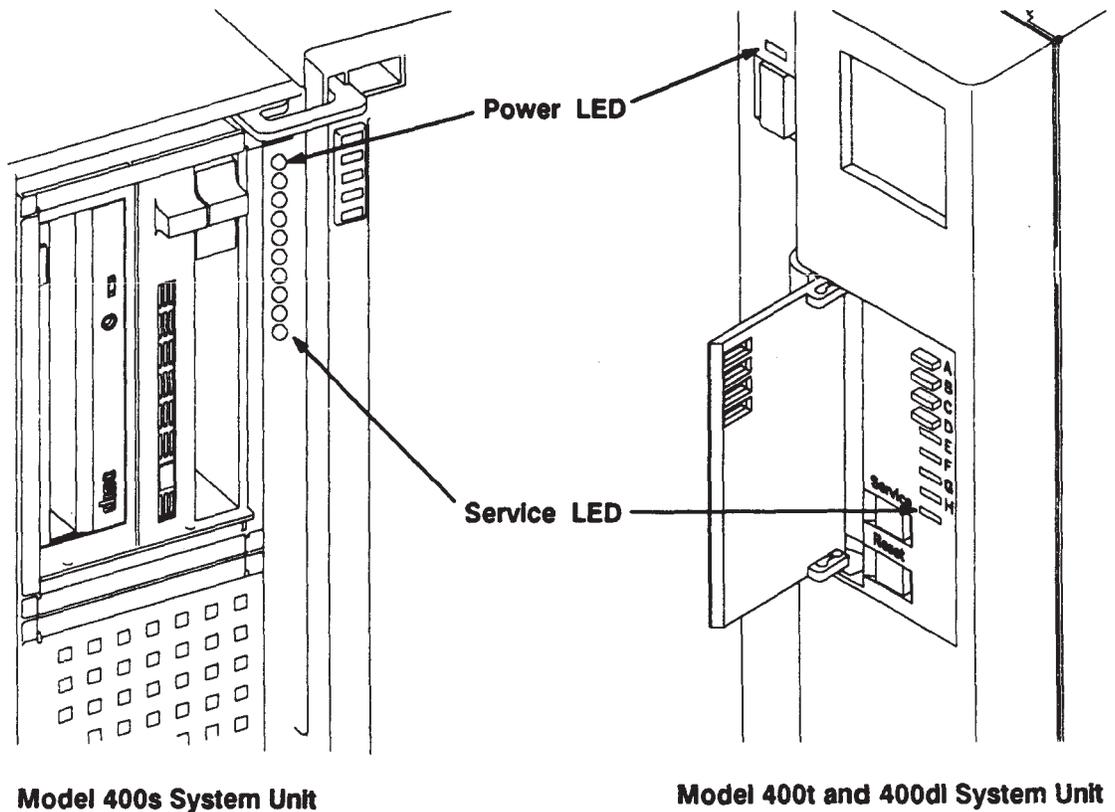
| Item | Control | Function |
|------|-------------------------------|--|
| 1 | Power Switch | Turns the monitor power on or off. |
| 2 | Power Indicator | Light is lit when monitor is on. |
| 3 | Contrast | Adjusts the light-to-dark and dark-to-light contrast. |
| 4 | Brightness Control | Adjusts the brightness of the display. |
| 5 | Vertical Centering | Positions the image vertically. |
| 6 | Horizontal Static Convergence | Separates or merges the red, green, and blue colors in the horizontal direction. |
| 7 | Vertical Static Convergence | Separates or merges the red, green, and blue colors in the vertical direction. |

Figure 2-7. 19-Inch Color Monitor Controls

2.3

LED Indicator Lights

Figure 2-8 shows the location of the front panel LEDs on the Series 400 system units. The Power LED indicates that the power is on. The Service LED, when on, indicates that the system is in SERVICE mode. The LEDs labeled 'A' through 'H' indicate system status. The Power LED and the LEDs labeled 'A' through 'D' are always visible. You can view the other five LEDs by opening the door.



Model 400s System Unit

Model 400t and 400dl System Unit

Figure 2-8. System Unit Front Panel LEDs

Table 2-1 shows the codes displayed by the LEDs during normal Domain/OS operation. Refer to Chapter 4 for a description of the LED codes displayed during power-up diagnostics.

Table 2-1. LED Codes Displayed During Normal Domain/OS Operation

| LED Display (A through D Flashing) | Message |
|---|---|
| P A B C D E F G H S  | Operating System Running |
|  | Disk Access In Progress |
|  | Network Receive In Progress |
|  | Network Transmit In Progress |
| P = Power-On Indicator   = LED On | S = Service Mode Indicator On = SERVICE Mode Off = NORMAL Mode |

Note that the “Network Receive In Progress” and “Network Transmit In Progress” codes can flash so rapidly that they appear as a steady (not flashing) display.



Chapter 3

Theory of Operation

This chapter describes the theory of operation for Series 400 systems. Its purpose is to help you understand the operation of these systems to the FRU level so that you can trace problems more effectively.

3.1 System-Level Operation

This section presents a general overview of the Domain/OS operating system and the system buses. Refer to Section 3.2 for details about the individual FRUs.

The Series 400 systems run either the Domain/OS or HP operating systems, such as HP-UX, and are available in the following three models:

- Model 400t
- Model 400dl
- Model 400s

The Model 400t has the following components:

- One DIO-II (Desktop computer Input/Output) bus slot for a monochrome or color graphics controller board
- One ISA subset bus slot or HP-IB interface slot for a network or HP-IB controller board
- Multiple interface ports
- Up to two internal disk drives

The Model 400dl is identical to the Model 400t with the exception of the CPU board. The Model 400dl CPU board does not have some of the interface connectors and the ISA and SGC logic that are available on the Model 400t CPU board. The Model 400dl CPU board limits the Model 400dl configuration to a monochrome graphics controller and an 802.3 LAN interface port, with no provisions for internal or external disk drives, an ISA subset slot, or a HP-IB slot.

The Model 400s has the same core processor and features as the Model 400t, but is more expandable. The Model 400s has the following features:

- More internal storage options than the Model 400t
- Two DIO-II interface slots standard
- Capability for an additional 3-slot DIO-II interface backplane or 4-slot ISA AT-compatible backplane

3.1.1 Domain/OS Virtual Memory Operating System

The Domain operating system provides two important functions for the system:

- Runs several programs at the same time
- Runs programs that would otherwise be too large to fit in main memory

To support these functions, the operating system breaks each object (for example, program, file, directory) into “pages” of 4096 bytes and assigns each page a virtual address (a unique identifier that the operating system uses to keep track of each page). The operating system can then use the virtual addresses to place pages from one or more objects at “physical addresses” in the system’s memory. By swapping pages in and out of memory as required by the different objects, the operating system makes the limited number of physical address locations appear virtually unlimited to the objects.

Virtual and physical addresses are references to data storage locations, based on the total size of the data storage area. A virtual address is the operating system's way of referring to a memory location, based on the size of memory from the object's point of view (virtually unlimited). A physical address is an absolute physical location in the system's total memory space. The location can be on the system's memory boards (the main memory) or in a memory component on any other board in the system.

3.1.2 System Buses

Figure 3-1 through Figure 3-5 show the functional organization of the buses and the bus interfaces on the CPU boards of the different Series 400 system models. The DIO system bus provides the main channel for address and data flow among the following system components:

- Microprocessor
- Floating-Point Coprocessor
- Memory Control and Memory
- ISA bus Programmable I/O (PIO) interface
- Graphics interface
- HP-IB interface
- Utility Interface
- Small Computer Systems Interface (SCSI)

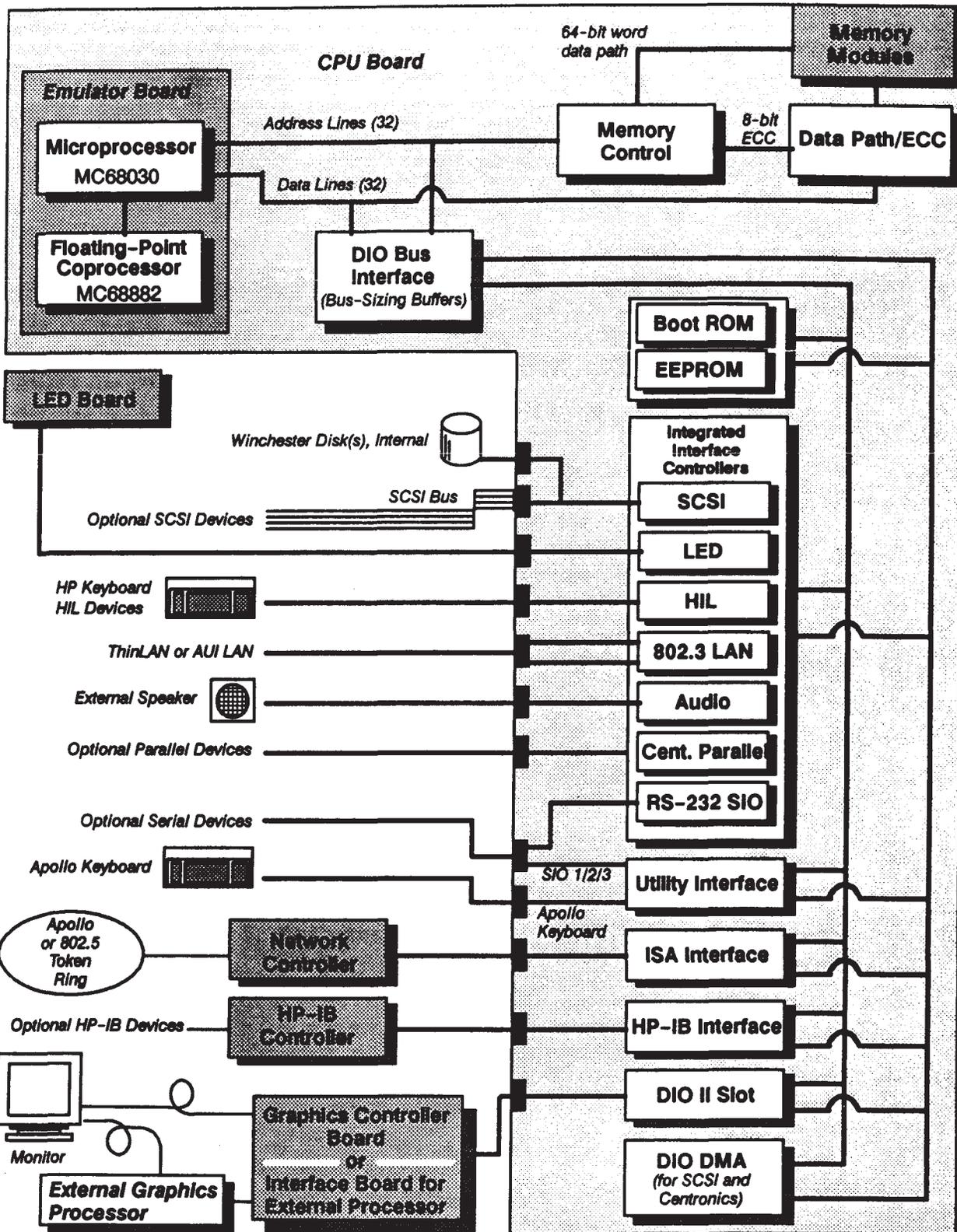


Figure 3-1. Model 400t System Block Diagram

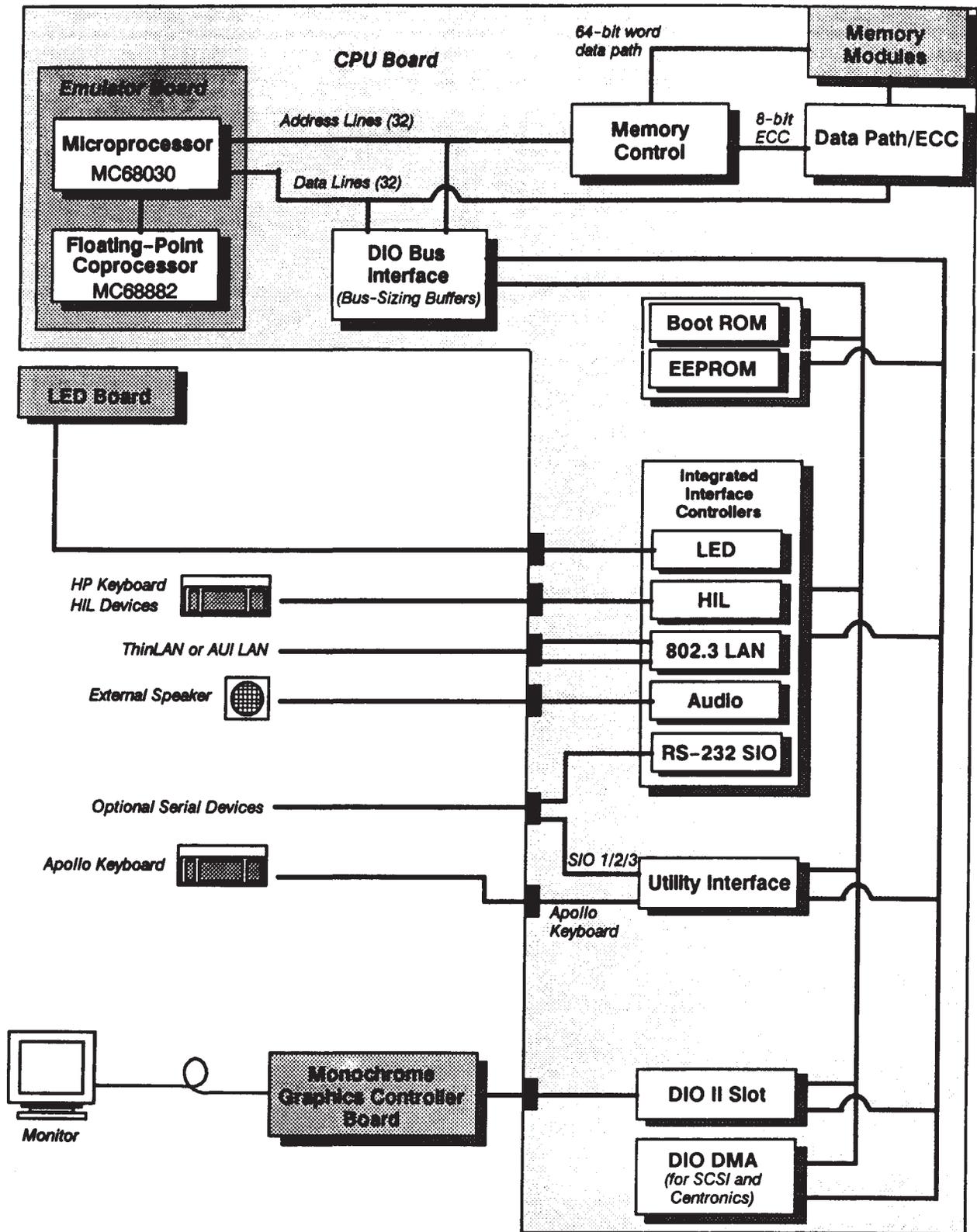


Figure 3-2. Model 400dl System Block Diagram

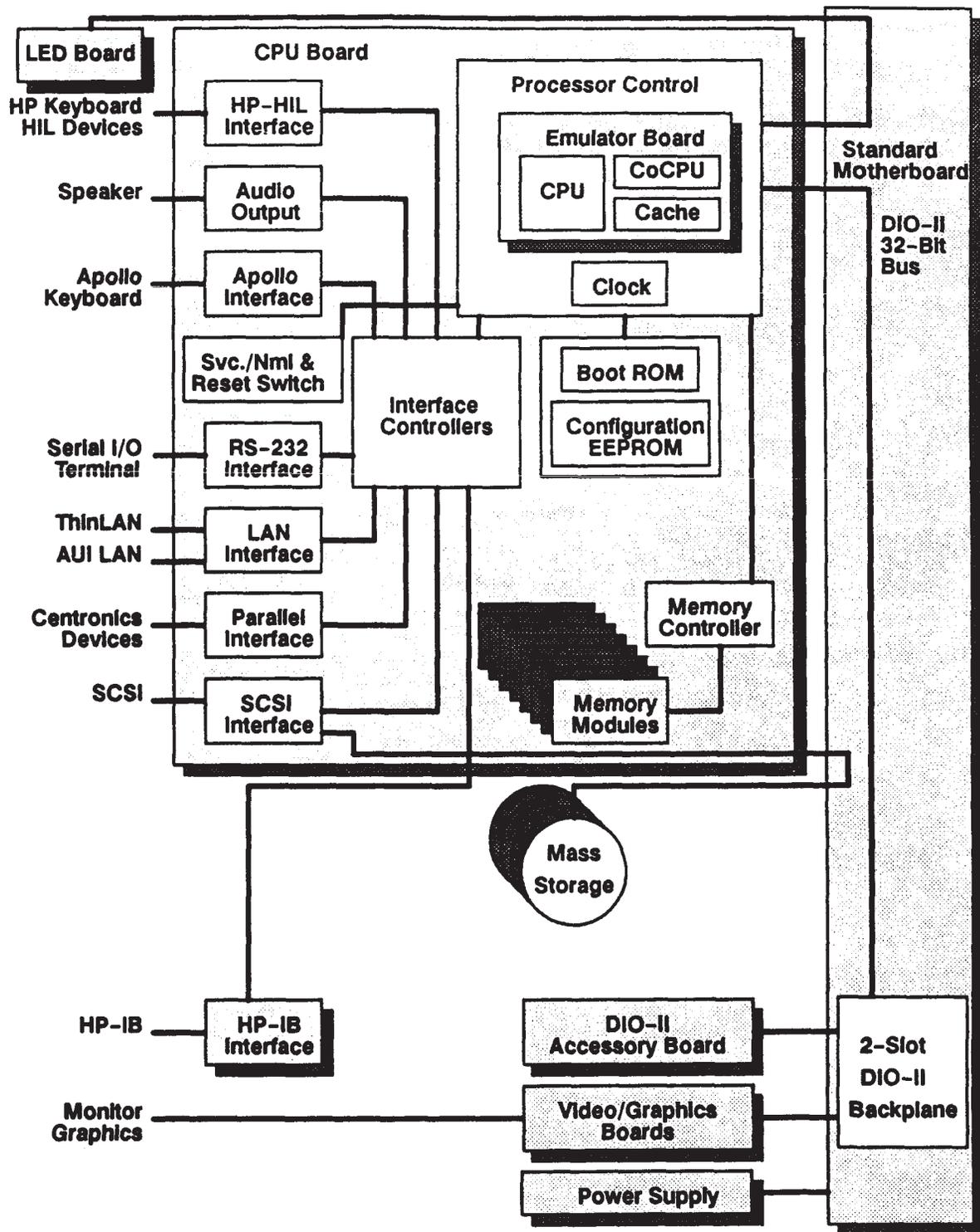


Figure 3-3. Model 400s Standard I/O System Unit Functional Block Diagram

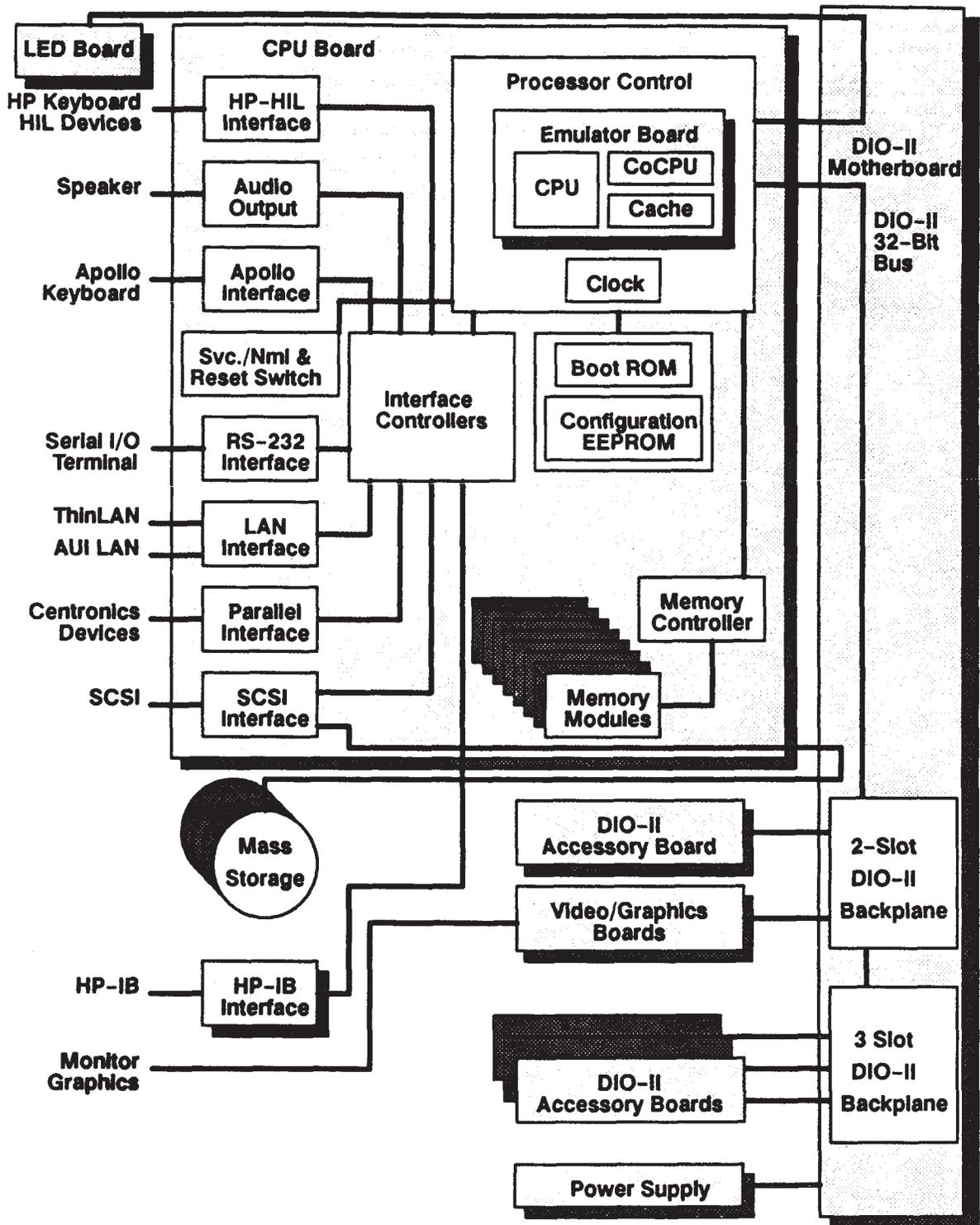


Figure 3-4. Model 400s DIO-II System Unit Functional Block Diagram

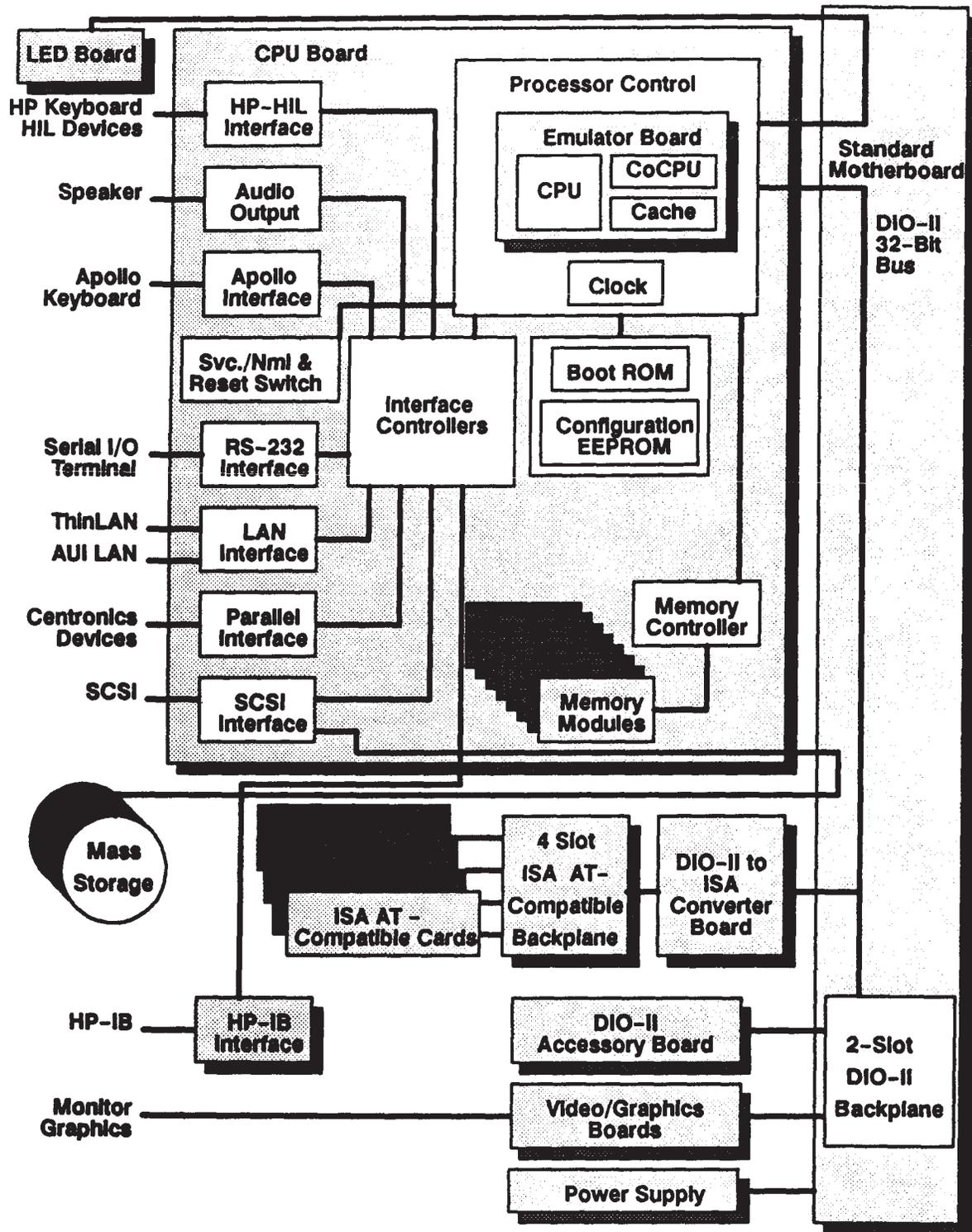


Figure 3-5. Model 400s ISA System Unit Functional Block Diagram

3.2 FRU-Level Operation

This section describes the operation of the major FRUs in the system. Refer to the appropriate block diagram (Figure 3-1 through Figure 3-5) as you read the descriptions of these FRUs. Refer to Chapter 4 for diagnostic procedures and to Chapter 5 for removal and replacement procedures.

3.2.1 CPU Board

The CPU board controls the program flow in the system, and is the host for the following system components:

- Memory boards
- SCSI devices
- Network and HP-IB boards
- Graphics controller board or graphics processor interface board

The following lists show the most important elements of the CPU board's hardware. An asterisk (*) next to some items denotes hardware that is not available on the Model 400dl.

- The emulator board, which includes the following components:
 - The MC68030 Microprocessor (the system's CPU)
 - The MC68882 Floating-Point Coprocessor (FPU)
- Boot ROM and EEPROM (for configuration data storage)
- The Utility Interface, which includes the following:
 - The system interrupt controller
 - Three full-duplex programmable ports for Serial I/O (SIO)
 - One full-duplex programmable serial port for the Apollo keyboard
- The Integrated Interface Controllers, which include the following controllers:
 - HP-HIL
 - LAN (IEEE 8013 with ThinLAN and AUI connections)

- LED
- Audio Tone Generator
- SCSI Bus*
- Centronics Parallel*
- RS-232 Serial Input/Output
- The system calendar with battery backup
- ISA Subset Bus Interface*
- HP-IB Bus Interface*
- DIO II and SGC* Bus slot for graphics controllers
- DIO Bus Interface
- DIO II Bus DMA support for SCSI and Centronics Parallel Interface Controllers*

CPU

The CPU executes MC68030 instructions in response to the operating system and user programs.

FPU

The MC68882 floating-point coprocessor executes floating-point math routines in hardware under the control of microcode. The FPU shares the CPU's access to the memory.

Boot ROM and Configuration EEPROM

The Boot ROM stores self test diagnostics and the system configuration program. The EEPROM stores the following information:

- Node ID
- 802.3 LAN ID
- Data from the configuration program, such as
 - System operating mode (HP-UX Compatible or Domain Compatible)
 - Primary network selection for Domain Compatible mode systems
 - Integrated interface parameters for HP-UX Compatible mode systems

Utility Interface (for Domain Compatible Systems)

The Domain/OS operating system uses the system clock (in conjunction with the system-ID memories on the network controller board) to provide the proper identification (year, month, day of the month, day of the week, hour, minute, and second) for object-creation operations such as file creation.. Problems with object creation can indicate a failure in the calendar device, battery, or (less frequently) a failure in reading the memory that contains the system ID.

The Serial I/O control component of the utility interface drives four asynchronous serial lines. Line SIO0 is the dedicated serial line for the keyboard. Lines SIO1, SIO2, and SIO3 are RS-232, general-purpose lines. All lines are fully programmable and support full-duplex communications. The three RS-232 SIO lines use a single 25-pin D-sub connector on the CPU board for an external port, which limits access to a single SIO line. An Apollo adapter cable connected to this port allows access to all three SIO lines.

HP-HIL interface

The Hewlett-Packard Human Interface Link (HP-HIL) is the HP standard for interfacing HP-HIL devices (such as HP keyboards) to the system. Asynchronous serial communications protocol enables you to select a set of input devices, connect them to the system unit, and work with any application program.

A link controller on the CPU board controls the HP-HIL. Each HP-HIL device has an interface for transferring information to and from the device. The HP-HIL interface supports the following parameters:

- Up to seven devices on the link.
- Maximum distance between devices is 2.4 meters, with a total link maximum length of 16.8 meters. These lengths do not include the 15 or 30 meter extensions.
- One Ampere of +12 V dc to the link.

802.3 LAN Controller

The LAN controller has a 32-bit DIO-II interface. The controller supports either an AUI or ThinLAN 802.3 network connection, which is jumper selectable on the CPU board. Refer to the CPU board jumper information in Appendix A for more 802.3 LAN jumper information.

The LAN controller manages the system's interface to the IEEE standard 802.3 network. The controller incorporates

- An intelligent IEEE 802.3 compatible communications controller that supports connection of a workstation to an IEEE 802.3 network
- Support for industry standard transport media and transmission protocols

- Communications with ETHERNET Version 1, Version 2, and IEEE 802.3 compatible controllers
- A transceiver that provides connection to “thin” ETHERNET cabling (Thin-LAN) through a BNC type T-connector on the back panel
- A 15-pin, D-connector on the back panel that provides connection to standard ETHERNET/IEEE 802.3 cabling (AUI) through a transceiver and transceiver cable
- Support for simultaneous Domain routing and TCP/IP gateway service on a single system or, in a shared mode, to all systems on an Apollo Token Ring network

For systems that run in HP-UX Compatible mode, you can use the Boot ROM’s Interface Configuration Mode to set the following 802.3 LAN configurations:

- Select code 0 through 31
- Interrupt levels 3 through 6

For more information about using the Interface Configuration Mode, refer to Appendix A.

An 801.3 LAN interface with a built-in media attachment unit (MAU) is part of the CPU board. The shared memory area has the memory controller circuits, 16 KB of memory, 64 nibbles of nonvolatile storage of the node address, and control, status, and ID registers. Multiplexing of DIO-II information and the 802.3 LAN chip set is also part of the controller circuit.

An AUI (attachment unit interface) connector enables connections to an external MAU. The MAU circuits used with the ThinLAN connector are not used. A replaceable fuse, located behind the AUI connector, protects the LAN circuits from MAU faults.

LED and Service/Normal Interface

This interface controller interfaces the LED board to the DIO II bus.

Audio Output Generator (for HP-UX Compatible Systems)

The Audio Output controller drives an external speaker with programmable volume, duration, and frequency. The controller defaults to an internal speaker if no external speaker is connected.

SCSI Interface

A Series 400 system incorporates an industry standard Small Computer Systems Interface (SCSI) that allows the connection of peripherals (such as Winchester and Magneto Optical disks, magnetic tape drives, and cartridge tape drives) to the system.

The SCSI interface uses a single-ended (versus differential) connection to daisy-chained devices. The SCSI controller provides the interface between the SCSI bus and the DIO II bus, and can use 32-bit DMA on the DIO II bus.

The length of the SCSI bus cable must not exceed 6 meters (19.6 feet). This maximum cable length includes the length of the bus inside the Series 400 system units and the length of cable inside each external SCSI device. For Model 400t and 400dl systems, the internal SCSI bus length is 0.6 meters (2 feet). For Model 400s systems, the internal SCSI bus length is 1.6 meters (5.5 feet). For more information about calculating the length of the SCSI cable, refer to the appropriate owner's guide:

- *HP Apollo 9000 Series 400 Workstation Domain/OS Owner's Guide*
- *HP Apollo 9000 Series 400 Workstation HP-UX Owner's Guide*

For bus termination on Model 400s systems, a terminator must be present at each unconnected end of the SCSI interface. One terminator is permanently connected to the end of the internal SCSI interface cable used for internal mass storage devices. If the external SCSI connector on the CPU board does not have a cable connected, a terminator must be installed on the connector. In all cases, the last external SCSI device must have a terminator in its unused connector.

For bus termination on Model 400t and 400dl systems, a SCSI bus terminator is always present on the CPU board, regardless of a system's configuration. If there is no external SCSI device, a terminator is not necessary on the system unit's external SCSI connector. If there are external SCSI devices connected to the system's external SCSI connector, the last external SCSI device must have a terminator on its unused connector.

For systems that use HP-UX Compatible mode, you can use the Boot ROM Interface Configuration Mode to select the following SCSI parameters:

- Select code from 0 to 31
- Interrupt level from 3 to 6
- Parity checking on or off
- Bus address from 0 to 7 (normally set to 7)

For information about using the Interface Configuration Mode, refer to Appendix C.

Centronics Parallel Interlace

This interface provides bidirectional support for external parallel devices. It uses an 8-bit Direct Memory Addressing (DMA) scheme to the DIO bus at up to 300 KB per second transfer rates.

RS-232 SIO Interface

The RS-232 interface has six modem control lines and an 8-bit DIO interface. It shares the 25-pin D-sub connector with the SIO lines of the Utility Interface chip. For systems that use HP-UX Compatible mode, you can use the Boot ROM's Interface Configuration Mode to configure the following parameters of the RS-232 interface:

- Select code from 0 to 31
- Interrupt level from 3 to 6
- Remote mode (for terminals) or local mode (for display monitors)
- Modem enable

For information about using the Interface Configuration Mode, refer to Appendix A.

ISA Subset Bus Interface

The CPU board has a single ISA subset bus slot for an Apollo or 802.5 Token Ring network interface board. The interface operates in programmed I/O mode only, which precludes the following ISA bus features: DMA, Bus mastership, and some interrupts (uses only three of eleven interrupts). The bus operates synchronously with the processor, but at one fourth the frequency.

HP-IB Interface

The HP-IB controller is an RS-232 interface that has six modem control lines and an 8-Bit DIO interface that supports HP-IB devices.

DIO-II and SGC Controller Slot

This single slot has both a DIO-II connector and an SGC (Standard Graphics Connection) connector to support either a DIO-II or SGC graphics controller. The graphics controller board (or interface board for external controllers) connects directly to the system's DIO bus.

DIO Bus Interface

The DIO bus interface controls the address and data bus buffers, and performs the following functions:

- Arbitrates the internal (CPU) bus and I/O (DIO) bus
- Controls processor board addresses, and the data and control bus buffer
- Provides interrupt timing
- Translates CPU control signals to DIO-II protocol and vice versa
- Generates cache addresses and cache control strobe timing

- Provides Multimap DIO-I accesses to system memory and the DIO-II interface for system memory
- Performs dynamic bus sizing for the CPU

DMA DIO Controller

The DMA controller is programmable for byte, word, and 32-bit transfers. This controller supports DMA transfers for the SCSI and Centronics parallel interfaces.

3.2.2

Memory

Memory boards for Series 400 systems are available in 2-, 4-, and 16-MB board configurations. The 2- and 4-MB boards consist of 1 Megabit (Mb) DRAMS. The 16-MB board consists of 4-Mb DRAMS, in a 4-bit wide configuration. Memory boards must be used in like pairs to form a memory block (for example, two 2-MB memory boards form a 4-MB block). These board pairs must reside in a high-to-low configuration, beginning with the lowest numbered memory slots on the CPU board. For example, if a Model 400s system uses a 32-MB board pair and an 8-MB pair, the 32-MB pair always resides in the two lowest-numbered slots (0A and 0B), and the 8-MB pair always resides in the third and fourth slots (1A and 1B). Do not allow empty slots between boards.

The three Series 400 systems use different memory boards and memory configurations:

- The Model 400t can use 2- and 4-MB boards, for memory configurations of 8 to 32 MB in 4- or 8-MB increments.
- The Model 400dl can use 4-MB boards, for a memory configuration of 8 or 16 MB.
- The Model 400s can use 4- or 16-MB boards, for memory configurations of 8 to 128 MB in 8- or 32-MB increments.

Memory design includes a memory data path that supports 8-bit Error Checking and Correction (ECC) on a 64-bit data word. The ECC logic is located on the data path between the RAM arrays and the processor or alternate bus master. This logic corrects single bit errors, and detects all double bit errors, and triple and quadruple bit errors grouped in nibbles. The system displays the message, “Uncorrectable Memory Error Detected” in the event of these double, triple, and quadruple bit errors (refer to Chapter 4 for more information about error codes). The memory controller decodes the address space occupied by memory, interprets the types and sizes of transfers, and generates signals and timing to the DRAMS. The controller also provides all control signals to the ECC logic.

3.23 LED Board

The LED board for Model 400s systems houses the LEDs that are visible on the front panel of the system unit. These LEDs indicate the progress of the boot ROM through its initialization, report status codes during normal Domain/OS operation, and display a FRU code in the event of an error. They also indicate power-on and Service mode status. Chapter 2 describes the LED Normal operation codes for Domain/OS; Chapter 4 describes the LED boot ROM error codes for systems that use Domain Compatible and HP-UX Compatible modes.

The LED board for Model 400t and 400dl systems houses nine LEDs instead of the 10 LEDs found on the Model 400s LED board. The power-on LED for Model 400t and 400dl systems is located on the power-on switch plate instead of on the LED board.

The Model 400t and 400dl LED board also contains the system Reset switch and Service/Normal switch. The Service/Normal switch is a push-button switch that only retains its state (Service or Normal mode) when the system is on; the system defaults to Normal mode when you turn it off. The LED board also routes the power supply dc V power-on signal between the power-on switch and the power supply.

3.2.4 Apollo Token Ring Network Controller-AT

The Apollo Token Ring (ATR) Network Controller-AT manages the system's interface to the ring network. The network controller incorporates

- A modem for modulation and demodulation of data from the ring
- The input-filtering and amplification hardware that converts data from the ring to a digital bit stream
- The receive logic responsible for converting digital data from serial format to parallel format
- The transmit logic responsible for converting digital data from parallel format to serial format
- A dual-ported RAM buffer
- The control logic that regulates the operation of the other functional units
- The relays that remove the system from the ring during power-off or offline operation

3.2.5 802.5 Network Controller-AT

The 802.5 Network Controller-AT manages the system's interface to the IEEE standard 802.5 network. The controller has the following features:

- Full compliance with IEEE 802.5 standards.
- Texas Instrument TMS380 chip set.
- 16 KB of on-board memory.
- Ability to operate with a variety of 802.5 Multistation Access Units (MAUs).
- 9-pin, D-shell, subminiature female connector to support Type 1 and 2 cables, and an RJ11 phone jack to support Type 3 cables.
- On-board, jumper-selectable address and interrupt level selection.

3.2.6 HP-IB Controller

The optional Hewlett-Packard Interface Bus (HP-IB) is HP's version of the IEEE 488 interface standard. HP-IB uses a separate board connected to the CPU board by a ribbon cable. A mounting plate secures the board to the system unit's back panel.

The HP-IB board uses a TMS9914 HP-IB controller which allows data transfer rates up to 450 KB/second. The TMS9914 is a memory-mapped I/O device which is multiple-mapped within a 64 KB internal I/O device.

One configuration function for the HP-IB system controller is part of the Boot ROM's interface configuration mode. When two or more HP-IB devices capable of controlling the interface are connected to the interface, one must be configured as the system controller. The function is set to *yes' if the system unit is the system controller or 'no' if the other device is the system controller.

3.2.7 I/O Boards for Model 400s Systems

The following backplanes support DIO II and ISA option boards.

DIO-II to ISA Converter Board

This board converts 32-bit DIO-II information to 16-bit ISA information while interfacing with the DIO-II bus on the motherboard. A connector on the converter board accepts the AT-compatible backplane.

AT-Compatible Backplane Board

This 4-slot backplane accepts 16-bit ISA PC-AT compatible boards. Although con-

nectors are provided for 32-bit boards, they are not supported. The Apollo Token Ring Network board is installed here.

DIO-II Backplane

This 3-slot DIO-II backplane is part of the DIO-II motherboard. It supports 32-bit DIO-II accessory boards.

3.2.8 Graphics Controller Boards

Graphics controller boards allow the system unit to send bit-mapped display information to medium or high resolution monitors. A variety of monochrome and color video boards are available for Series 400 systems. The color boards provide up to 8-plane color display capability.

Graphics interface boards connect to display processors that are external to the system through a local graphics bus. Graphics processors are used for applications requiring an extensive graphics capability.

Supported video/graphics boards include

- VRX Color Video Board (HP A1416A). This version displays 1280 by 1024 individual pixels and drives the high-resolution color monitors. It provides 8 image planes and 2 overlay planes.
- GAD Bus Interface Board (HP 98702A). This interface board drives one of the following graphics processors:
 - HP 98705A Graphics Processor, providing 8 color planes and 4 overlay planes.
 - HP 98705B Graphics Processor, providing 16 color planes, 4 overlay planes, and 16-bit Z planes.
 - HP 98705C Graphics Processor, providing 8 color planes and 4 overlay planes. This processor has a slower graphics engine than the HP 98705A processor.
- PDMA Graphics Interface Board (98735-^658). This board drives one of the following display controllers to provide 24 image planes, 24-bit Z planes, 4 overlay planes, 4 window planes, and 4 display mode planes:
 - HP 98735A Single Engine Graphics Processor
 - HP 98736A VDMA Dual Engine Graphics Processor
 - HP 98736B VDMA 3-Stage Engine Graphics Processor

- VRX Monochrome Graphics Controller Board (HP A1096A). This board is a high-resolution, 19-inch monochrome display controller that has the following features:
 - High-resolution, 1280 x 1024 display
 - Flicker-free, 72-Hz, noninterlaced screen refresh
 - Low power requirements
 - 256-KB image memory, using high-density dynamic dual-ported video RAMs

The image memory stores a bitmap of the images that the controller displays on the monitor. To display the images, the controller scans the bitmap and sends the image to the monitor in a serial bit stream via a coaxial cable.

3.2.9 Power Supplies

Power supplies for Model 400t/400dl and Model 400s systems are autoranging units that automatically adjust to a 100 – 120 or 220 – 240 V ac input voltage. The on/off switch for these supplies does not control the ac voltage input to the supplies. The supplies receive ac power when plugged into a wall outlet. The on/off switch turns on the dc output of the supplies by passing a low-level dc control voltage and input signal.

Model 400t and 400dl Power Supply

The power supply for Model 400t and 400dl systems contains a voltage margin feature that enables the CPU to alter the nominal + 5V output voltage by five percent above or below nominal. This power supply houses a two-speed fan. A thermistor on the CPU board controls the fan speed according to the inlet ambient temperature of the system unit. The Model 400t and 400dl power supply distributes dc voltages through the CPU board to individual assemblies. For the Model 400t, the power supply also distributes dc voltages directly to any internal disk drives through cables.

Model 400s Power Supply

The Model 400s power supply doesn't control fan speeds or have a voltage margin feature. The power supply distributes power through the motherboard and cables to individual assemblies, as shown in Figure 3-6.

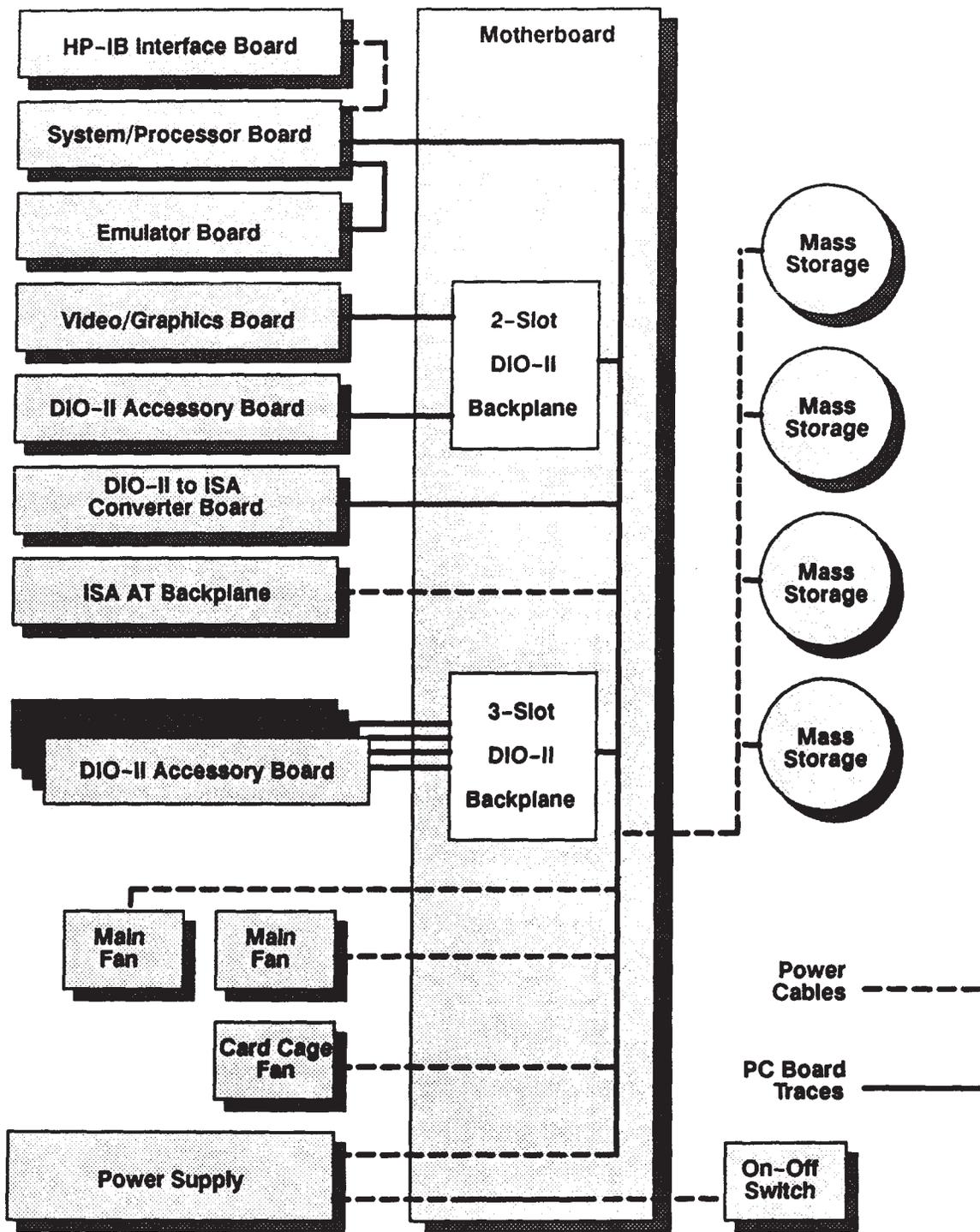


Figure 3-6. Model 400s System Unit Power Distribution Diagram



Chapter 4

Fault Isolation

This chapter provides information about isolating a failing Field Replaceable Unit (FRU). It consists of the following three parts:

- Part 1 contains troubleshooting flowcharts and diagnostic information for systems that use Domain Compatible mode.
- Part 2 contains troubleshooting flowcharts and diagnostic information for systems that use HP-UX Compatible mode.
- Part 3 explains checkout procedures for Series 400 systems, which are referenced by the troubleshooting flowcharts.

The flowcharts contained in this chapter are logically structured to point you in the right direction (run diagnostics, replace FRUs, and so on). The remainder of the information in this chapter supports the directions in the flowcharts. Follow the removal and replacement procedures in Chapter 5 if the flowcharts call for FRU replacements.

Troubleshooting in Domain Compatible Mode

You must be familiar with the Domain/OS shells and commands to troubleshoot Series 400 system units that are running in Domain Compatible mode. You must be able to start and stop processes. You should also become familiar with a number of standalone utilities, and with both the online and offline diagnostics. The *Domain Hardware Utilities Reference* manual describes all standalone utilities for Domain nodes, and *Using Domain Diagnostics, Volume 1* describes the MD environment and the diagnostics.

For Series 400 systems that run Domain Compatible mode, you note any error or status messages, and then run the power-up diagnostics, known as Self Test. If the Self Test diagnostics fail, replace the FRU that is indicated. If the tests pass but you still suspect a problem, you should run the next level of diagnostics. If you can boot Domain/OS, run the System Acceptance Exerciser (SAX). If you are restricted to the MD, run the

offline Test Stimulus Code (TSC). If the TSC or SAX diagnostics fail, replace the indicated FRU. If the system does not report errors, the suspected problem is probably not hardware related. Refer to the following sections for more information about Self Test, TSC, and SAX.

Troubleshooting in HP-UX Compatible Mode

You must be familiar with the HP-UX operating system to troubleshoot Series 400 system units that are running in HP-UX Compatible mode with HP-UX. You must be able to start and stop processes. You should also be familiar with the Boot ROM Test Mode, Series 300 Test Tools and the HP-UX ce.utilities. The *Series 200/300 Test Tools Manual* has instructions for running the Series 300 Test Tools. Instructions for using ce.utilities are found in the *System Support Tape User's Guide*.

For Series 400 systems that run HP-UX Compatible mode, you note any error or status messages, and then run the power-up boot ROM diagnostics, known as Self Test. If the Self Test diagnostics fail, replace the FRU that is indicated. If the tests pass but you still suspect a problem, run the TSC diagnostics. Refer to the following sections for more information about Self Test and TSC.

Part 1 Troubleshooting Flowcharts and Diagnostics for Domain Compatible Mode

4.1 Troubleshooting Flowcharts for Systems that Use Domain Compatible Mode

This section provides flowcharts that route you through a series of standard troubleshooting procedures for Series 400 systems that use Domain Compatible mode (see Figure 4-1 through Figure 4-9). Refer to Part 3 of this chapter for the checkout procedures that these flowcharts reference.

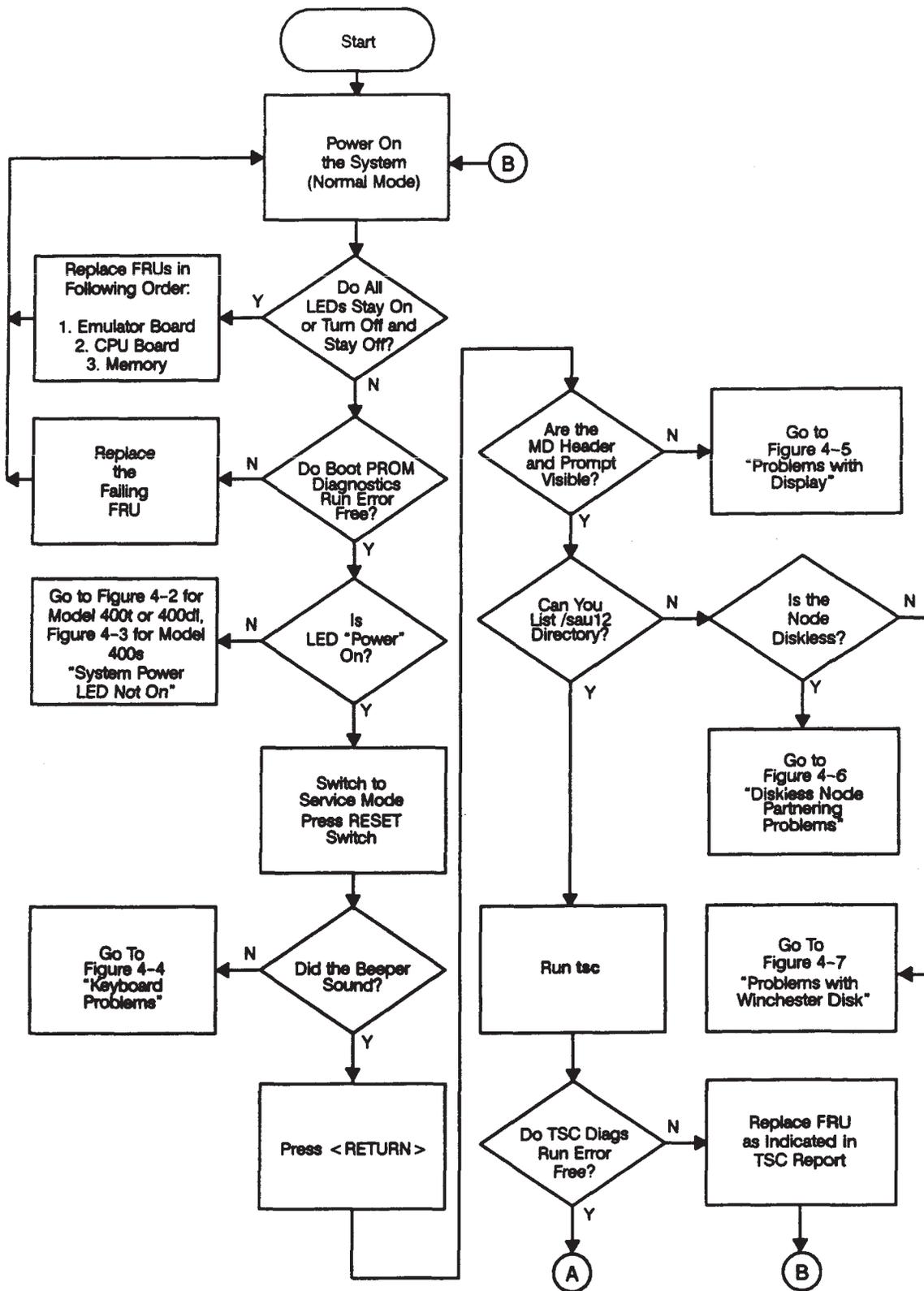


Figure 4-1. Main Flowchart

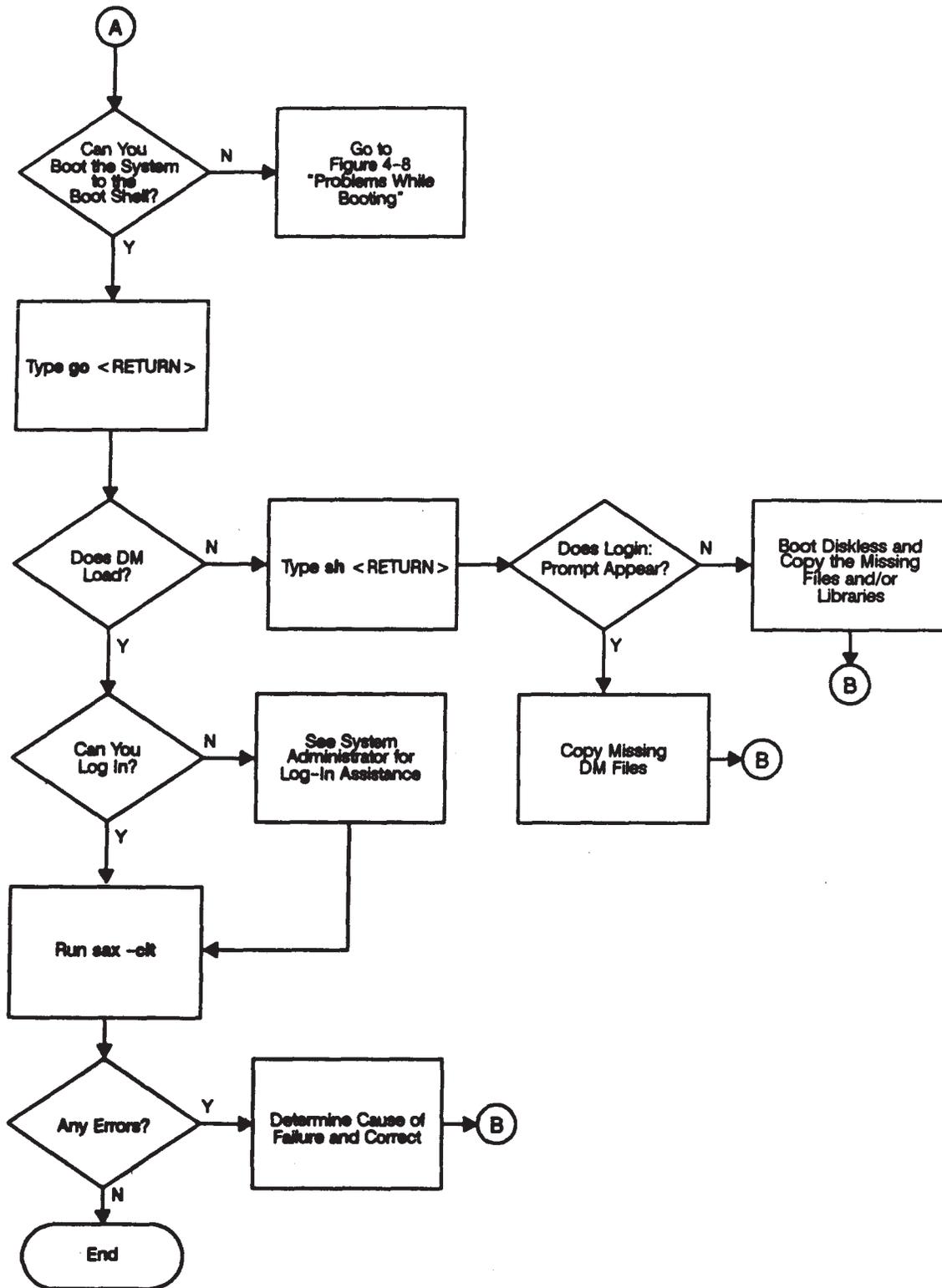


Figure 4-1. Main Flowchart (Cont.)

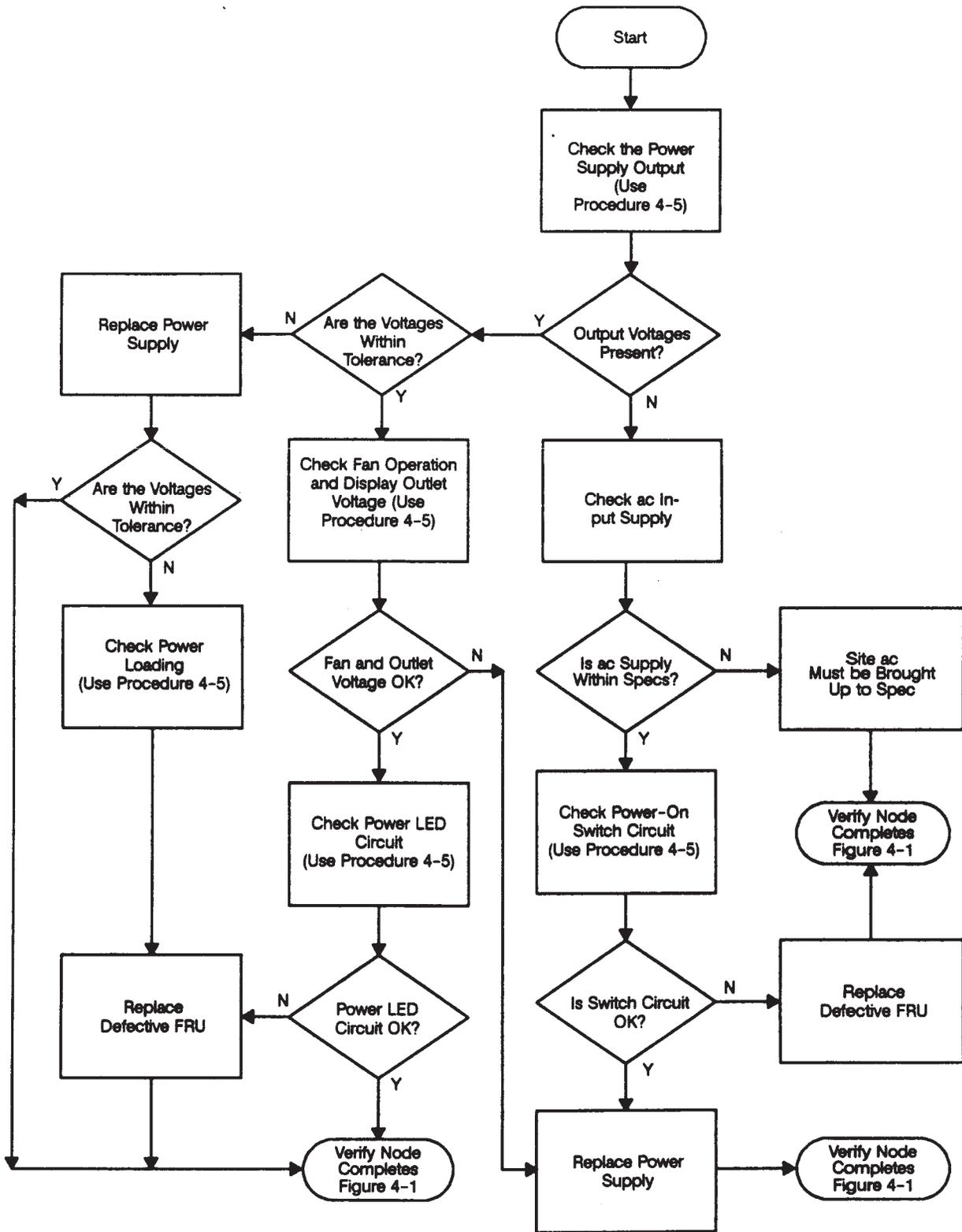


Figure 4-2. Model 400t and 400dl System Power LED Not On

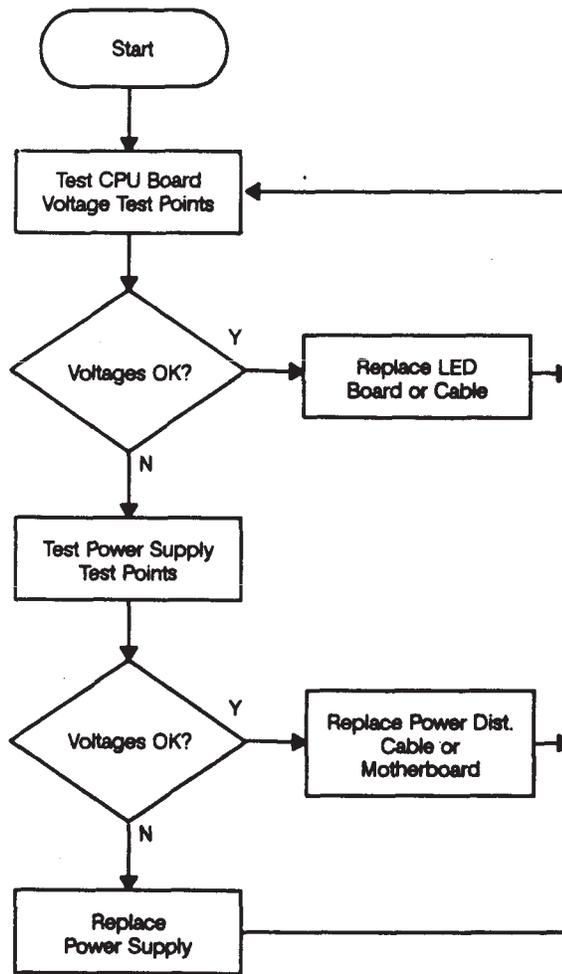


Figure 4-3. Model 400s System Power LED Not On

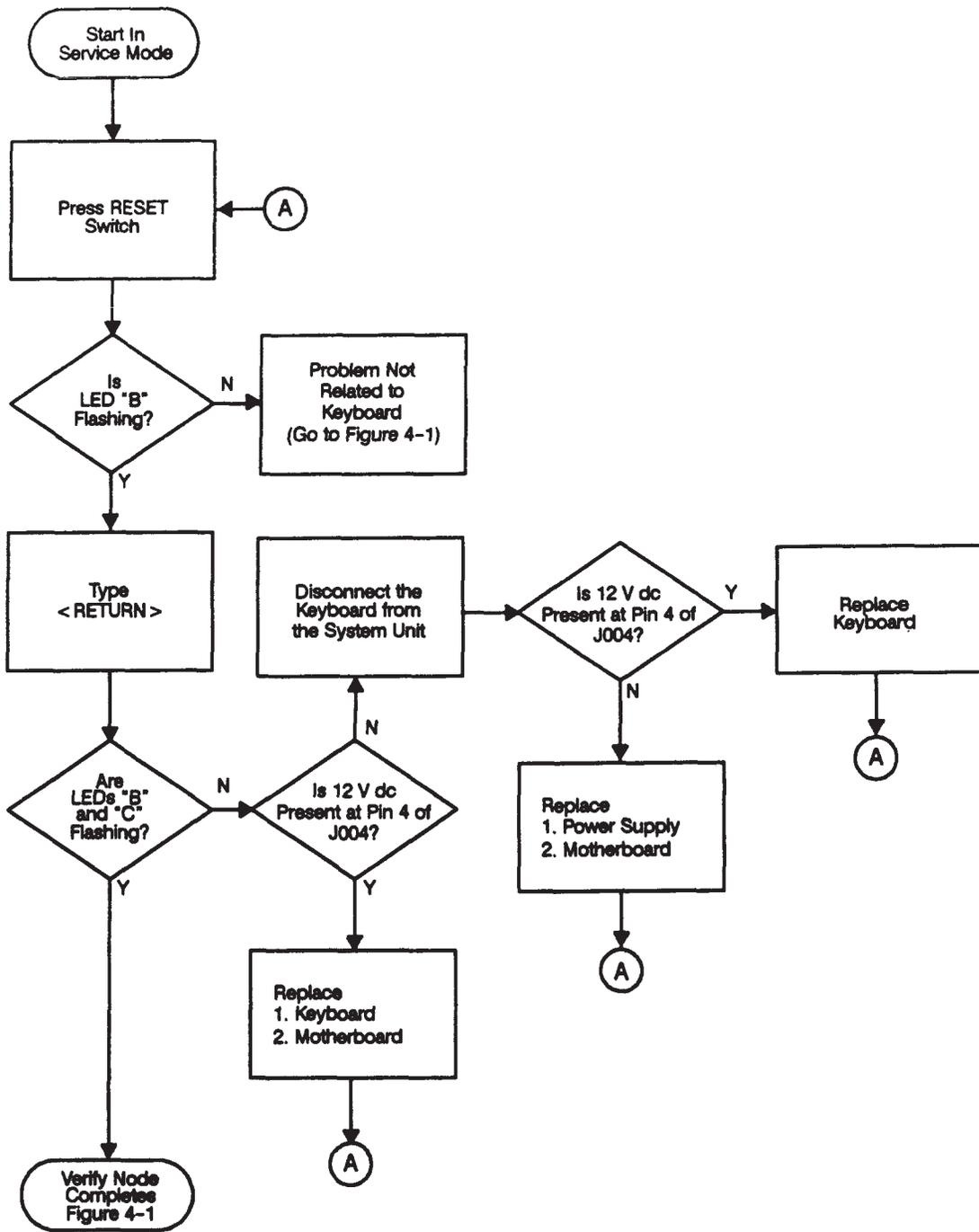


Figure 4-4. Domain Keyboard Problems

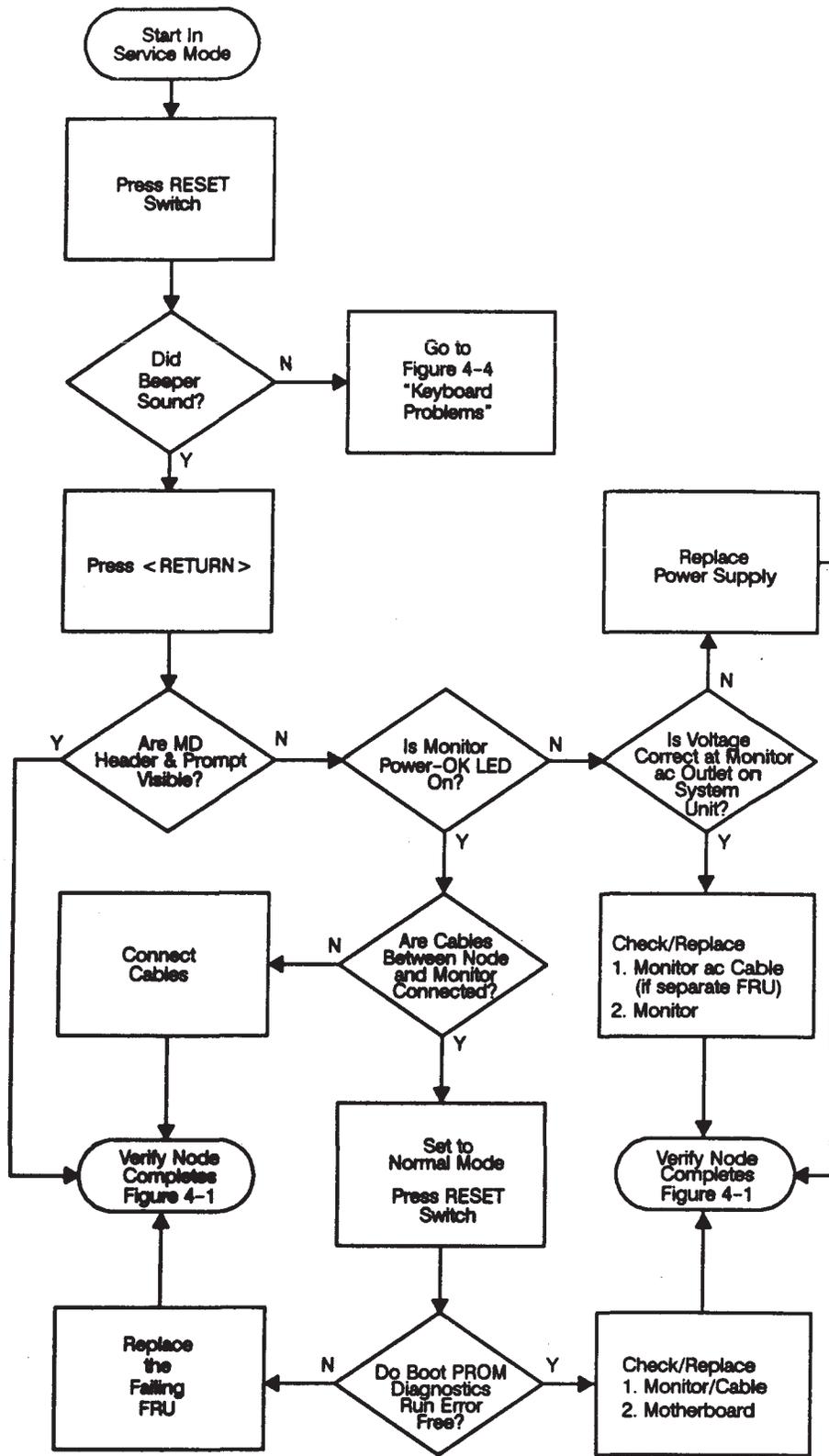


Figure 4-5. Problems with Display

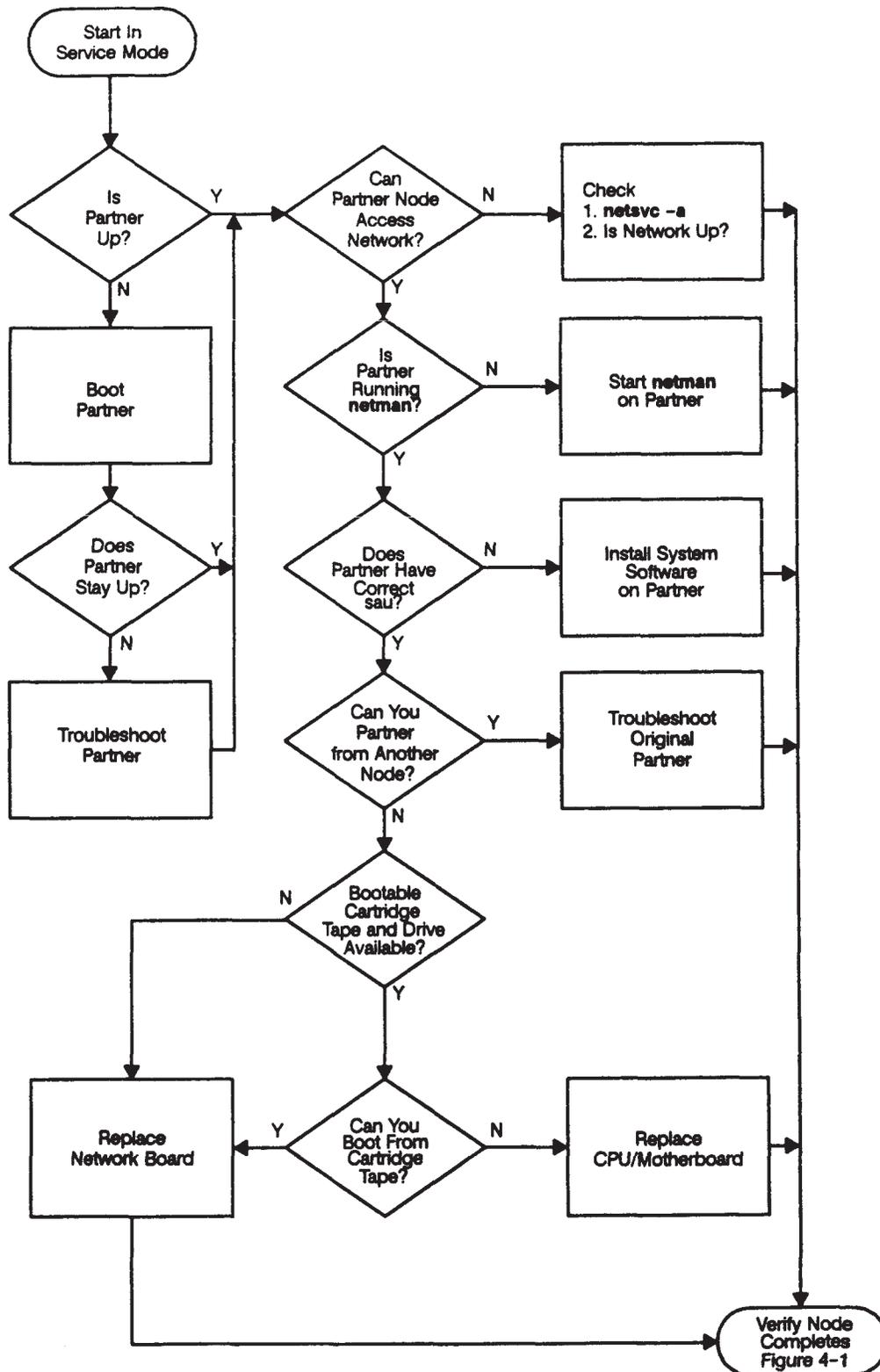


Figure 4-6. Diskless Node Partnering Problems

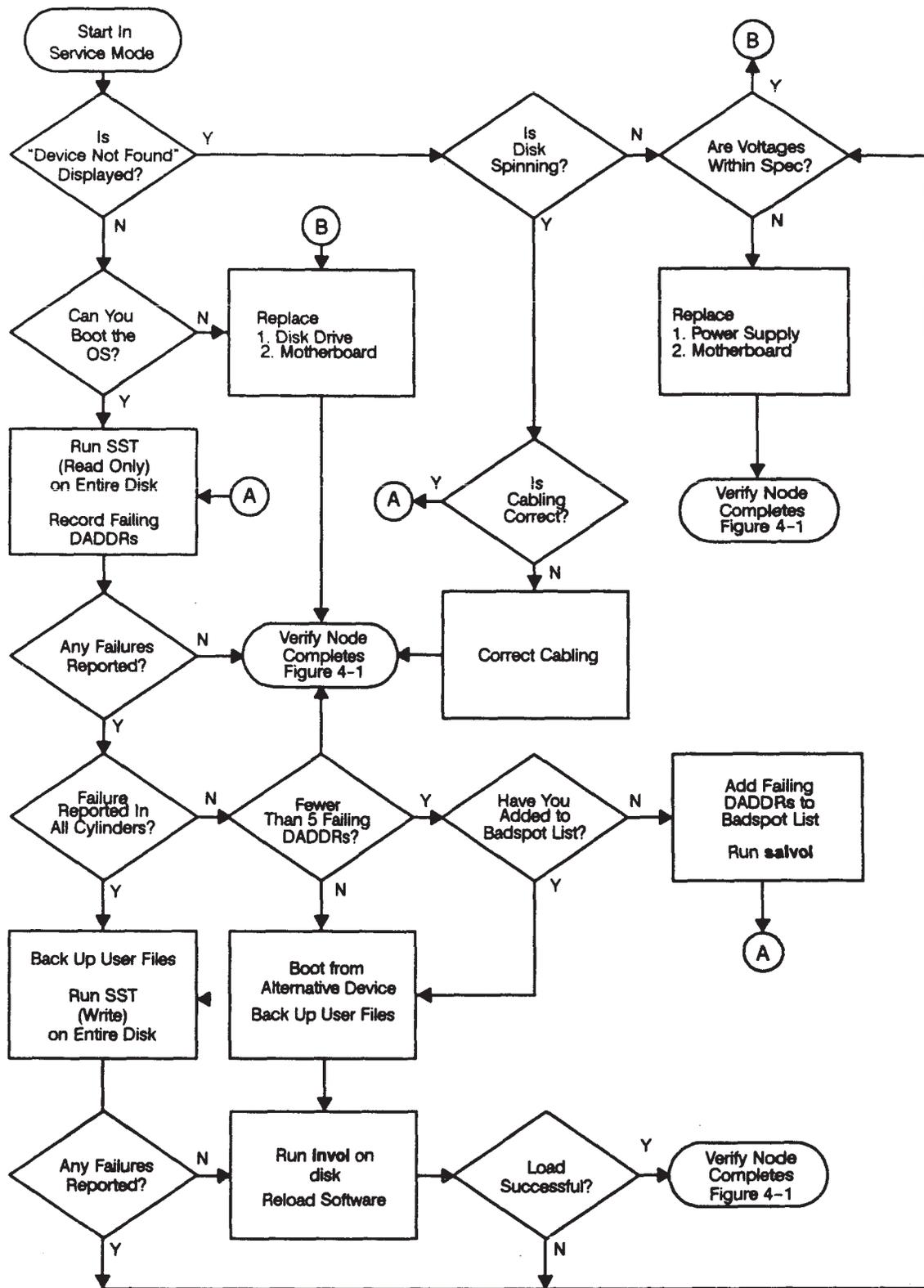


Figure 4-7. Problems with Winchester Disk

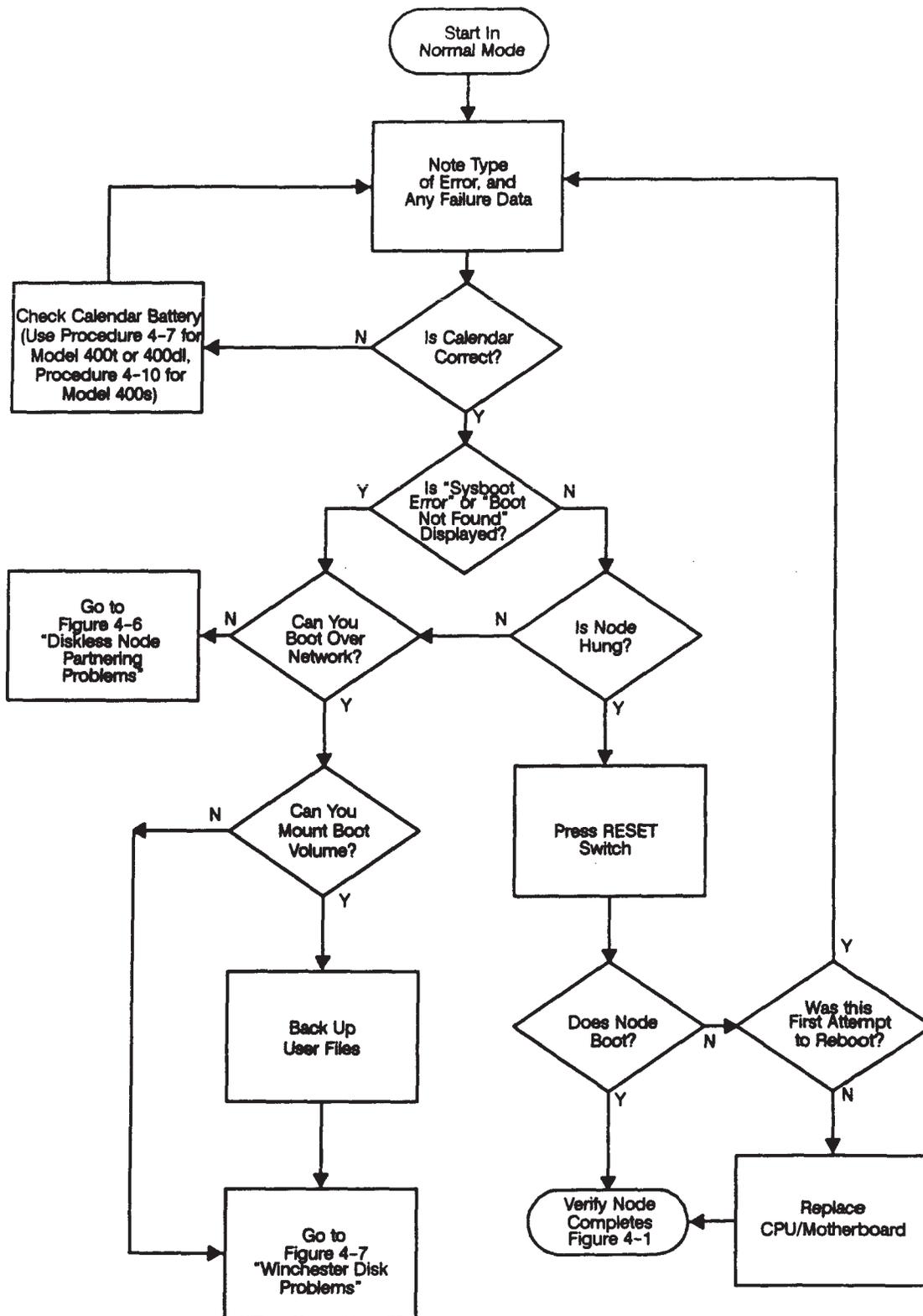


Figure 4-8. Problems While Booting

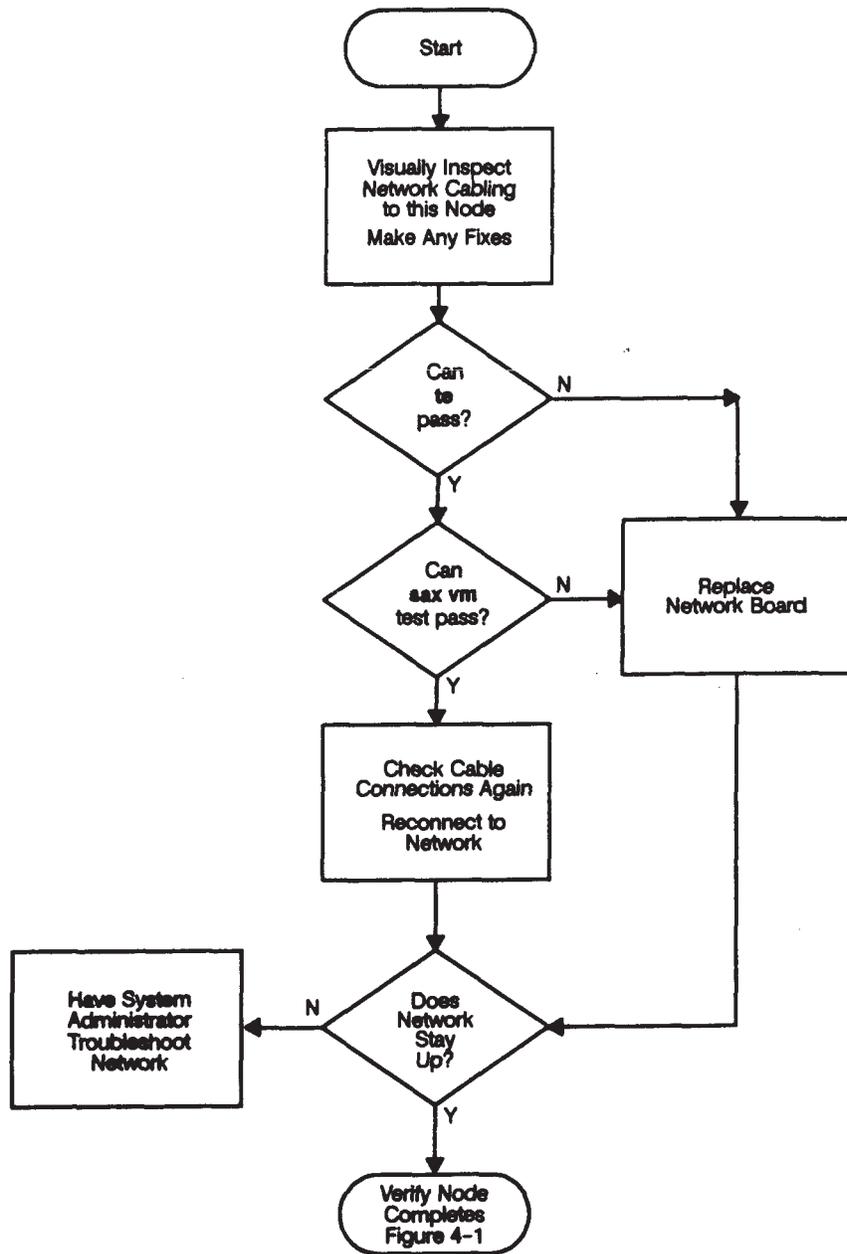


Figure 4-9. Node Causes Network Problems

4.2 Diagnostic Summary for Domain Compatible Mode

Several levels of operations exist within systems that run in Domain Compatible mode. Each level has diagnostic or error reporting capabilities. The following sections explain each of these levels.

- The Mnemonic Debugger (MD) level has
 - Self Test diagnostics
 - Extended Self Test diagnostics
 - Test Stimulus Code (TSC) diagnostics
 - Standalone utilities
- The **sysboot (netboot)** program
- The online level has
 - Phase II (boot) shell
 - Online exercises

The functional capabilities of the failing node determines which diagnostic tool you can use. Always start troubleshooting by noting any error messages and then running the Self Test diagnostics.

On a standalone system, you can run the Self Test diagnostics that reside on the Boot ROM; if a disk exists, you can also run Loadable Tests (the part of Self Test that resides in the /SAU directory), TSC, and SAX.

If a system is diskless, you can boot Loadable Tests, TSC, and SAX from another disk on the network. If the diskless system is running Domain/OS, you can also run SAX by logging onto a remote system (using the **crp** command).

If the system display is inoperative, you can access Self Test, TSC, and SAX by using the serial line connected either to a terminal (TTY) or to a workstation that emulates a terminal (EMT). Refer to Appendix D for information about using TTY and EMT.

Table 4-1 lists the primary methods to access diagnostics and where these diagnostics are stored.

Table 4-1. Methods To Access Diagnostics

| Method of Access | Diagnostics | Location |
|--|--|--|
| Standalone System, Diskless | Self Test | Boot ROM |
| Standalone System, Disk or Network (diskless booting, crp) or Serial Line (TTY, EMT) | Self Test Loadable Self Tests TSC SAX | Boot ROM /SAU directory /SAU directory /systest directory |

Figure 4-10 illustrates the relationships between diagnostics, with respect to their physical locations, and shows the sequence in which they load.

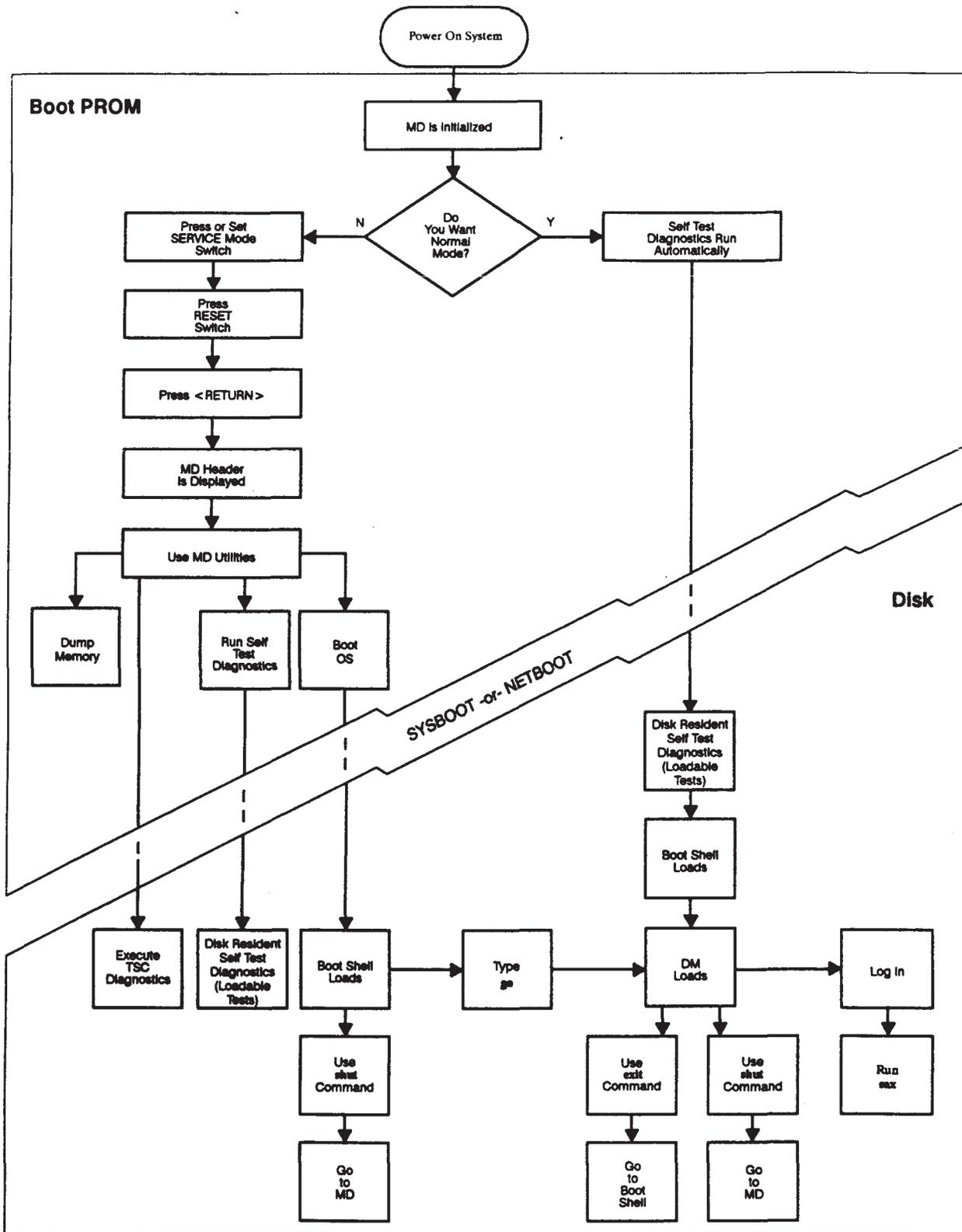


Figure 4-10. Diagnostic Relationships for Domain/OS Compatible Mode

4.3 Mnemonic Debugger Level

Several diagnostic tools exist at the Mnemonic Debugger (MD) level. In this section, we discuss how to run the Self Test diagnostics and how to interpret the LED error codes. We also explain the MD level LED status codes and briefly discuss TSC diagnostics. We document other MD diagnostic tools in the following manuals:

- *Using Domain Diagnostics, Volume 1* (including *new* MD commands and MD crash codes)
- *HP 9000 Series 200/300 Computers Test Tools Manual* (more extensive information about TSC diagnostics)
- *Domain Hardware Utilities Reference* (*invol*, *salvol*, and *calendar* utilities)
- *HP Apollo 9000 Series 400 Workstation Domain/OS Owner's Guide* (dumping memory)

NOTICE: When executing utilities such as **calendar**, **invol**, and **salvol**, you must specify the device type, along with the controller number and unit number. For example, if you intend to run the **calendar** program, a “device found” message appears on the screen. When you are prompted to enter the device type (**w,s,f**, or other), you *must* include the controller and unit numbers specified in the “device found” message along with the device type, such as **w6:0** (Winchester disk controller 6, unit 0).

4.3.1 Self Test Diagnostics

This section

- Describes the Self Test diagnostics
- Explains how to run them
- Provides a table of the LED error codes that the Self Test diagnostics return during power-up and forced execution

Self Test Diagnostics Overview

Self Test diagnostics consist of *Test*, *Extended Test*, and *Continuous Test*. The Self Test code resides in the Boot ROM and in a file named *self_test* in the /SAU directory. We refer to the part of Self Test that resides in the *self_test* file as *Loadable Tests*.

The *Test* section of Self Test checks all system hardware that loads and executes a standalone program, such as the

- CPU
- I/O console (keyboard or terminal)
- SCSI storage devices
- Network controllers

Test runs automatically during Normal mode power-up, and from the **TE** command at the MD prompt.

Before *Test* verifies any SCSI devices on the SCSI bus, it checks the SCSI controller for proper operation. *Test* checks direct access media SCSI devices, which include Winchester and HP magneto-optical drives, by invoking a diagnostic that resides on the drive. Non-direct access media devices, such as tape and floppy drives, are not tested. If the drive's diagnostic passes, *Test* searches the drive for an Apollo PV label to find the location of the drive's reserved diagnostic logical blocks. Once it locates the reserved blocks, *Test* performs a read test to them. If it does not find the PV label, it displays "pv label not found" on the display screen.

Test checks a network controller, which includes the integrated LAN controller on the CPU board, by calling a diagnostic that resides in a PROM on the network controller.

Extended Test consists of all the *Test* diagnostics, plus tests that

- May query you
- Check external graphics controllers and devices
- Exceed the power up time length

Extended Test runs from the **ET** command at the MD prompt.

Continuous Test loops the extended test diagnostics until they report an error or you press < **RESET** >. *Continuous Test* runs from the **CT** command at the MD prompt.

Test and *Extended Test* diagnostics for the following devices reside in the *self_test* file:

- SGC, ISA, and EISA buses
- SGC graphics controller boards
- VRX Monochrome (A1096A) and VRX Color (A1426A) controller boards
- Future system devices

How to Run the Self Test Diagnostics

The following three procedures show you how to force execution of the Self Test diagnostics:

- Procedure 4-1 shows how to run *Test* diagnostics.
- Procedure 4-2 shows how to run *Extended Test* diagnostics.
- Procedure 4-3 shows how to run *Continuous Test* diagnostics.

Procedure 4-1. *Running the Standard Self Test Diagnostics*

1. Log out and stop any user processes.
2. Shut down to the MD prompt by typing the following at the “login:” prompt:
login: **shut**
3. At the MD prompt “>”, type the following:
> **re** < RETURN >
4. After the beeper sounds, press < RETURN > and type the following:
> **te** < RETURN >

end of procedure

Procedure 4-2. *Running the Extended Self Test Diagnostics*

1. Log out and stop any user processes.
 2. Shut down to the MD prompt by typing the following at the “login:” prompt:
login: **shut**
 3. At the MD prompt “>”, type the following:
> **re** < RETURN >
 4. After the beeper sounds, press < RETURN > and type the following:
> **et** < RETURN >
- Answer the prompts as they appear.

end of procedure

Procedure 4-3. Running the Continuous Self Test Diagnostics

1. Log out and stop any user processes.
2. Shut down to the MD prompt by typing the following at the “login:” prompt:
login: **shut**
3. At the MD prompt “>”, type the following:
> **re** < RETURN >
4. After the beeper sounds, press < RETURN > and type the following:
> **ct** < RETURN >

end of procedure

Self Test Diagnostic Error Messages

If an error occurs, the Self test diagnostics use the LEDs and the display screen to display a message or code that calls out the failing FRU.

If the system is in NORMAL mode and an error occurs, you receive a prompt asking if you wish to continue the tests and try to boot the operating system. The LEDs and the display screen show the failing FRU and system status.

If the system is in SERVICE mode and an error occurs, the tests halt, with the LEDs and the display screen showing the failing FRU and system status.

Figure 4-11 shows the LEDs on the front panel that call out the failing FRU during the CPU/CPU board/Memory testing. The Power LED is always on when the system is powered on. The SERVICE mode LED is on only when SERVICE mode is enabled.

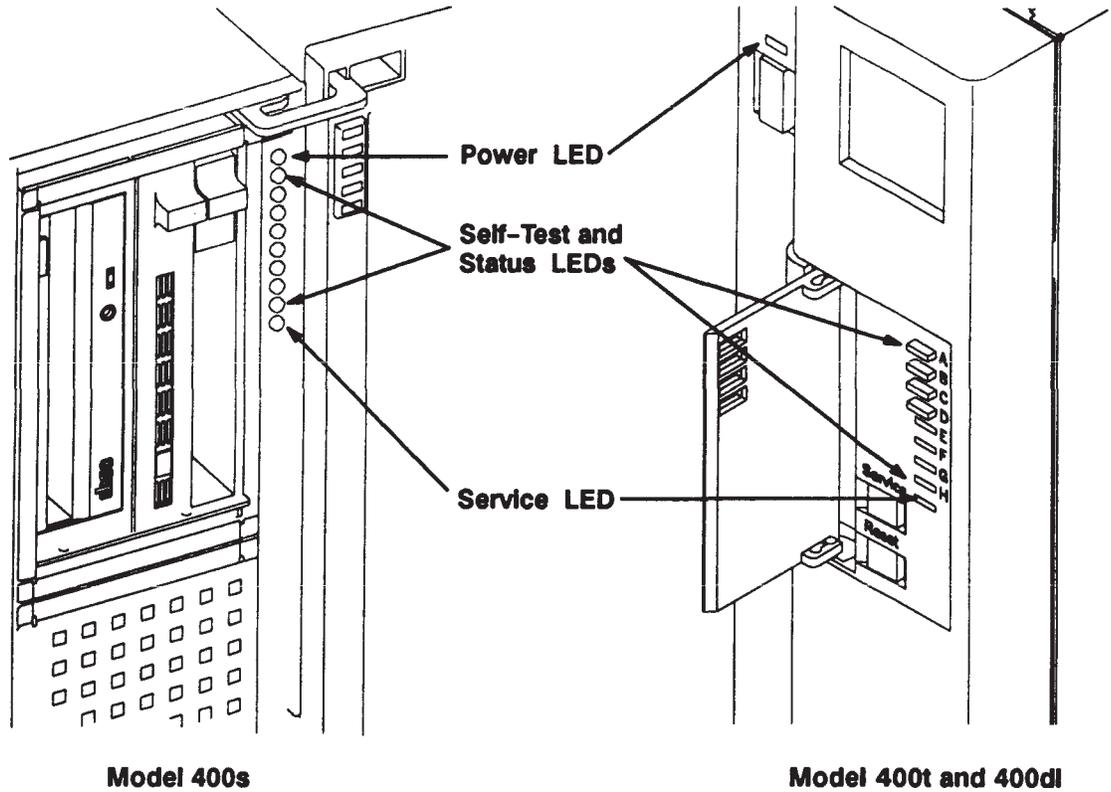


Figure 4-11. Front Panel LEDs

Table 4-2 shows the FRU code display and hex numbers for the system as they appear on the front panel display. Use these LED codes to determine the failing FRU.

The Self Test diagnostics use the display screen to report the test status. Any failing FRUs are called out on the display screen. When a memory error occurs, Self Test reports the address of the error and the Megabyte of memory in which the error occurred on the display screen.

Table 4-2. Self Test LED FRU Codes

| LED Display | FRU Name | Hex Code |
|--|---------------------------------|----------|
| P A B C D E F G H S | | |
| █ □ □ █ █ □ □ □ □ □ | SCSI Device 0 | 30 |
| █ □ □ █ █ □ □ □ █ □ | SCSI Device 1 | 31 |
| █ □ □ █ █ □ □ █ □ □ | SCSI Device 2 | 32 |
| █ □ □ █ █ □ □ █ █ □ | SCSI Device 3 | 33 |
| █ □ □ █ █ □ □ █ □ □ | SCSI Device 4 | 34 |
| █ □ □ █ █ □ □ █ █ □ | SCSI Device 5 | 35 |
| █ □ □ █ █ □ □ █ █ □ | SCSI Device 6 | 36 |
| █ □ □ █ █ □ □ █ █ □ | SCSI Device 7 | 37 |
| █ □ □ █ █ □ □ □ □ □ | Network Interface Board | 38 |
| █ □ □ █ █ □ □ □ □ □ | Graphics Interface Board | 39 |
| █ □ □ █ █ □ □ █ █ □ | CPU Board (SIO) | 3A |
| █ □ □ █ █ □ □ █ █ □ | Memory | 3B |
| █ □ □ █ █ □ □ █ █ □ | Emulator Bd, CPU Bd, or EEPROM* | 3C |
| █ □ □ █ █ □ □ █ █ □ | System Bus | 3D |
| █ □ □ █ █ □ □ █ █ □ | Apollo Keyboard | 3E |
| █ □ □ █ █ □ □ █ █ □ | CPU Board (Utility) | 3F |
| P = Power-OK Indicator S = Service Mode Indicator █ █ = LED On On = Service Mode, Not On = Normal Mode | | |
| * Screen displays "Mother Board" for this failure. | | |

Identifying Defective Memory Boards

You must know the memory configuration rules for Series 400 systems before you try to identify a failed memory board. The following list explains these rules (refer to Figure 4-12 as you read the list):

- Memory boards must be installed in like pairs. Each board pair forms a block of memory.
- Memory board slots on the CPU board are numbered 0A, 0B, 1A, 1B, 2A, 2B, 3A, and 3B.
- Memory boards must be installed in consecutive slots (beginning with slot 0A) with no empty slots between boards.
- In systems that contain different sized memory boards, the largest memory boards precede the smaller boards in the board slots. For example, if a system's memory configuration consists of four 4-MB boards and two 2-MB boards, the 4-MB boards reside in slots 0A through 1B, and the 2-MB boards reside in slots 2A and 2B.

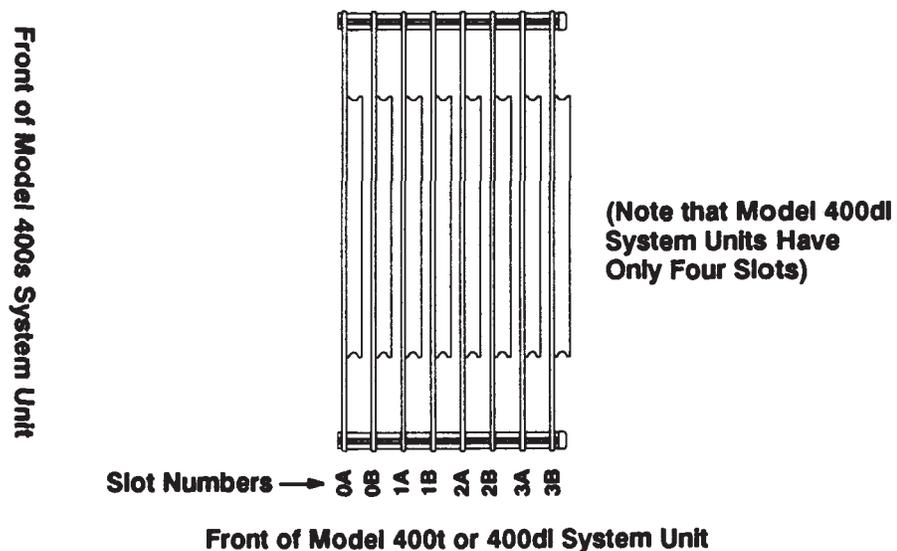


Figure 4-12. Memory Board Slots

To identify a defective memory board, perform the following steps:

1. Identify the size of the memory board in each memory slot.
2. Note the Megabyte of memory that Self Test reports on the display screen.
3. Count the Megabytes of memory in the system, beginning at Slot 0A, until you reach the slot where the Megabyte of memory is located.

For example, if the system's memory configuration consists of two 4-MB boards and two 2-MB boards, and Self Test reports an error at Megabyte 5, the defective board would be the 4-MB board in slot 0B.

When you identify a defective memory board, follow the memory board replacement procedure in Chapter 5 to replace it.

4.3.2 MD Level LED Status Codes

At the MD level, while in Service mode, the front panel LEDs display system status codes. Table 4-3 lists the codes and their meanings.

Table 4-3. MD Status LED Codes

| LED Display (E through H Flashing) | System Status | Hex Code |
|--|--|---|
| <p>P A B C D E F G H S</p> | <p>Keyboard Wait Loop</p> <p>Waiting at MD Prompt</p> <p>Waiting for Disk</p> <p>Waiting for Net Transmit</p> <p>Waiting for Volunteer Response</p> <p>Waiting for Net Receive</p> | <p>08</p> <p>0C</p> <p>02</p> <p>03</p> <p>04</p> <p>05</p> |
| <p>S = Service Mode Indicator On = Service Mode, Not On = Normal Mode</p> <p>P = Power-OK Indicator ■ = LED On</p> | | |

4.3.3 Test Stimulus Code Diagnostics

TSC diagnostics reside in the /SAU directory on the system disk. These diagnostics thoroughly test the components of the CPU board, the keyboard, and the EtherLAN network. TSC diagnostics report a test failure on the display and by lighting LED "A" on the system unit's front panel.

You can run TSC diagnostics from a system's disk, from another disk on the network, or (if the display is inoperative) through an SIO line to another system (refer to Appendix D for information about using the SIO line). For more information about TSC diagnostics, refer to *HP 9000 Series 200/300 Computers Test Tools Manual*.

To run the TSC diagnostics, follow Procedure 4-4.

Procedure 4-4. *Running the TSC Diagnostics*

1. Log out and stop any user processes.
2. Shut down to the MD prompt by typing the following at the “login:” prompt:
login: **shut**
3. At the MD prompt “>”, type the following:
> **re** <RETURN>
4. After the beeper sounds, press <RETURN> and type the following:
> **ex tsc** <RETURN>

end of procedure

4.4 The **sysboot** Program

The **sysboot** program is a standalone program that boots programs from disk, including the operating system and the diagnostics described in this chapter.

NOTICE: Diskless nodes execute a slightly different boot program, called **netboot**, that boots the operating system across the network. Use **ctboot** to boot from a cartridge tape drive.

The **sysboot** program uses the screen to display errors. These errors can occur when the MD encounters problems while trying to locate or read the **/sau12** directory on the system’s Winchester disk, or on another boot device specified as the load device.

If you encounter **sysboot** errors, follow the troubleshooting procedure shown previously in Figure 4-8.

4.5 Online Level

At the online level of operation, several diagnostic tools are available. This section describes the boot shell, the system error log, and the System Acceptance Exerciser (SAX). We document the remainder of the online tools (the `/systest/ssr_util` directory, Storage Subsystem Tests (SST), Graphics Exerciser (GRTEST), and more extensive information about SAX) in *Using Domain Diagnostics, Volume 1*.

4.5.1 Boot Shell

The boot shell is the first user-space program executed by Domain/OS. The boot shell runs as Process 1 with log-in rights of **user.none.none**. In Service mode, control stops in the boot shell, and there is a small command environment available to you. In Normal mode, the boot shell does nothing more than an internal **go** command, which results in the loading of the Display Manager (DM) or Server Process Manager (SPM). Type **help** at the boot shell prompt “)” to see a list of available commands.

If you are waiting for a response from the boot shell, always press < **RETURN** > before assuming that the shell is dead. Once you have acquired the boot shell, try some commands (**help**, **wd**, **ld**). Try to load and execute the commands in **/bscom**. Use the **sh** command to bring up a single-user shell. If there are problems bringing up the DM, a shell, or SPM, you can try specifying **debug 1**. This causes information about each library to display as it loads. (Turn this mode off with **debug 0**.) At this point, Domain/OS is fully functional, so any forms of remote access that don't require helper processes to be running should be possible.

4.5.2 System Error Log

A system error log is automatically created at boot time. The error log is a file in which the system stores error information (for example, disk errors and parity errors). The file **sys_error_log** is actually a 1-block (1024-byte) ring buffer. The oldest entries are overwritten first, and the file never exceeds one block in length. The error logging process consumes minimal system resources. It requires one wired page of memory and whatever disk I/O is needed to log errors to the file.

This error information is valuable to you during troubleshooting. To read this file in a shell, type the following at the prompt:

```
/systest/ssr_util/syserr < RETURN >
```

The system responds by displaying the contents of the file, which, if your node has no problems, may look like the following display:

```
tuesday, September 26, 19xx
    2:40 pm (EDT) system startup

error totals
    system startups          1
    system shutdowns        0
```

The following display shows how the system error log stores a memory failure. Note that “board pair - 2” pertains to the second group of memory board slots on the CPU board, which are labeled 1A and 1B. The “board - 0” reference applies to the first board in the pair (the board in Slot 1A). Refer to the *Identifying Defective Memory Boards* Subsection earlier in this chapter for more information about memory board configurations.

```
Wednesday, may 2, 1990
    3:34:31 pm (EST)  eccc error
    mcsr - 00000091, physical address: FF5D8DE4 or FF5D8DEC,
    ( board pair - 2, board - 0, bit - 64, syndrome - 01 )
```

4.5.3 System Acceptance Exerciser (SAX)

SAX tests reside in the /systest directory on the system disk. These tests verify system operation by completely exercising the system, including system options, peripherals, and networks.

SAX includes Storage Subsystem Tests (SST), a new diagnostic for detailed testing of storage devices, which replaces all storage tests of previous SAX releases.

You can also run SST outside of the SAX environment. When run by itself, SST presents you with a prompt-based user interface. You can also select a graphical interface.

You can run SAX tests from a system’s disk, from another disk on the network, or (if the display is inoperative) through an SIO line to another system. For more information about SAX tests, refer to *Using Domain Diagnostics, Volume 1*.

Part 2 Troubleshooting Flowcharts and Diagnostics for HP-UX Compatible Mode

4.6 Troubleshooting Flowcharts for Systems that Use HP-UX Compatible Mode

This section provides flowcharts that route you through a series of standard troubleshooting procedures for Series 400 systems that use HP-UX Compatible mode (see Figure 4-13 and Figure 4-14). Refer to Part 3 of this chapter for the checkout procedures that these flowcharts reference.

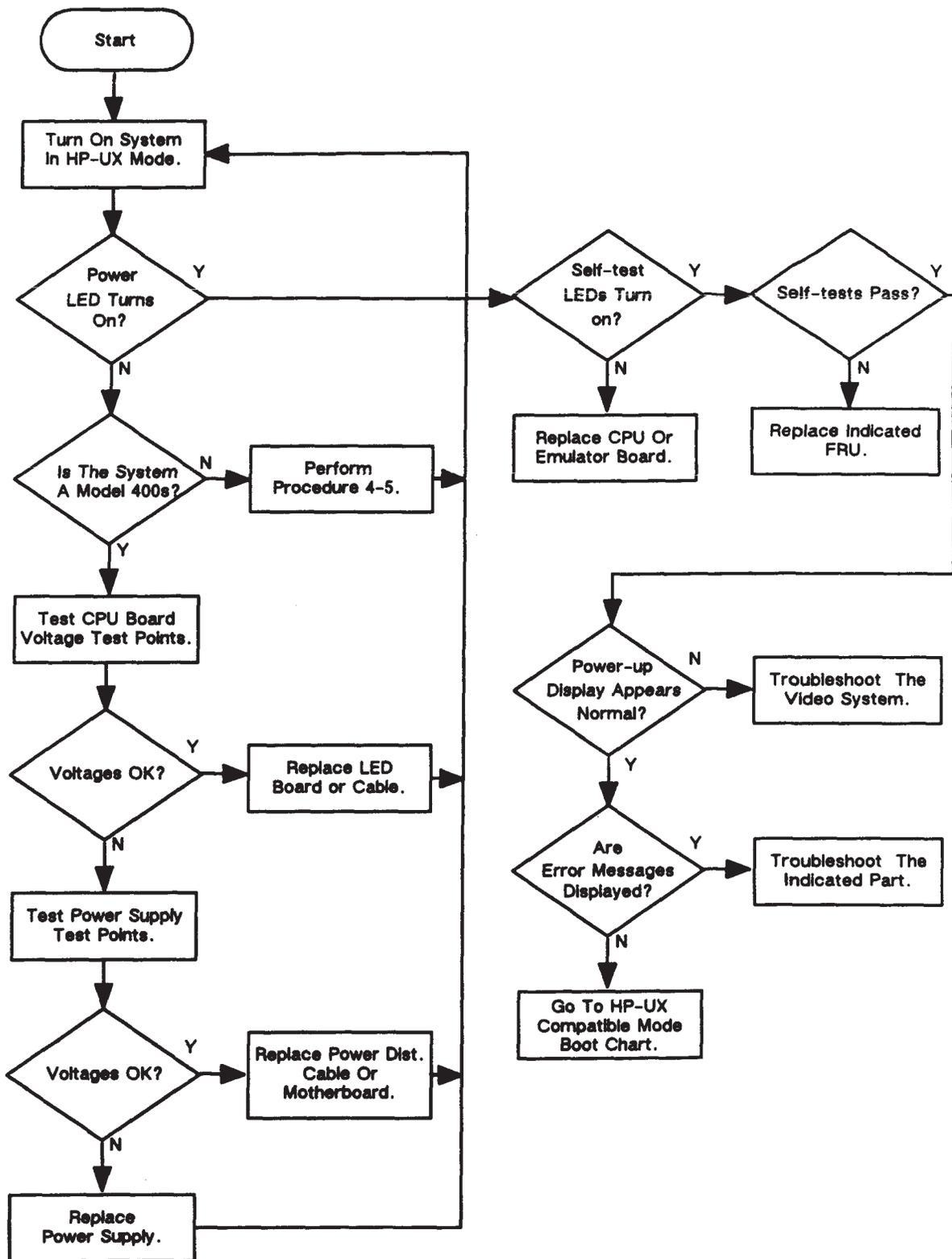


Figure 4-13. HP-UX Compatible Mode Main Troubleshooting Flowchart

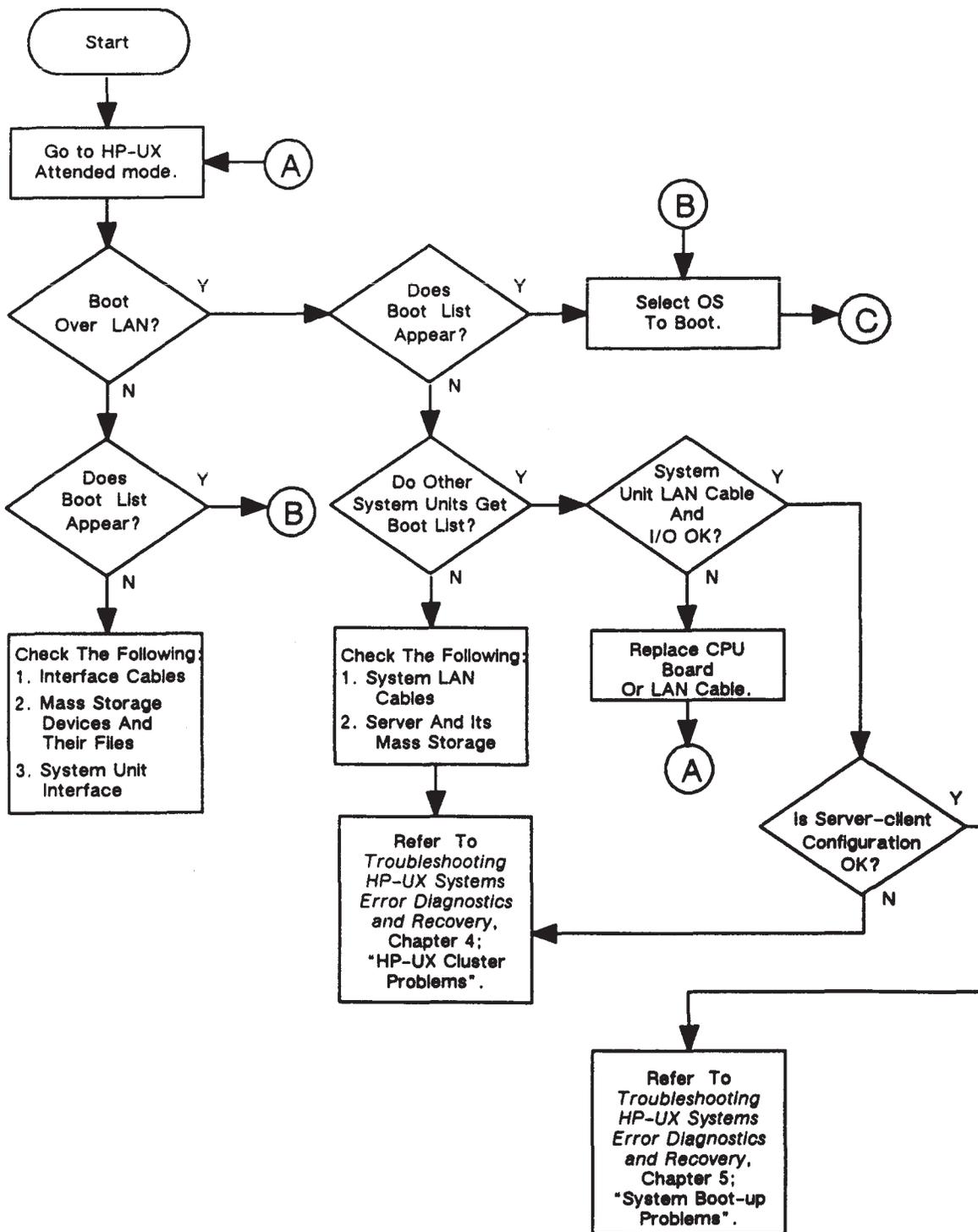


Figure 4-14. HP-UX Compatible Mode Boot Flowchart

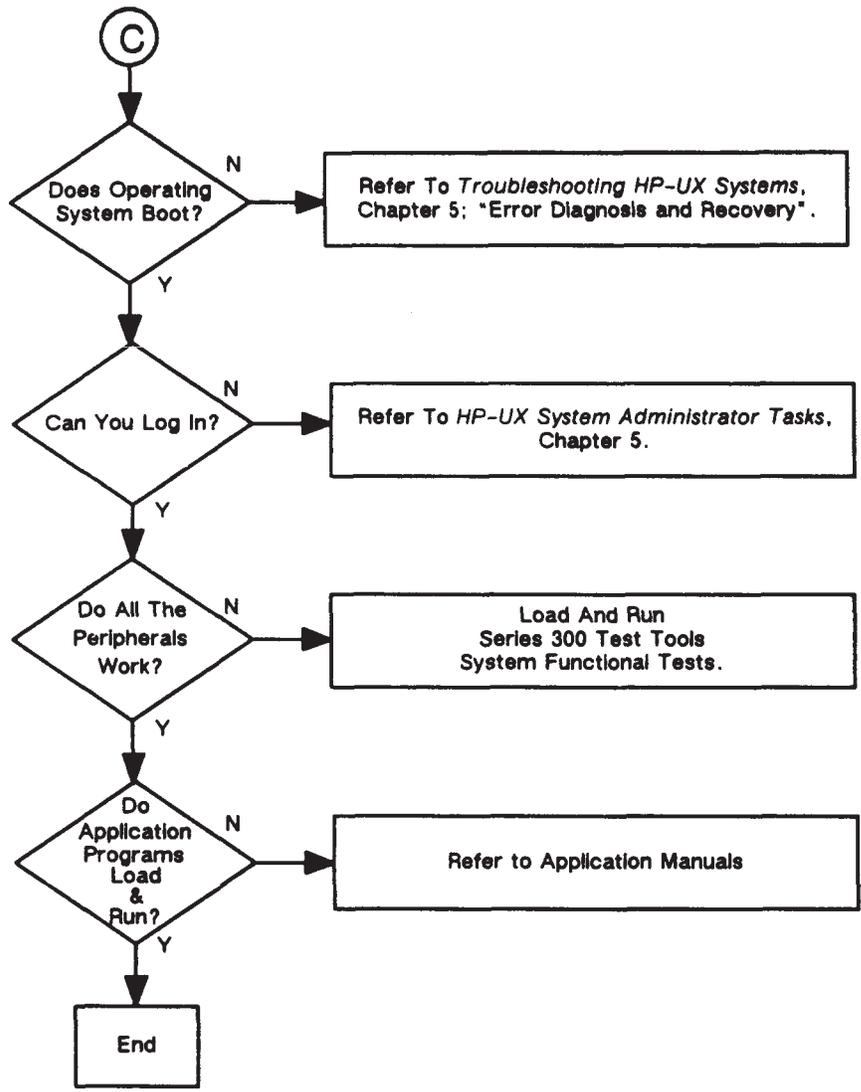


Figure 4-14. HP-UX Compatible Mode Boot Flowchart (Cont.)

4.7 Hewlett-Packard Boot ROM Functions

A Series 400 Boot ROM, Revision 1, is used in the Series 400 system units for the HP-UX Compatible Mode. The Boot ROM is on the CPU board. When the system unit is turned on, these Boot ROM instruction sets are executed by the CPU:

- Power-Up Sequence.
- Default Configure Mode. Configuring the system unit's information is in Appendix A.
- Test Mode.
- Booting the Operating System.

4.7.1 Display Types

Two display types are used with Series 400 systems:

- Monitors connected to video board outputs
- Terminals connected to the CPU board's RS-232 interface

If your system uses a terminal connected to the system units's RS-232 interface, display updates appear at the bottom of the screen. Older information scrolls up. New information appears with the screen's uppermost line that changed and all lines below that appearing at the screen's bottom.

For example, at turn-on, the screen appears as shown in Subsection 4.7.2. If your terminal uses 32 display rows and you turn on and then reset the system unit, then reset it, your screen shows the bottom few lines of the power-up display at its top. After resetting, the power-up display appears below those lines.

4.7.2 Power-Up Display

When you turn your system unit on after the first time and the default functional mode is Hewlett-Packard, the Boot ROM invokes the power-up display and starts its self-test. The Power-Up Display looks like this:

```
Copyright 1990,  
Hewlett-Packard Company,  
All Rights Reserved.
```

```
Series 400 BOOTROM, Rev. 1, 5 Jun 90  
MD 12 (date code)  
Bit-Mapped video  
MC680n0 Processor
```

```
.  
. .  
. . .
```

```
System Search Mode  
RESET to Power-up
```

4.7.3 Power-Up Sequence

When you turn on the system unit, the CPU executes a power-up sequence of events before an operating system is booted. This is required to initialize and test hardware to make sure the system unit is ready to boot an operating system. The 29 steps of the power-up sequence are

1. Test the CPU chip.
2. Turn on test LEDs.
3. Test the top 16 KB of RAM.
4. Set up data structures.
5. Load configuration data from EEPROMs.
6. Search for any boot extension ROMs and call any valid ones.
7. Determine processor type.
8. Initialize and test system/processor board timer.
9. Look for a RAM/monitor debugger.
10. Reset all I/O.
11. Initialize the video circuits.

12. Checksum the Boot ROM.
13. Display CPU type.
14. Look for floating point co-processor.
15. Initialize HP-HIL (keyboard) electronics.
16. Drop Interrupt level.
17. Preload for main RAM test.
18. Test internal HP-IB interface.
19. Test DMA.
20. Test remaining RAM and set up bottom of memory.
21. Report any memory failures and the amount of memory found.
22. Initialize the bottom of memory.
23. Find and report any DIO-II I/O cards in the backplane.
24. Test LAN interface.
25. Test SCSI interface.
26. Initialize bit-mapped video/graphics boards.
27. Test interfaces that have I/O dependent test code.
28. Checksum any ROMs in ROM space and report any problems.
29. Output final LED value.

4.7.4 Human Interfaces

Several devices can act as the “console”, or primary human interface, for the Boot ROM. The list of possible console devices is explained in this section.

Output Devices

An RS-232 interface in the remote mode connected to a terminal can be used as an output device. Bit-mapped video/graphics boards with their internal address set to 560000_{16} may also be used. Bit-mapped video/graphics boards with their DIO-II address set in the range 01000000 to $01C00000_{16}$ are the most commonly used.

The following algorithm is used to determine the output device:

1. If there is a remote card, choose the one with the lowest select code.
2. If there is an internal bit mapped display controller, choose it as console.
3. If there is a bit mapped display controller in DIO-II space, choose the one with the lowest select code. If not go the next step.
4. Use dummy display drivers.

Only one output device at a time is used as the console output device; however, the Boot ROM initializes and clears any bit mapped video/graphics board that it finds, even if that board is not chosen as the console device. Note that if a device fails self-test then, the device is considered not present. The Boot ROM always tests a device before choosing it as the console output device.

Input Devices

Common input devices include the HP 46021A Keyboard or a terminal connected to the RS-232 interface. Keyboards may be directly connected to the HP-HIL interface port, or to one or two graphics display controllers connected to a local graphics bus interface board. HP-HIL interfaces in graphics display controllers are considered an external interface.

Note that if an internal HP-HIL interface and a remote terminal are both present in a system, they are both enabled. Similarly, if an external HP-HIL interface and a remote console are both present in a system, they are both enabled, provided no internal keyboard is present. An external interface is never enabled when an internal interface is present.

When more than one external keyboard is present, the one with the lowest select code is enabled. If several HP 98735 Graphics Display Controllers exist on a system, then you must ensure that the external keyboard associated with the display controller at the address 560000_{16} has the lowest select code of all the external keyboards in the system. This must be done to ensure that the keyboard associated with the first display controller is not input console while the second display controller is output console. The Boot ROM does not attempt to verify the display/keyboard relationship.

If a keyboard controller or a remote RS-232 card fails, then it is considered by the algorithm to be not present. For example, if an internal keyboard fails self-test, a `Keyboard Failed` message is displayed; however, the input device search algorithm goes ahead and looks for an external keyboard. The Boot ROM always tests a device before choosing it as the console input device.

If no output device is present, but a keyboard is, then that keyboard still acts as the console input device. Similarly, if no input device is present, but a display controller is, then that display controller still acts as the console output device. If neither an input device nor an output device is present, the Boot ROM goes ahead and automatically boots the default operating system as long as no errors are discovered during self test (see Section 4.9 for more information about the Boot ROM self tests).

Remote Human Interface

Early in the power-up sequence, a search is made for an RS-232 interface set to 'remote.' The search starts at select code 0 and ends at select code 31 or when an RS-232 interface is found that passes self-test. If one is found, it becomes the remote human interface.

To indicate that a remote human interface has been found at, for example, select code 9, the first line of the display, is

Remote Interface at 9

After this point, the internal display does not change until an operating system is booted. Any internal or external keyboard, if present, works just as it would if there were no remote console.

A remote interface requires an 80-column wide terminal with at least 24 lines that accepts Hewlett-Packard standard terminal escape sequences as listed in the following table.

Table 4-4. Terminal Escape Sequences

| Key Sequence | Function |
|-------------------|--------------------------------|
| Escape H Escape J | Clear screen and reset cursor. |
| Escape &aDDY | Move cursor to row DD. |
| Escape &aDDC | Move cursor to column DD. |

4.7.5 Booting Operating Systems over the LAN

LAN interfaces are identified by product number or circuit equivalent, then (LAN) then the select code, and link address of the interface as follows:

HP98643 (LAN) at 21, 080009000001

If a failure is detected in the power-up test, the following failure message is displayed:

```
HP98643 (LAN) at 21, 080009000001 Failed
```

This message shows that one of the internal tests on the interface failed. The tests include register operations, shared ram, non-volatile ram checksum and several different internal loopback tests.

If extended testing is selected from the Test Menu, the LAN interface is subject to both the normal testing and the external loopback tests. LAN error messages (see Table 4-5) may be displayed below the LAN identification message.

If no servers respond to the Boot ROM's attempts to initiate a boot session, then the user sees no other indication of LAN activity. For each server that responds, the display shows the following :LAN, followed by the select code, followed by either the servers name or its Link Address. Under this will appear the list of systems provided by that server as shown in the following example:

```
:LAN, 21, 080009000008
  1H SYSTEM_HPUX
  2B SYSTEM_BKUP
```

Table 4-5. LAN Boot Error Messages

| Displayed Message | Meaning and What To Do |
|-------------------|--|
| Cable Failed | LAN interface cable not properly terminated. Connect cable or terminate LAN |
| MAU Failed | MAU circuit failed. On AUI LAN, could mean MAU is not connected. Check LAN connections or replace CPU board. |
| NO HEARTBEAT | LAN self-test, done after each transmission, is failing. Replace CPU board. |
| SYSTEM NOT FOUND | Server could not open file, or file was wrong type. Check file system or mass storage device. |
| NO SERVER | Server did not respond to boot request. Check server. |
| NOT READY | LAN hardware power-up or reset failed. Try again. If error repeats, replace CPU board. |
| READ ERROR | File open worked, but server has since failed to respond or has sent an end of file message. Check server. |
| BAD HARDWARE | LAN hardware failed to respond to some operation or it reported a catastrophic failure. Replace CPU board. |
| BAD STATE | Boot ROM LAN code damaged. Replace CPU board. |

4.8 Diagnostic Summary for HP-UX Compatible Mode

Several levels of operations exist within systems that run in HP-UX compatible mode. Each level has diagnostic or error reporting capabilities:

- The Boot ROM level has
 - Self Tests
 - Test Mode
- Series 300 Test Tools have
 - Computer Tests
 - System Functional Tests
 - CS/80 Disk Tests
- HP-UX has ce.utilities.

4.9 Boot ROM Self-Tests

When the system unit first powers up, the CPU starts executing Boot ROM code. Before code is executed to boot an operating system, you need to set up and test several things. The Boot ROM has several code segments to manage these responsibilities.

4.9.1 Hardware Initialization Support

Some hardware, such as video board initialization and floating RAM positioning, must be immediately initialized at power-up to prevent improper operation.

4.9.2 FRU Go/No-Go Self-Test Support

Because of several factors such as current hardware design, limited code space and the fact that testing for unknown or unexperienced failures is virtually impossible, Boot ROM self-tests may not always handle all hardware failures correctly.

Several “UNEXPECTED” failure messages may be displayed at any time. When the CPU executes an instruction set, certain events are expected to occur. Should an interrupt (either internally from the CPU or externally from some other device) occur and cause a RAM or CPU address to be used out of sequence, the system displays the following error message

```
UNEXPECTED USE OF (address)
```

Table 4-6 lists these messages. The address' 5 most significant hexadecimal digits are FFFFF, so only the 3 least significant digits (LSD) are used in the table. When a range of addresses is shown, each address in the range is six addresses apart.

When an "UNEXPECTED" failure message equates to an interrupt level, vectored interrupt, or trap, the following situations normally exist:

Interrupt levels 1 through 7

Can happen at any time and are usually caused by an interface set to the indicated interrupt level. If the error repeats, replace the CPU board.

CPU traps

Usually occur when the operating system is being used. A CPU trap indicates something in the processor circuits didn't go right. If the error repeats, replace the emulator or CPU board.

Other errors

Several things on the CPU/emulator board in an interface or processor circuit can cause these errors. If the error repeats, replace the CPU or emulator board.

Table 4-6. Unexpected Use of (address) Failure Messages

| 3 Hex LSDs | Unexpected Event |
|------------|--|
| FFA | Bus error |
| FF4 | Address error |
| FFE | Illegal instruction |
| FE8 | Zero by zero trap |
| FE2 | Check trap |
| FDC | TRAPV trap |
| FD6 | Privilege violation |
| FCA | 1010 Op. Code |
| FC4 | 1111 Op. Code |
| FBE | Interrupt Level 1 (keyboard) |
| FB8 | Interrupt Level 2 (not used) |
| FB2 | Interrupt Level 3 |
| FAC | Interrupt Level 4 |
| FA6 | Interrupt Level 5 |
| FA0 | Interrupt Level 6 |
| F9A | Interrupt Level 7 (Reset from keyboard) |
| F3A-F94 | CPU traps |
| F34 | Reset from keyboard |
| F2E | Keyboard timeout (fast handshake) |
| F28 | Battery backup interrupt |
| F22 | Non-maskable interrupt from the backplane |
| F1C | Spurious interrupt |
| EEC - F16 | Vectored interrupt |
| EE6 | Format error, co-processor violation, or unknown |
| EE0 | Co-processor exception vectors |

4.9.3 Failure Indications

As the self-test progresses, the LEDs display the current state. At the end of the test, a power-up with no errors is indicated by all LEDs turned off and by immediate entry into the boot scanner.

If a failure occurred during the self-tests, then that failure is indicated on the LEDs at the end of the tests. If there was more than one failure, the highest priority failure is indicated on the LEDs.

The highest priority failure also sets off the beeper. The lower 7 bits of the LED value are sounded off, most significant bit first, one second per bit, with a zero represented by a low tone and a one represented by a high tone.

If the failure was a Boot ROM checksum error, the following message is displayed:

CONTINUE AT OWN RISK (Press RETURN To Continue)

Once this message has been printed, the RETURN key must be pressed to continue to the boot scanner. The probability is fairly low that the error adversely affects the user, but if it does, it could be catastrophic.

For all other failures, the following message is displayed:

WAITING 1 MINUTE (Press RETURN To Abort Wait)

The Boot ROM times out after approximately one minute and then continues into the boot scanner. This allows time for the monitor or terminal to warm up and for the user to read the error messages. These failures are usually non-fatal so, in an unattended mode, the Boot ROM still boots the first operating system it finds. Pushing the RETURN key terminates the beeping error code and aborts the one minute wait. Pushing the RETURN key also makes the system unit go into attended mode. This means that the Boot ROM displays all operating systems found and does not boot a system until one is chosen and entered by the user.

4.9.4 General Description of Failure Codes

Table 4-7 and Table 4-8 show the general meaning of error codes. LED patterns are represented by a black rectangle for on and a white rectangle for off. A grey rectangle indicates the LED in that position is on or off, depending on the binary code used to represent the device or failure type. Use the key that accompanies the sample display shown in Figure 4-15 to determine LED on/off values.

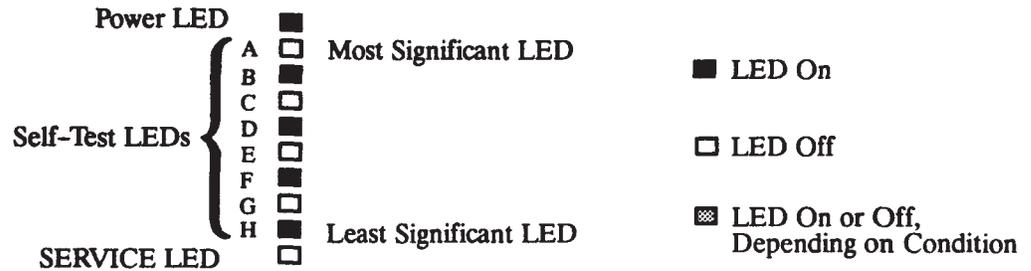


Figure 4-15. Sample Boot ROM Self-Test LEDs with Key

Test LEDs are mounted vertically on the system unit's front upper right-hand corner. The front panel must be opened to see all of them.

Table 4-7. General Failure Code Descriptions (Upper Two Bits Fail Indicators)

| Upper 2 Bits Fail Indicator | LED Code and Failure Description | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|-------------------------------------|---|--------------------------|------|-------------------------------------|-----|-------------------------------------|--------|-------------------------------------|-------|-------------------------------------|----|-------------------------------------|-------|-------------------------------------|-------------|-------------------------------------|-----------|-------------------------------------|-------|-------------------------------------|----------|-------------------------------------|--|--------------------------|--|
| State indications only. | A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> LEDs indicate power-up state. | | | | | | | | | | | | | | | | | | | | | | | | |
| Required device missing or data acknowledge failure. | A <input type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> LEDs indicate device. | | | | | | | | | | | | | | | | | | | | | | | | |
| Failing device. | A <input type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> LEDs indicate device. | | | | | | | | | | | | | | | | | | | | | | | | |
| Special codes. (Special case highest priority codes) | A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | LEDs never accessed. | <table border="0"> <tr> <td><input type="checkbox"/></td> <td>LEDs</td> <td><input checked="" type="checkbox"/></td> <td>CPU</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>failed</td> <td><input checked="" type="checkbox"/></td> <td>board</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>to</td> <td><input checked="" type="checkbox"/></td> <td>timer</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>acknowledge</td> <td><input checked="" type="checkbox"/></td> <td>failed or</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>data.</td> <td><input checked="" type="checkbox"/></td> <td>missing.</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td></td> <td><input type="checkbox"/></td> <td></td> </tr> </table> | <input type="checkbox"/> | LEDs | <input checked="" type="checkbox"/> | CPU | <input checked="" type="checkbox"/> | failed | <input checked="" type="checkbox"/> | board | <input checked="" type="checkbox"/> | to | <input checked="" type="checkbox"/> | timer | <input checked="" type="checkbox"/> | acknowledge | <input checked="" type="checkbox"/> | failed or | <input checked="" type="checkbox"/> | data. | <input checked="" type="checkbox"/> | missing. | <input checked="" type="checkbox"/> | | <input type="checkbox"/> | |
| <input type="checkbox"/> | LEDs | <input checked="" type="checkbox"/> | CPU | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | failed | <input checked="" type="checkbox"/> | board | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | to | <input checked="" type="checkbox"/> | timer | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | acknowledge | <input checked="" type="checkbox"/> | failed or | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | data. | <input checked="" type="checkbox"/> | missing. | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 4-8. General Failure Code Descriptions (Lower Two Bits Fail Indicators)

| Lower 2 Bits Fail Indicator | LED Code and Failure Description |
|---|---|
| State indications only. | A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> LEDs indicate power-up state. |
| Miscellaneous (highest priority). | A <input type="checkbox"/> Ignore. B <input type="checkbox"/> Ignore. C <input type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> Failure indicator. F <input checked="" type="checkbox"/> Failure indicator. G <input checked="" type="checkbox"/> Failure indicator. H <input checked="" type="checkbox"/> Failure indicator. |
| Internal peripheral failure (medium priority) | A <input type="checkbox"/> Ignore. B <input type="checkbox"/> Ignore. C <input type="checkbox"/> D <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> Peripheral number. F <input checked="" type="checkbox"/> Peripheral number. G <input checked="" type="checkbox"/> Peripheral number. H <input checked="" type="checkbox"/> Peripheral number. |
| Internal interface failure (lowest priority). | A <input type="checkbox"/> Ignore. B <input type="checkbox"/> Ignore. C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> Select code. E <input checked="" type="checkbox"/> Select code. F <input checked="" type="checkbox"/> Select code. G <input checked="" type="checkbox"/> Select code. H <input checked="" type="checkbox"/> Select code. |

4.9.5 State and Failure Codes

Table 4-9 lists the LED state and failure codes used by the Boot ROMs.

Table 4-9. System Unit LED State and Failure Codes

| LEDs | State or Failure | LEDs | State or Failure | LEDs | State or Failure |
|--|---|---|--|---|---|
| A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | No failure. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input checked="" type="checkbox"/> | Failed CPU register test. Replace emulator board. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input checked="" type="checkbox"/> H <input type="checkbox"/> | Testing the top 16 KB of memory. |
| A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Top 16 KB of memory missing or not found. Check memory in slot 0A. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input checked="" type="checkbox"/> | Searching for user supplied extension ROM. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input type="checkbox"/> | Started executing extension ROM instructions. |
| A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | Starting test vector list. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Resetting all interfaces. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | I/O on-board test code running. |
| A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Internal checksum. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input checked="" type="checkbox"/> | DIO-II console testing. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input type="checkbox"/> | Failed Boot ROM checksum. Replace CPU board. |
| A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | Preloading memory for main test. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input checked="" type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Testing memory. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input checked="" type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input checked="" type="checkbox"/> | Failure: not enough memory. Replace slot 0A memory module. |

(Continued)

Table 4-9. System Unit LED Failure Codes (Cont.)

| LEDs | State or Failure | LEDs | State or Failure | LEDs | State or Failure |
|--|--|---|---|---|--|
| A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input checked="" type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input checked="" type="checkbox"/> H <input type="checkbox"/> | Failure: ROM system. Replace ROM system. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input checked="" type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input checked="" type="checkbox"/> H <input checked="" type="checkbox"/> | Failure: Boot error. Replace CPU board. | A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input checked="" type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Failure: Operating system tried to load at too high of a memory address. Try again or replace CPU or emulator board. |
| A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input checked="" type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input checked="" type="checkbox"/> | Not enough memory to load operating system. Add more memory. | A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Failure: 4 MS timer. Replace CPU board. | A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input checked="" type="checkbox"/> H <input type="checkbox"/> | Failure: HP-HIL circuit. Replace CPU board. |
| A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Failure: HP-IB board. Replace HP-IB board. | A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Failure: DMA circuit. Replace CPU board. | A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Failure: High-resolution video board font ROM. Replace video board. |
| A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/> E <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> G <input type="checkbox"/> H <input checked="" type="checkbox"/> | Failure: Video board bit-map circuit. Replace video board. | A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Failure: DIO-I Interface at select code identified by five lowest LEDs. Replace board that has the failed interface. | A <input checked="" type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> | Failure: DIO-II Interface at select code identified by five lowest LEDs. Replace board that has the failed interface. |

4.9.6 Boot ROM Messages

Table 4-10 lists and explains the messages displayed for Boot ROM functions. If necessary, it also indicates a procedure to resolve the problem.

Table 4-10. Boot ROM Displayed Status Messages

| Displayed Message | Meaning and What To Do |
|-----------------------------------|--|
| CONFIGURE MODE | System unit is in configure mode. Press B, F, I, or X and RETURN. |
| Bit Mapped Display | Bit-mapped video board identified. |
| BOOTING A SYSTEM | An operating system is booting. |
| (n) Bytes | Memory amount in decimal. Message appears after memory test completes. |
| Console Keyboard at (select code) | Remote keyboard circuit found at the select code indicated. |
| DMA | DMA circuit identified. |
| HP-HIL Keyboard | CPU board HP-HIL circuit identified. Keyboard may now be used. |
| HP-IB | HP-IB interface circuit identified. |
| HPnnnnn (type) at (SC) | HP interface circuit identified: nnnnn = product number type = interface type SC = select code Found either the DIO-II accessory card or an equivalent circuit on the CPU board. |
| HP98265 (SCSI [E] SC) | HP SCSI interface circuit identified: [E] = S for single-ended D for differential SC = select code Found either the DIO-II accessory card or an equivalent circuit on the CPU board. |
| LOADING MEMORY | Memory is loading with Boot ROM code. |
| MC68030 Processor | MC68030 CPU identified. |
| MC68882 Coprocessor | MC68882 CoCPU identified. |
| Remote Interface at (select code) | Remote interface identified at the indicated select code. |
| RESET To Power UP | Press RESET to re-start power-up. |

(Continued)

Table 4-10. Boot ROM Displayed Status Messages (Cont.)

| Displayed Message | Meaning and What To Do |
|---|--|
| RESET To Re-try | Press RESET to retry what failed previously. |
| SYSTEM SEARCH MODE (ENTER To Pause) | Looking for an operating system. Press ENTER to pause. |
| SYSTEM SEARCH MODE (RETURN To Pause) | Looking for an operating system. Press RETURN to pause. |
| SELF-TEST MODE | System unit is in Self-Test Mode. Press T for extended testing. Press L for continuous self-tests. |
| TESTING MEMORY | Testing memory. Wait until it finishes. |
| WAITING 1 MINUTE (ENTER To Abort Wait) | System unit has paused while you decide what to do. Press ENTER to abort the one minute wait. You may now continue. |
| WAITING 1 MINUTE (RETURN To Abort Wait) | System unit has paused while you decide what to do. Press RETURN to abort the one minute wait. You may now continue. |

Table 4-11 lists and explains the messages displayed for Boot ROM failures. It also indicates procedures to resolve the problems.

Table 4-11. Boot ROM Displayed Failure Messages

| Displayed Message | Meaning and What To Do |
|---|--|
| CONTINUE AT OWN RISK (ENTER To Continue) | A self-test was not completed. You may continue, but errors may occur. Press ENTER to restart power-up sequence. |
| CONTINUE AT OWN RISK (RETURN To Continue) | A self-test was not completed. You may continue, but errors may occur. Press RETURN to restart power-up sequence. |
| DATA PARITY ERROR AT (address) | Parity error at (address). Replace memory module that has the indicated address. |
| F Disk Error | Error in disk drive. Troubleshoot disk drive. |
| MEMORY FAILED AT (address) | Memory failed at (address) Refer to Table 4-14 and Table 4-15 and replace memory module. |
| MEMORY GONE AT (address) | Memory not found at indicated address Replace memory module that has the indicated address. |
| NOT ENOUGH MEMORY | Not enough memory to load operating system. Add more memory. |
| PARITY BIT ERROR AT (address) | Parity error at (address). Replace memory module that has the indicated address. |
| RAM FAILED ABOVE FFFFC000 | Failure in top 16 KB of memory. Replace memory in slot 0A. |
| RAM GONE ABOVE FFFFC000 | CPU could not find top 16 KB of memory Replace memory in slot 0A. |
| SYSTEM WOULD LOAD TOO HIGH | An addressing error would make the operating system try to load at too high an address. Probable cause: 1. Bad media 2. Data transfer error 3. Bad processor, interface, or mass storage device |

(Continued)

Table 4-11. Boot ROM Displayed Failure Messages (Cont.)

| Displayed Message | Meaning and What To Do |
|---------------------------------|--|
| SYSTEM NOT FOUND | Selected operating system not found on mass storage devices. Verify operating system is available on a mass storage device, then try again. If error repeats, troubleshoot processor, interface, and mass storage. |
| UNEXPECTED USE OF (address) | Possible CPU related error. Refer to Table 4-6. |
| CONFIGURATION EEPROM Failed | <p>Configuration EEPROM or associated circuits may not work correctly. One of these situations may exist:</p> <ul style="list-style-type: none"> - Some default and some new configuration values are set. - Some error occurred that should not affect operation. Try again. If error repeats, replace CPU board. |
| EEPROM Has Bad Information | <p>Configuration Mode started; (main menu may appear), but something failed. Try again. If problem continues, replace CPU board.</p> <p>If Configuration Mode does not start and no error message appears, a hardware failure probably occurred. Replace the CPU board.</p> |
| EEPROM Load Section Missing | Could not load new configuration data. Hardware failure. Replace CPU board. |
| EEPROM Defaults Section Missing | Default configurations could not be found. Hardware failure. Replace CPU board. |
| Too much data to save | Too many interfaces for EEPROM to manage. Reconfigure system unit with fewer interfaces. |

4.9.7 SCSI Testing

There are two levels of SCSI testing: normal and extended. Only the normal testing can be completed on system units with internal SCSI mass storage devices.

Normal testing is done at power-up or if the Boot ROM is in LOOPING test mode. This test only checks the general functionality of various registers on the interface and it only detects gross failures.

The identification line may be followed by one of these error messages:

```
register test failed
```

```
fuse burned out
```

If any of these messages appear, no attempt is made to use the interface as a boot source. The fuse may be reset by resetting the system unit or cycling system unit power.

Extended testing is done in a non-looping extended test mode. There are 4 sections to this test:

1. Register test. If this test fails, the remaining sections do not test.
2. Loopback test for external devices only. It checks transmit and receive functionality both with and without DMA interaction. If there is only one device attached to the interface, the test can be performed with the device turned off and the cable still attached. If there is more than one device, then the cable must be detached from the device before running this test.

If this test fails, the cable test can still be executed. If the user cancels testing at this point by typing X in response to the prompt, this section and the following sections of the test are skipped. It takes a second or so with bit-mapped video circuits to clear the display and shut down the IODC interface.

This test requires user interaction and provides these messages shown in Table 4-12.

Table 4-12. Extended SCSI Test Messages

| Message | What To Do |
|-------------------------------------|--|
| if internal devices present, type X | Cancel the test if there are any internal SCSI devices. The last three sections of this test cannot be run if there are any internal SCSI devices present. |
| Turn OFF ALL SCSI devices | Turn off power to ALL SCSI peripherals. If a particular sequence is required for proper system shut-down, that sequence must be followed. |
| Disconnect cable at nearest device | Remove the SCSI cable at the first SCSI peripheral down the SCSI interface from the system unit. |
| X cancels, RETURN continues testing | Pressing < X > cancels the SCSI test. Pressing < RETURN > continues the SCSI test. |

3. Cable test for external devices. This is used only if there are no internal devices.

The purpose of this test is to check the cable for shorted or broken wires. If the loopback test failed, this test may also fail due to failed circuitry on the CPU board rather than due to a bad cable.

NOTICE: This test should only be run if you have a special test connector and should be skipped if one is not available. At the end of this test, it is VERY important that the test connector be removed. Failure to do so will cause the Boot ROM to hang while trying to use the interface connected to this cable.

This test displays these messages:

```
Attach SINGLE-ENDED test connector
X cancels, RETURN continues testing
```

Connect the single-ended part of the SCSI test connector to the SCSI port on the back panel of the system unit.

4. Reconfigure the system. The messages shown in Table 4-13 are displayed after the SCSI tests are completed.

Table 4-13. Extended SCSI Test System Reconfiguration Messages

| | |
|----------|------------------------|
| Messages | Meaning and What To Do |
|----------|------------------------|

Remove test connector Connect cable to device Restore power to devices RETURN continues operations This message appears only if the test has been run. Remove the SCSI test connector from the SCSI port on the system unit. Reconnect the SCSI interface cable to the device from which it was previously disconnected. Power on all external SCSI peripherals. Press < RETURN > to continue with the next part of the self-test and booting operations.

4.9.8 SCSI Interface ID Situations

During the search for an operating system phase of the boot process, the Boot ROM looks for an SCSI interface by checking only the least significant 3 binary bits of each interface select code set to 111. This means any interface whose select code is 7,15, 23, or 31 is accessed as if they were an SCSI interface.

4.10 Test Mode

When your display's last lines show the following message, you can start the Test Mode:

```
RESET to Power-UP, SPACE to clear input   Waiting for System Selection ?
```

Type < t > and the following Test Mode display appears in the screen's upper right-hand corner:

```

                Self Test Controls
      Keys  Test Option  Selected
      -----
      1     Continuous   N
      2     Extended     N
      3     Test Memory   Y

      D     set Defaults
      R     Run Tests
      -----
Type [key] RETURN ?
```

4.10.1 Self Test Control Menu

A Self Test Controls menu has three columns to provide you with these controls:

- Keys — the keyboard keys used to select the test option you want to run
- Test Option — the type of test to run
- Selected — indicates the yes/no (Y/N) status of the option

The next few subsections explain each Self-Test Controls Menu.

Continuous Self-Tests

Continuous Self-Tests cause the Boot ROM to continuously repeat the self-tests. Entering configure mode while already in continuous self-test mode and choosing the Continuous option stops the continuous self-test and causes the Boot ROM to resume normal operation.

While in continuous mode, the Boot ROM does not wait or stop for most failures. It just continues looping through self-test. The following failures do stop self-test looping:

- A memory failure in the top 16 KB of memory. The Boot ROM stops with the display blanked.
- Boot ROM checksum failure. The Boot ROM stops with these messages displayed:

```
CONTINUE AT OWN RISK  
RETURN To Continue
```
- Something in the Boot ROM has changed. It may have a bad instruction or it cannot execute instructions properly. If you continue, something may not work correctly. Either the CPU or emulator board should be replaced.
- Typing < **Return** > causes the Boot ROM to continue self-test looping.

Extended Self-Tests

When you select Extended, the self-test starts over and the long memory test will be run. It takes about 4 seconds per megabyte (as opposed to the standard, or default, memory test, which takes about 1 second per megabyte).

This mode also invokes extended testing by executing external loopback and cable testing on the LAN and the external SCSI interfaces. Extended SCSI self-tests cannot be performed on internal SCSI mass storage devices. A prompt asks you to turn OFF any SCSI peripherals.

Extended Test Mode can be used while running in continuous mode. The result is continuous extended testing. SCSI extended testing cannot be done in this combination.

With the ThinLAN interface, all extended test functions do work. If an external Media Attachment Unit is not connected for AUI interfaces, the extended test reports a failure.

Test Memory

Memory tests are enabled as a default mode. If you do not want to run memory tests, type the command A, then select the No option from the prompt.

Memory tests are performed on main memory. Both read/write and parity tests are run. You see error messages displayed if memory fails. Memory error messages are interpreted differently for each type of memory test.

For word-wide memory error messages, the following messages appear at the bottom of your display in this format:

```
Memory Failed at (address)
(W:BBCCDDEE, R:BBCCDDEF)
```

In the above message, the hex address had the hex data BBCCDDEE written (W) into and read (R) out of the address. If the read data is different than the write data as shown in the above example in the least significant hex digits, that indicates an error.

Parity error messages are of two types:

```
PARITY BIT ERROR AT (address)
```

means a failure was detected in the parity checking RAM for the address shown.

```
DATA PARITY ERROR AT (address)
```

means a RAM failure was detected at the indicated address. The address in parity error messages is the lowest of four consecutive addresses. Errors could have occurred

in any or all of these four addresses. Parity errors are displayed during the Test Memory phase of the self-test and testing continues.

Figure 4-16 shows how the memory modules are numbered.

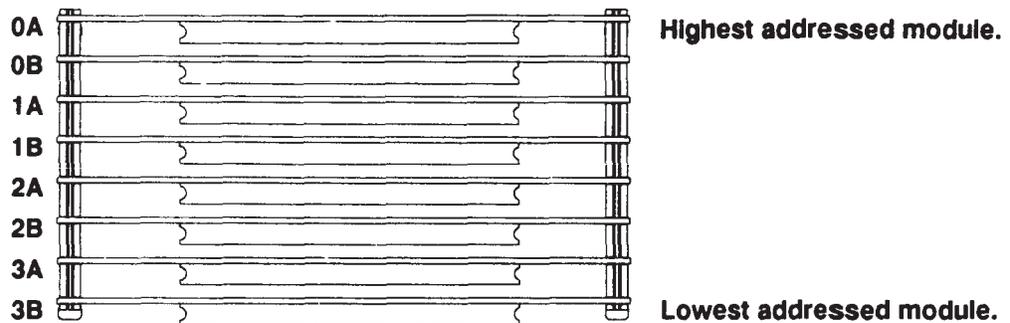


Figure 4-16. Memory Module Numbers

Refer to Table 4-14 and Table 4-15 to determine the memory module with the failing address. Memory modules are grouped in pairs called Module Pairs representing two memory modules.

In Table 4-14 and Table 4-15, blocks of memory are identified by module pairs. For example, an 8 MB block at the top of memory has addresses FFFFFFFF down through FF800000. In Model 400t/dl system units, Table 4-14 lists two address ranges; FFFFFFFF down through FFC00000 and FFB00000 down through FF800000. The entire address range of FFFFFFFF down through FF800000 is used for the 8 MB block consisting of two 4 MB memory modules in the pair. These two address ranges do not mean that one is used for module A and the other for module B. Addresses for each module are determined by the least significant bit for each address range. For Model 400s system units, Table 4-15 lists only one address range of FFFFFFFF down through FF800000 for the 8 MB block because the 4 MB modules are the smallest used in Model 400s system units.

Table 4-14. 400t and 400dl Memory Addresses vs. Memory Block

| Block Memory Addresses | | 98229-66520 | 98229-66521 | 98229-66523 |
|--|---------------|----------------------------|----------------------------|-----------------------------|
| Upper Address | Lower Address | Two Modules 4 MB Blocks | Two Modules 8 MB Blocks | Two Modules 16 MB Blocks |
| FFFFFFF | FFC00000 | Module Pair | Module Pair | Module Pair |
| FFBFFFFF | FF800000 | | | |
| FF7FFFFF | FF400000 | | | |
| FF3FFFFF | FF000000 | | | |
| FEFFFFFF | FEC00000 | | | |
| FEBFFFFF | FE800000 | | | |
| FE7FFFFF | FE400000 | | | |
| FE3FFFFF | FE000000 | | | |
| FDFFFFFFF | FDC00000 | | | |
| FDBFFFFF | FD800000 | | | |
| FD7FFFFF | FD400000 | | | |
| FD3FFFFF | FD000000 | | | |
| FCFFFFFF | FCC00000 | | | |
| FCBFFFFF | FC800000 | | | |
| FC7FFFFF | FC400000 | | | |
| FC3FFFFF | FC000000 | | | |
| Address LSD of F, E, D, C, 7, 6, 5, and 4 are on the 'A' board. Address LSD of B, A, 9, 8, 3, 2, 1, and 0 are on the 'B' board. | | | | |

Table 4-15. 400s Memory Addresses vs. Memory Block

| Block Memory Addresses | | 98229-66521 | 98229-66524 |
|--|---------------|----------------------------|-----------------------------|
| Upper Address | Lower Address | Two Modules 8 MB Blocks | Two Modules 32 MB Blocks |
| FFFFFFF | FF80000 | Module Pair | Module Pair |
| FF7FFFF | FF00000 | | |
| FEFFFFFF | FE80000 | | |
| FE7FFFF | FE00000 | | |
| FDFFFFF | FD80000 | | |
| FD7FFFF | FD00000 | | |
| FCFFFFFF | FC80000 | | |
| FC7FFFF | FC00000 | | |
| FBFFFFFF | FB80000 | | |
| FB7FFFF | FB00000 | | |
| FAFFFFFF | FA80000 | | |
| FA7FFFF | FA00000 | | |
| F9FFFFFF | F980000 | | |
| F97FFFF | F900000 | | |
| F8FFFFFF | F880000 | | |
| F87FFFF | F800000 | | |
| Address LSD of F, E, D, C, 7, 6, 5, and 4 are on the 'A' board. Address LSD of B, A, 9, 8, 3, 2, 1, and 0 are on the 'B' board. | | | |

Table 4-16 shows an example memory map. It lists four 16 MB and four 4 MB modules for a total of 80 MB of memory in a 400s system unit. Note that the four 16 MB modules are installed in slots 0A through 1B. The four 4 MB modules are installed in slots 2A through 3B. An address range is shown for each pair of modules. Each module has its address' least significant digits listed.

Table 4-16. Example Memory Map for 400s with 80 MB of Memory

| Slot Number | Address Range | Memory Module | Module Address' LSD |
|-------------|-----------------------------|---------------|------------------------|
| 0A | FFFFFFFF ↓ FE000000 | 16MB | F, E, D, C, 7, 6, 5, 4 |
| 0B | | 16MB | B, A, 9, 8, 3, 2, 1, 0 |
| 1A | FDFFFFFFFF ↓ FC000000 | 16MB | F, E, D, C, 7, 6, 5, 4 |
| 1B | | 16MB | B, A, 9, 8, 3, 2, 1, 0 |
| 2A | FBFFFFFFF ↓ FB800000 | 4MB | F, E, D, C, 7, 6, 5, 4 |
| 2B | | 4MB | B, A, 9, 8, 3, 2, 1, 0 |
| 3A | FB7FFFFFFF ↓ FB000000 | 4MB | F, E, D, C, 7, 6, 5, 4 |
| 3B | | 4MB | B, A, 9, 8, 3, 2, 1, 0 |

Set Defaults

Typing the command **D** sets the Test Memory default value to 'yes' for testing.

Run Tests

When you are ready to run the self-tests with the options you have selected, type the command **R**.

Part 3 Checkout Procedures

This part consists of two sections:

- The first section provides hardware checkout procedures for the Model 400t and 400dl systems.
- The second section provides hardware checkout procedures for the Model 400s system.

4.11 Checkout Procedures for Model 400t and 400dl Systems

This section provides checkout procedures for the following Model 400t and 400dl system components:

- Power supply and related FRUs (Procedure 4-5)
- Winchester disk power (Procedure 4-6)
- Calendar battery (Procedure 4-7)

WARNING: These procedures involve the verification of high-voltage components. They should be performed by qualified service personnel only.

CAUTION: Make sure that you are properly grounded before you attempt any of the following procedures. Use an antistatic mat with static straps and other static prevention devices whenever possible.

You must remove the system unit cover to perform the following procedures. Refer to Figure 4-17, which illustrates the system unit cover removal. Figure 4-18 shows the power connections, which are referenced in the procedures that follow.

NOTICE: Always replace the system unit cover during troubleshooting sessions if the system is to run for an extended period of time. The system unit cover is used to maintain proper air flow cooling within the system unit.

NOTICE: To maintain FCC/EMI compliance, verify that the covers are properly seated when closing the system unit.

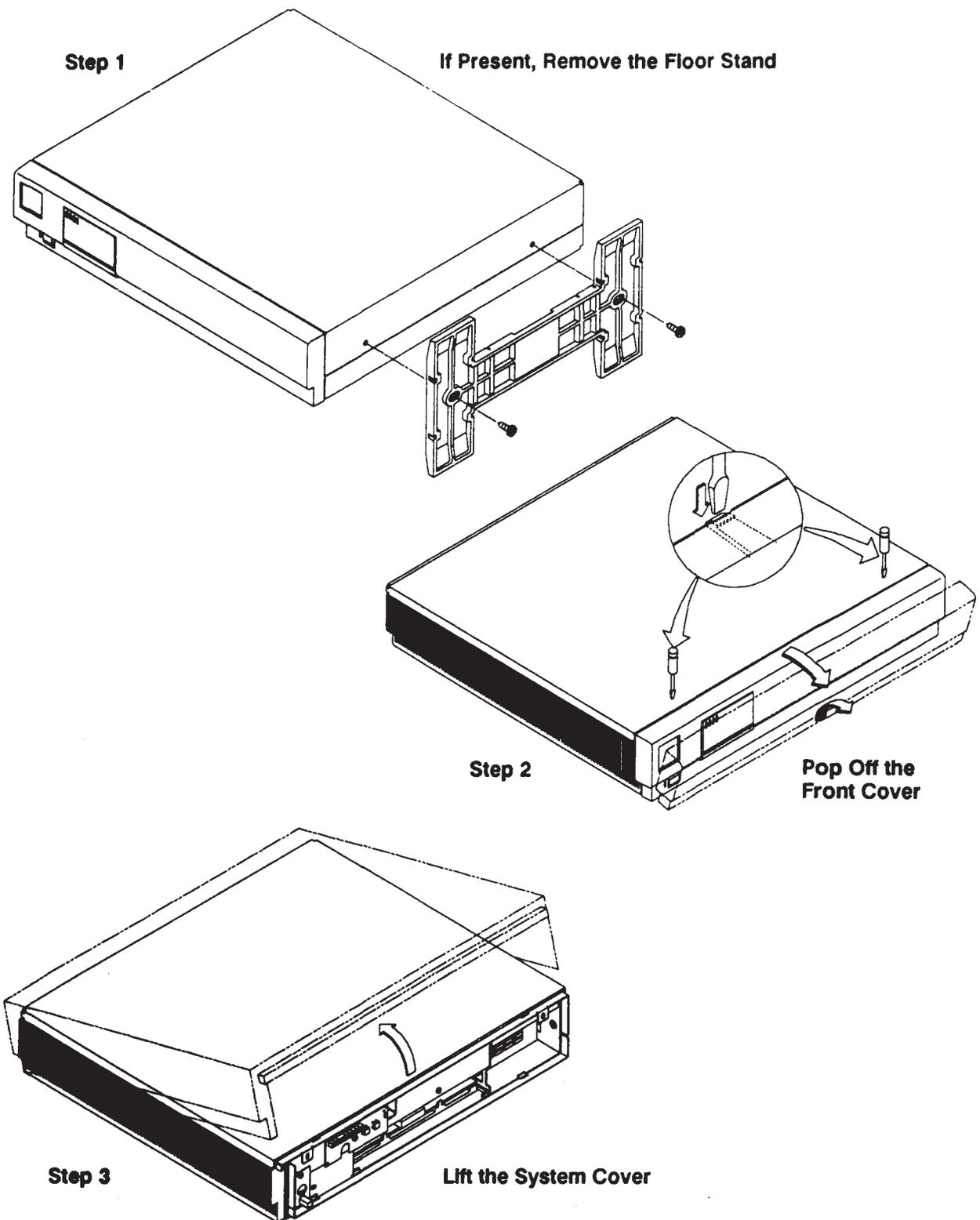


Figure 4-17. System Unit Cover Removal (Model 400t and Model 400dl)

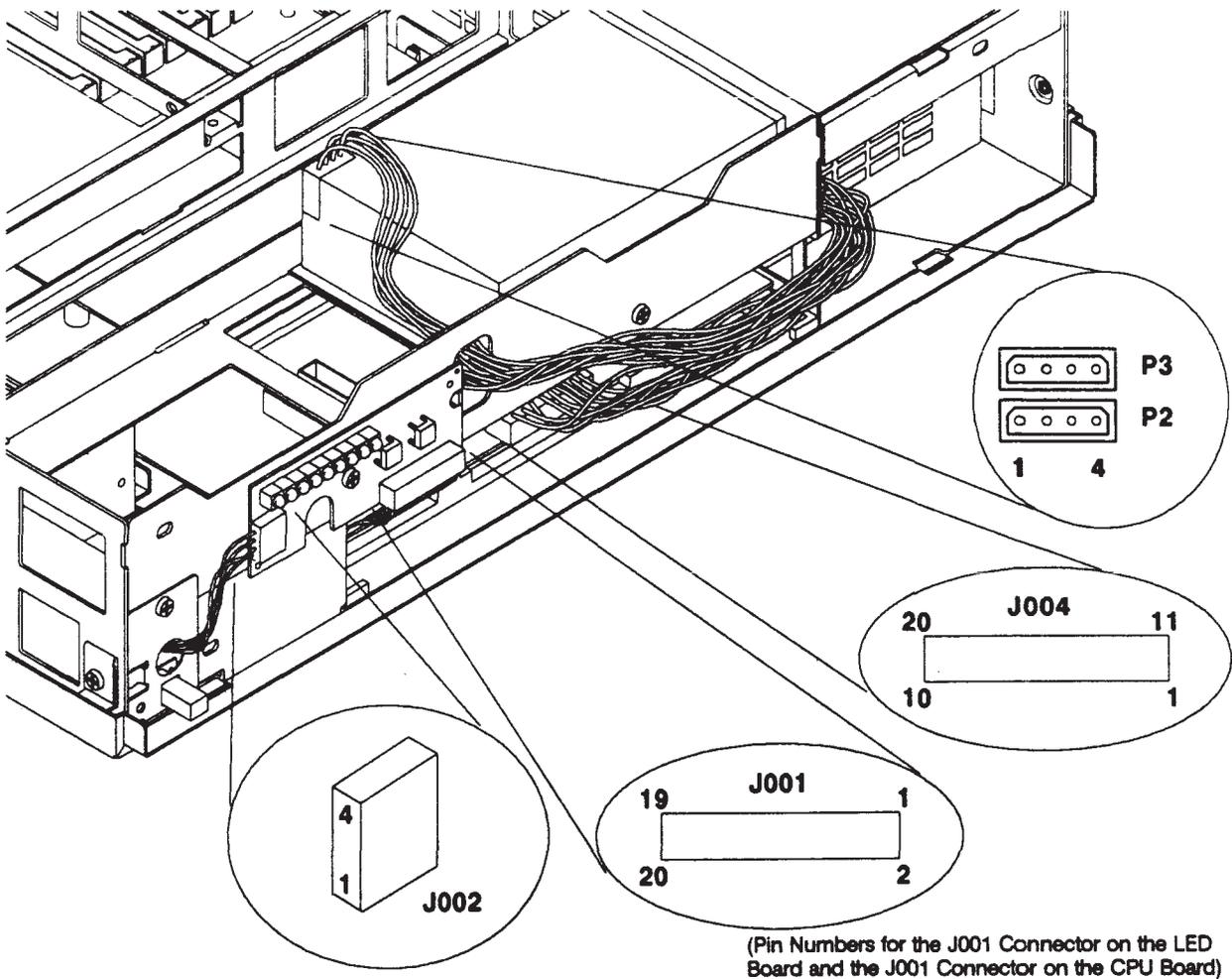


Figure 4-18. Power Connections (Model 400t and Model 400dl)

The following three procedures show you how to checkout the Model 400t and 400dl system components:

- Procedure 4-5 describes how to check the power supply and related FRUs.
- Procedure 4-6 describes how to check the Winchester disk power.
- Procedure 4-7 describes how to check the calendar battery.

Procedure 4-5. *Power Supply Verification for the Model 400t and 400dl Systems*

Note the following information about the power supply operation before you perform this procedure:

- The power supply delivers dc voltages to the CPU board and disk drives when you press the power-on switch on the front panel. The power-on switch activates the power supply by pulling low a signal line at Connector J004, Pin 8. (The signal line is normally high when the supply is off.)
- When you power on the system, a relay within the power supply closes to route ac voltage to the display monitor outlet at the rear of the system unit.
- The system fan, which is housed in the rear of the power supply, is not a separate FRU. If the fan doesn't operate, you must replace the power supply.

You need a voltmeter and an ohmmeter to perform this procedure.

NOTICE: Before you replace the power supply or a related FRU, always visually check the power supply harness and other FRU cables for loose, broken, or pinched wires.

If you find a defective FRU, follow the removal and replacement procedures in Chapter 5 to replace it.

First, make sure that the system power is off and that the power cord is unplugged. Then, remove the system cover. Now continue with the following steps.

1. If connected, disconnect the system from the network. If the system uses a network connector, unplug it from the network wall outlet. If the system uses BNC connectors to connect to the network, unplug them from the rear of the system unit. This opens the loop in the network. To complete the loop while you are servicing the system, use a barrel type BNC connector between the IN and OUT connectors.

2. Plug in the power cord and power on the system. Do not unplug the J004 connector from the CPU board. Measure the voltages through the top of the connector. Use the voltmeter to test for the voltages on the J004 connector as listed in Table 4-17.

*Table 4-17. Model 400t and 400dl Power Supply
Voltages and Tolerances*

| Voltage (V dc) | Tolerance at J004 Connector | J004 Connector Pin No. | Wire Color |
|---------------------------|---|--|-----------------------|
| + 5 | 4.85 to 5.25 V dc | 1, 3, and 9 | Red |
| Ground | — | 14, 16, 18, and 20 | Black |
| + 12 | 11.4 to 12.6 V dc | 7 | Violet |
| -12 | -11.28 to -12.72 V dc | 6 | Green |
| + 12 | 11.4 to 12.6 V dc | 4 | Brown |
| + 9 | 8.7 to 9.3 | Differential between Pins 17 and 19 | Orange Yellow |
| Voltage (V dc) | Tolerance at P2 and P3 Connector | P2 and P3 Connector Pin No. | Wire Color |
| + 5 | 4.85 to 5.25 V dc | 4 | Red |
| + 12 | 11.4 to 12.6 V dc | 1 | Violet |
| Ground | — | 2 and 3 | Black |

Continue on with Step 3, Step 4, or Step 5, depending on the configuration of the dc output voltages.

3. If the dc output voltages are not present at J004, perform the following steps:
 - A. Check the ac outlet for power with a voltmeter. If the ac outlet power is incorrect, an electrician must correct it.
 - B. With the power-on switch open, use a voltmeter to check Pin 8 on the J004 connector for +16 to + 20 V dc. If the voltage is not correct, replace the power supply.

If the voltage is correct at Pin 8, close the power-on switch. If you read Pin 8 at ground, replace the power supply. If you still detect +16 to + 20 V dc, replace the power-on switch panel. If the new switch doesn't fix the problem, replace these FRUs in the following order:

- Ribbon Cable (connects LED board to CPU board)
- LED Board
- CPU Board

You can check these FRUs before you replace them by checking the power-on switch circuits for continuity as shown in Table 4-18. Check for continuity with Connectors J004 and J002 unplugged. Refer to Figure 4-18 for the locations of the connectors and pins listed in Table 4-18.

Table 4-18. Switch Circuit FRU Pin Numbers

| To Check This FRU | Check for Continuity Between These Two Connectors | |
|-----------------------------------|---|------------------|
| FRU | Connector Pin | to Connector Pin |
| CPU Board | J004 8 | J001 15 |
| Cable from LED Board to CPU Board | J001 15 | J001 15 |
| LED Board | J001 15 | J002 4 |
| CPU Board | J004 20 | J001 1 |
| Cable from LED Board to CPU Board | J001 1 | J001 1 |
| LED Board | J001 1 | J002 3 |

4. If the dc output voltages are present at J004, but not within tolerance, perform the following six steps:
 - A. Power off the system and unplug the ac power cord from the wall outlet. Replace the power supply.
 - B. If the problem persists, you must check for power loading. Power off the system and unplug the power cord from the wall outlet. Remove one option board (graphics, network, or HP-IB) from its board slot (refer to Chapter 5 for information about removing the board). Plug the power cord into the ac wall outlet and power on the system. Recheck the voltages. If necessary, repeat this procedure for a second option board. If you replace a defective board, configure any switches or jumpers the same as on the original board (refer to Appendix B).
 - C. If the cause of the problem isn't an option board, power off the system and unplug the power cord from the ac outlet. Reinstall the board(s) in its slot.
 - D. Unplug connector P2 from the disk drive. Power on the system unit and recheck the voltages. If necessary, repeat this step on a second disk drive. Replace the disk drive if the voltages are now within specifications (see Chapter 5).
 - E. If the problem persists, replace the CPU/Motherboard (see Chapter 5) and repeat this procedure.
 - F. After you verify that the power supply voltages are within the specified ranges, power off the system and unplug the ac cord from the wall outlet. Replace the system unit cover. Make sure that all of the internal connections are secure.
5. If the dc output voltages are within tolerance, perform the following three steps:
 - A. If the fan does not operate, replace the power supply.
 - B. If the display outlet ac voltage is incorrect, replace the power supply.
 - C. If the power LED is not on, replace the Power-On Switch Panel. If the LED still doesn't light, replace these FRUs in the following order:

Ribbon Cable (connects LED board to CPU board)
LED Board
CPU Board

You can check the LED board and CPU board before you replace them by checking the power LED circuits for continuity as shown in Table 4-19. Check for continuity with Connectors J004 and J002 unplugged. Refer to Figure 4-18 for the locations of the connectors and pins listed in Table 4-19.

Table 4-19. Power-On LED Circuit FRU Pin Numbers

| To Check This FRU | Check for Continuity Between These Two Connectors | |
|-----------------------------------|---|------------------|
| FRU | Connector Pin | to Connector Pin |
| CPU Board | J004 9 | J001 4 |
| Cable from LED Board to CPU Board | J001 4 | J001 4 |
| LED Board | J001 4 | J002 1 |
| CPU Board | To LED Register On CPU Board | J001 14 |
| Cable from LED Board to CPU Board | J001 14 | J001 14 |
| LED Board | J001 14 | J002 2 |

end of procedure

Procedure 4-6. Winchester Disk Power Checkout for the Model 400t and 400dl

You need a voltmeter to perform this procedure.

Start this procedure with the system power off and the power cord unplugged.

Remove the system cover.

1. Ensure that the power connector (P2 or P3) is securely attached to the Winchester disk drive.
2. Plug in the system unit's power cord and power on the system.
 - A. If the fan does not start to spin, go to Procedure 4-5.
 - B. If the fan starts spinning, and the system unit's green Power LED is on, go to Step 3 in this procedure.
3. Use the voltmeter to test the voltages at the power supply input connector to the Winchester drive. Unplug P2 or Pi to check the voltages. Figure 4-19 shows the connector voltages.

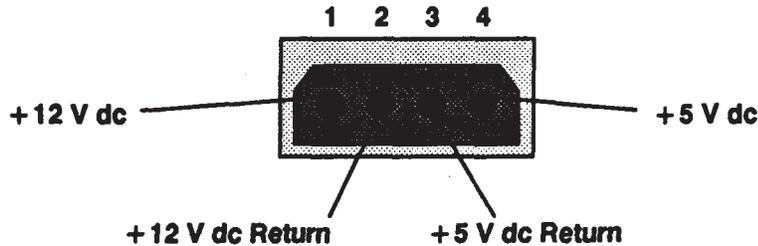


Figure 4-19. Disk Drive Power Supply Input Connector (P2 or P3)

4. If the voltages are not within specifications, see Table 4-17 and perform the power supply checkout in Procedure 4-5.
5. If the power supply checks out within specifications and the problem persists, check the jumper configurations for the disk drive (refer to Appendix A for the disk jumper configurations).

end of procedure

Procedure 4-7. *Calendar Battery Checkout for Model 400t and 400dl Systems That Use Domain Compatible Mode*

Start this procedure with the system power off.

1. Turn on the system unit and the monitor. If the calendar backup battery is not working (incorrectly seated, or dead), you will see an incorrect date printed in one of the messages shown in Figure 4-20.

NOTICE: You may see the third message the first time you boot the system or if the clock has never been set.

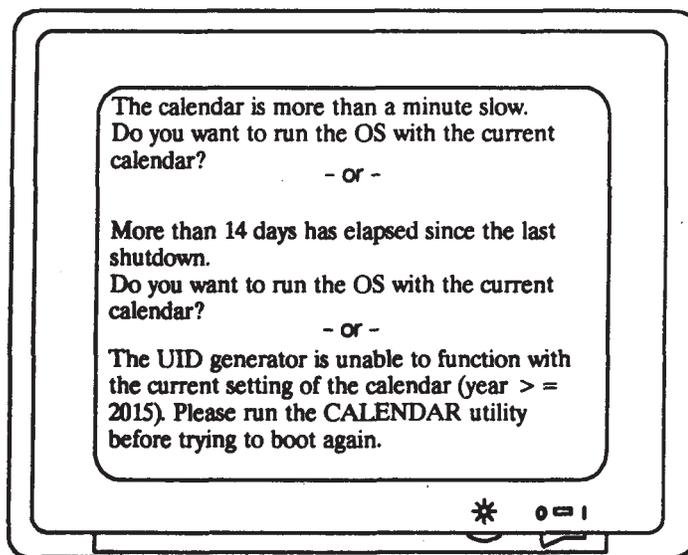


Figure 4-20. Calendar Battery Message

2. Turn off the system unit and unplug its ac power cord from the wall outlet. Remove the system unit cover.
3. Check to see if the calendar backup battery is properly seated on the CPU board. If the battery is seated properly, replace it. If it is not seated properly, seat it correctly and replace the system unit cover. Plug in the ac power cord and turn on the system again. If the error message does not appear, the problem is fixed. If the error message appears again, the battery must be replaced. Refer to the battery replacement procedure in Chapter 5.

end of procedure

4.12 Checkout Procedures for the Model 400s System Unit

The following three procedures show you how to check the Model 400s system components:

- Procedure 4-8 describes how to check the power supply and related FRUs.
- Procedure 4-9 describes how run the HP-UX ce.utilities.
- Procedure 4-10 describes how to check the calendar battery.

Procedure 4-8. Power Supply Verification for the Model 400s System Unit

Note the following information about power supply operation before you perform this procedure:

- The power supply delivers dc voltages to all boards, internal mass storage devices and fans when you press the power-on switch.
- If the power is not completely connected to the motherboard with a normal load and is turned off, then turned on, it may be a minute or two before the voltages come up to their normal values.

NOTICE: Before you replace the power supply or a related FRU, always visually check the power supply harness and other FRU cables for loose, broken, or pinched wires.

If you find a defective FRU, follow the removal and replacement procedures in Chapter 5 to replace it.

1. Start this procedure with the system unit power off and the power cord unplugged. Remove the top cover.
2. If connected, disconnect the system unit from the network. If the system uses a network connector, unplug it from the network. If the system uses BNC connectors to connect to the network, unplug the BNC 'T' from the system unit connector leaving the network intact through the arms of the 'T' connector.
3. Plug in the power cord and power on the system. Measure the + 5, -12 and +12 voltages on the CPU board test points through the holes in the top of the chassis as shown in Figure 4-21. To measure the -5 and + 9 V dc, you must open the power supply drawer and measure it at the connector.

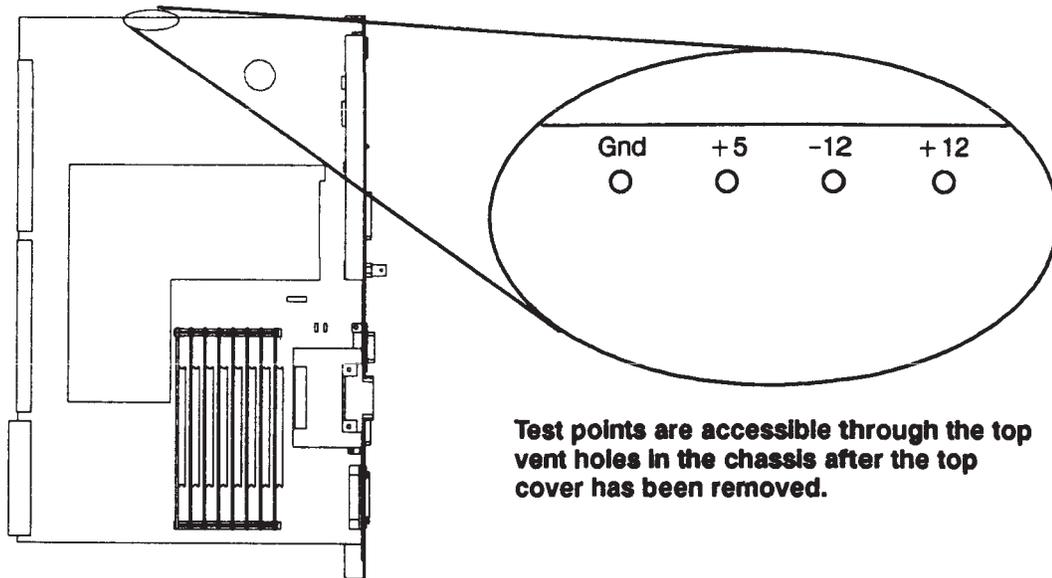


Figure 4-21. Model 400s System Unit CPU Board Voltage Test Points

Table 4-20 lists the voltages that the power supply provides to the system unit.

Table 4-20. Model 400s System Unit Power Supply Voltages and Tolerances

| Voltage (dc) | Tolerance |
|--------------|-----------------------|
| + 5 | 4.85 to 5.20 V dc |
| -5 | -4.60 to -5.50 V dc |
| + 9 | 8.70 to 9.30 V dc |
| + 12 | 11.40 to 12.60 V dc |
| -12 | -11.40 to -12.60 V dc |

Continue with Step 4 or Step 5, depending on the result of your voltage checks.

4. If the DC output voltages are not present at the CPU board test points, perform the following steps:
 - A. If the system unit has an ISA backplane, remove the right side and RFI covers. Check the voltages on the ISA power distribution cable on the ISA backplane as listed in Figure 4-24. If the voltages are present, replace the CPU board. If the voltages are not present, go on to step B.
 - B. Check the ac outlet for power with a voltmeter. If the ac outlet power is incorrect, an electrician must correct it.

- C. Switch the system unit power off and remove the power supply screws and slide the power supply out about 3 inches. Switch the power on and measure the voltages on the two power supply connectors as shown in Figure 4-22 and Figure 4-23 (leave the connectors connected to the power supply and measure the voltages through the rear of the connectors). If the voltages are not present, go to Step D. If the voltages are present, go to Step E.
 - D. Check Pin 24 on the large connector shown in Figure 4-22 for + 5 V dc. If the voltage is not correct, replace the power supply.

If the voltage is correct at Pin 24, close the power-on switch. If you read Pin 24 at ground, replace the power supply. If you still detect + 5 volts, replace the power-on switch. If the new switch doesn't fix the problem, go to Step E.
 - E. Either the power distribution cable, motherboard, or CPU board are defective. Check the power distribution cable for continuity. If the power distribution cable is defective, replace it. Otherwise, replace the CPU board and recheck the voltage test points. If the voltages are not present, replace the motherboard.
5. If the voltages are present at the CPU board or power supply test points but not within tolerance, perform the following steps
- A. Power off the system unit and unplug the ac power cord from the power supply. Replace the power supply.
 - B. If the problem persists, reinstall the original power supply and follow the information in this step to check for power loading by a board. Power off the system unit and remove one board other than the CPU board. Power on the system unit and retest. If necessary, repeat this procedure for a second board. If you replace a defective board, configure any switches or jumpers the same as the original board.
 - C. If a board does not appear to have caused the problem, power off the system unit and unplug the power cord from the power supply. Reinstall the boards in their slots.
 - D. Unplug the internal mass storage power distribution cable from one of the mass storage devices. Power on the system unit and recheck the voltages. If necessary, repeat this step for each internal mass storage device. Replace the mass storage device if the voltages are within specifications.

end of procedure

4.12.1 Main Power Distribution Cable Connectors

The main power distribution cable large connector's pin numbers are the same as its pins on the power supply board (see Figure 4-22). Its small connector's pin numbers are different than its pins on the power supply board (see Figure 4-23). Note that you must check these voltages with the connectors attached to the power supply. Check the voltages through the rear of the connectors.

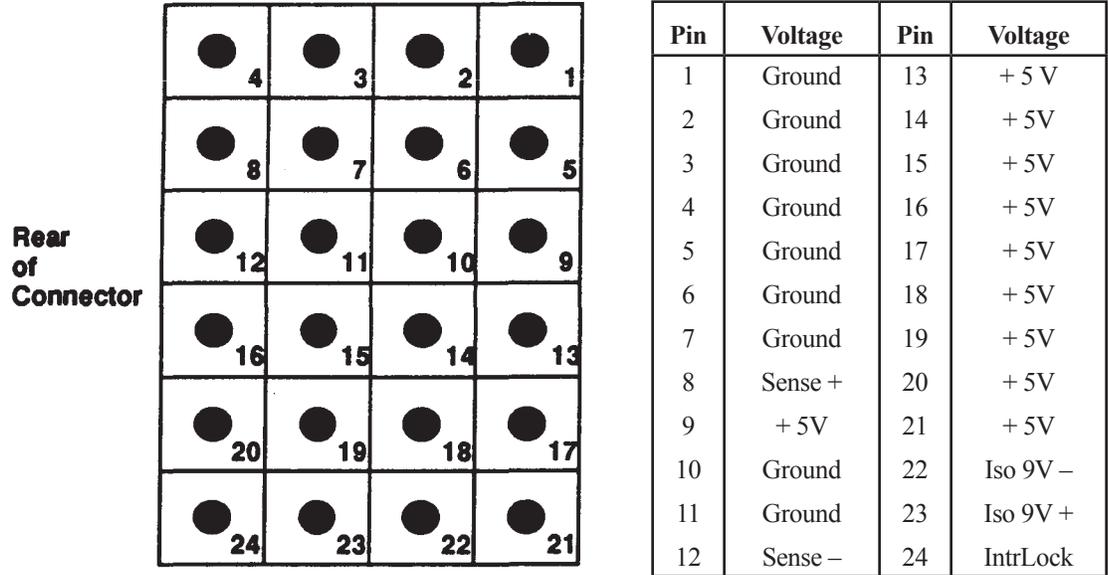


Figure 4-22. Model 400s System Unit Power Supply Large Cable Connector

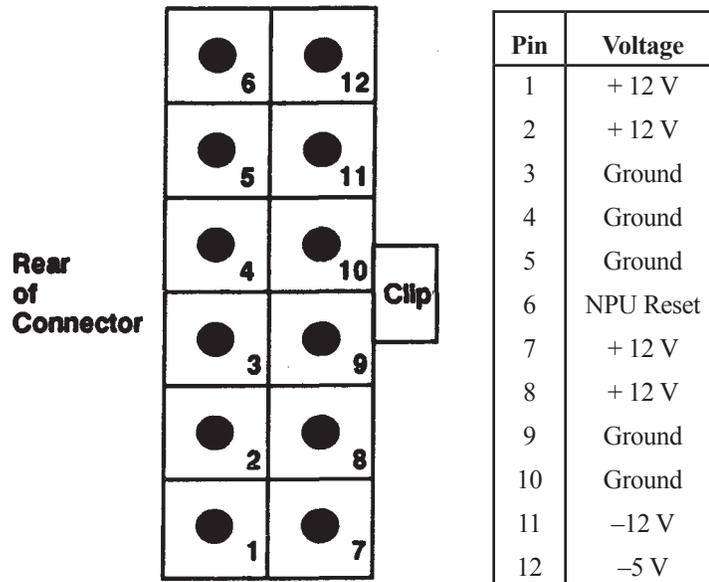


Figure 4-23. Model 400s System Unit Power Supply Small Cable Connector

Figure 4-24 shows the voltages of the ISA backplane power cable connector.

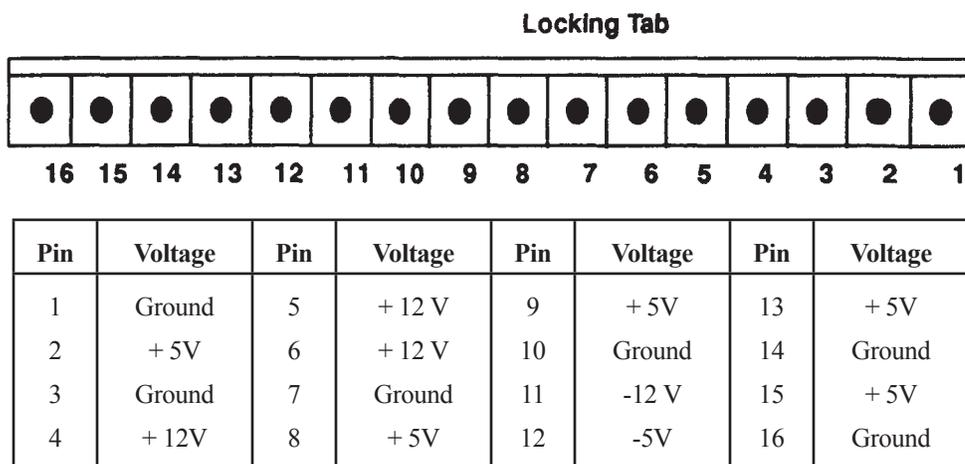


Figure 4-24. Model 400s System Unit ISA Backplane Power Cable Connector

Figure 4-25 shows the voltages for a storage device connector on the motherboard.

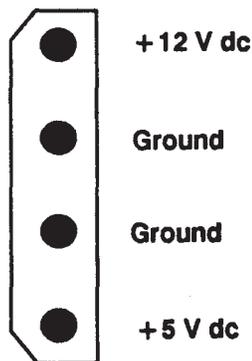


Figure 4-25. Model 400s System Unit Motherboard Mass Storage Power Distribution Connector

Procedure 4-9. *Using the HP-UX ce.utilities*

1. If not already connected, connect a tape drive on the system for the System Support Tape.
2. Verify that the system unit is in the HP-UX compatible mode.

3. From the Auto System Select Mode, note the tape drive with the System Support Tape with these operating systems:

SYSTEM_SF

SYSTEM_S3

4. If you want to run the Series 300 System Functional Tests, select SYSTEM_SF as the temporary operating system to boot.

If you want to run the Series 300 Computer Tests select SYSTEM_S3 as the temporary operating system to boot.

Refer to the *System Support Tape User's Guide and the Series 300 Test Tools Manual* for detailed instructions.

5. To continue and run specific ce.utilities tests, boot the HP-UX operating system. The remaining steps of this procedure can only be performed with the HP-UX operating system running.
6. To list all tests on the tape, type the following command where drive is the device file name of the tape drive:

lifs /dev/drive < Return >

7. To find out what files are available for a certain test, type the following command:

lifcp -r /dev/drive: filename1 - | cpio -ictv < Return >

where *filename1* is one of these six ce.utility tests:

| | | |
|--------|-------|-----|
| CRTADJ | FLOAT | ECC |
| CS80 | SFT | VME |

Note that the HP 98720A and HP 98730A tests are not supported on Series 400 system units.

8. If you want to list the file names for a specific ce.utility test in a new file, type the following command where *filename2* is the name of the file in which you want to list the files:

lifcp -r /dev/drive: filename1 - | cpio -ictv [> filename2] < Return >

9. To read the list of file names, type the following command:

more filename2 < Return >

10. To find out what ce.utilities tests are already in the HP-UX operating system, type these commands:

```
cd /usr/diag/CE.utilities < Return >
```

```
ls < Return >
```

11. If you want to run a test that is not already in HP-UX, you must first copy the test from the tape to the HP-UX file system. A new directory, **/usr/CE.utilities**, is automatically created and the files from the tape are copied into it. Type the following command, where *test* is one of the eight test files you want to copy from the tape to the file system:

```
lifcp -r /dev/drive:test - | cpio -icdvxm < Return >
```

Information on each CE.utility test may be found as follows:

- CRTADJ: refer to *System Support Tape User's Guide*.
- CS/80: refer to the *Series 300 Test Tools Manual*.

NOTICE: If the CS/80 test is run in single user mode, the system halts when the exerciser is stopped. You must reboot HP-UX to continue.

- FLOAT type the following commands and a help file appears on the screen.

```
cd /usr/CE.utilities/Floatcard < Return >
```

```
./help < Return >
```

- SFT refer to the *Series 300 Test Tools Manual*.
- VME: type the following command and a readme file appears on the screen.

```
more vme_README < Return >
```

- ECC: type the following commands for information on setting up and executing the ECC tests.

```
cd /etc
```

```
man ecclogger < Return >
```

Refer to the *System Support Tape User's Guide* and the *Series 300 Test Tools Manual* for detailed information on running the CE.utilities.

end of procedure

Procedure 4-10. *Calendar Battery Checkout for Model 400s Systems That Use Domain Compatible Mode*

Start this procedure with the system power off.

1. Turn on the system unit and the monitor. If the calendar backup battery is not working (incorrectly seated, or dead), you see an incorrect date printed in one of the messages shown in Figure 4-26.

NOTICE: You may see the third message the first time you boot the system or if the clock has never been set.

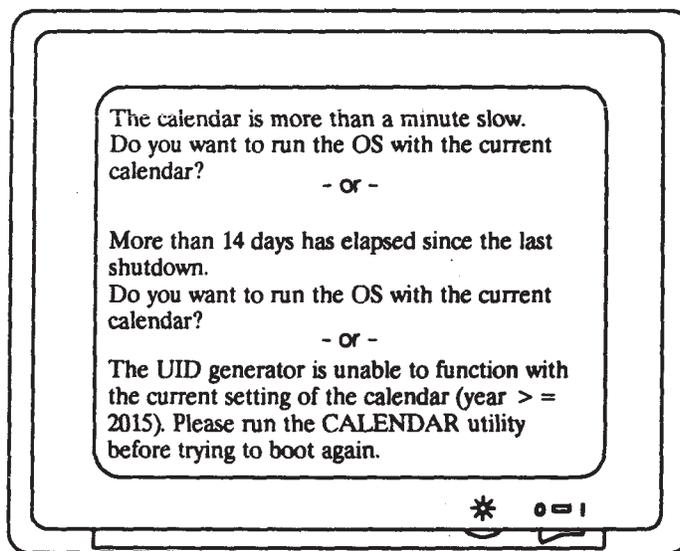


Figure 4-26. Calendar Battery Message

2. Turn off the system unit and unplug its ac power cord from the wall outlet. Remove the top cover from the system unit.
3. Check to see if the calendar backup battery is properly seated on the CPU board. If the battery is seated properly, replace it. If it is not seated properly, seat it correctly and replace the system unit cover. Plug in the ac power cord and turn on the system again. If the error message does not appear, the problem is fixed. If the error message appears again, the battery must be replaced. Refer to the battery replacement procedure in Chapter 5.

end of procedure



Chapter 5

FRU Removal and Replacement

This chapter provides information about removing and replacing a Field Replaceable Unit (FRU). Part 1 describes FRU removal and replacement for Model 400t and 400dl systems. Part 2 describes FRU removal and replacement for the Model 400s system.

5.1 Introduction

The FRU is the actual hardware that the CE replaces at the customer site. The CE implements the actual replacement strategy based on the factors at each customer site. HP Apollo systems have the following maintenance strategy where the FRUs are different at each level.

- Level 1 is the Subassembly level. At this level, the CE performs system repairs at the customer site with a replaceable part. These parts include PCBs, power supplies, monitors, keyboards, fans, cables, and complete Winchester disk drives. These replacement parts are stocked at each branch office.
- Level 2 is the Major Unit level. At this level, the CE replaces entire systems in accordance with the option swap policy.

5.2 Recommended Equipment

You need the following tools and equipment to properly repair the system:

- Standard CE tool kit
- Antistatic kit, including antistatic mat, static straps, and antistatic bags for PC boards

Part 1 Removing and Replacing Model 400t and 400dl FRUs

5.3 System Assemblies

This section describes the system assemblies and the cables and connectors that link the assemblies. To view the hardware described in this section, you must first power down the system and unplug it from the wall outlet. Then, remove the cover from the system unit (see Figure 5-1).

The following figures show Model 400t and 400dl system unit components:

- Figure 5-2 shows the system assemblies within the system unit.
- Figure 5-3 shows a rear view of the system unit.
- Figure 5-20, at the end of Part 1, shows an exploded view of the system unit FRUs. Accompanying tables list the FRU part numbers.

CAUTION: Make sure that you are properly grounded before you attempt any of the following procedures. Use an antistatic mat with static straps and other static prevention devices whenever possible.

NOTICES: Always replace the system unit cover during troubleshooting sessions if the system is to run for an extended period of time. The system unit cover is used to maintain proper air flow cooling within the system unit.

To maintain FCC/EMI compliance, verify that the covers are properly seated when closing the system unit.

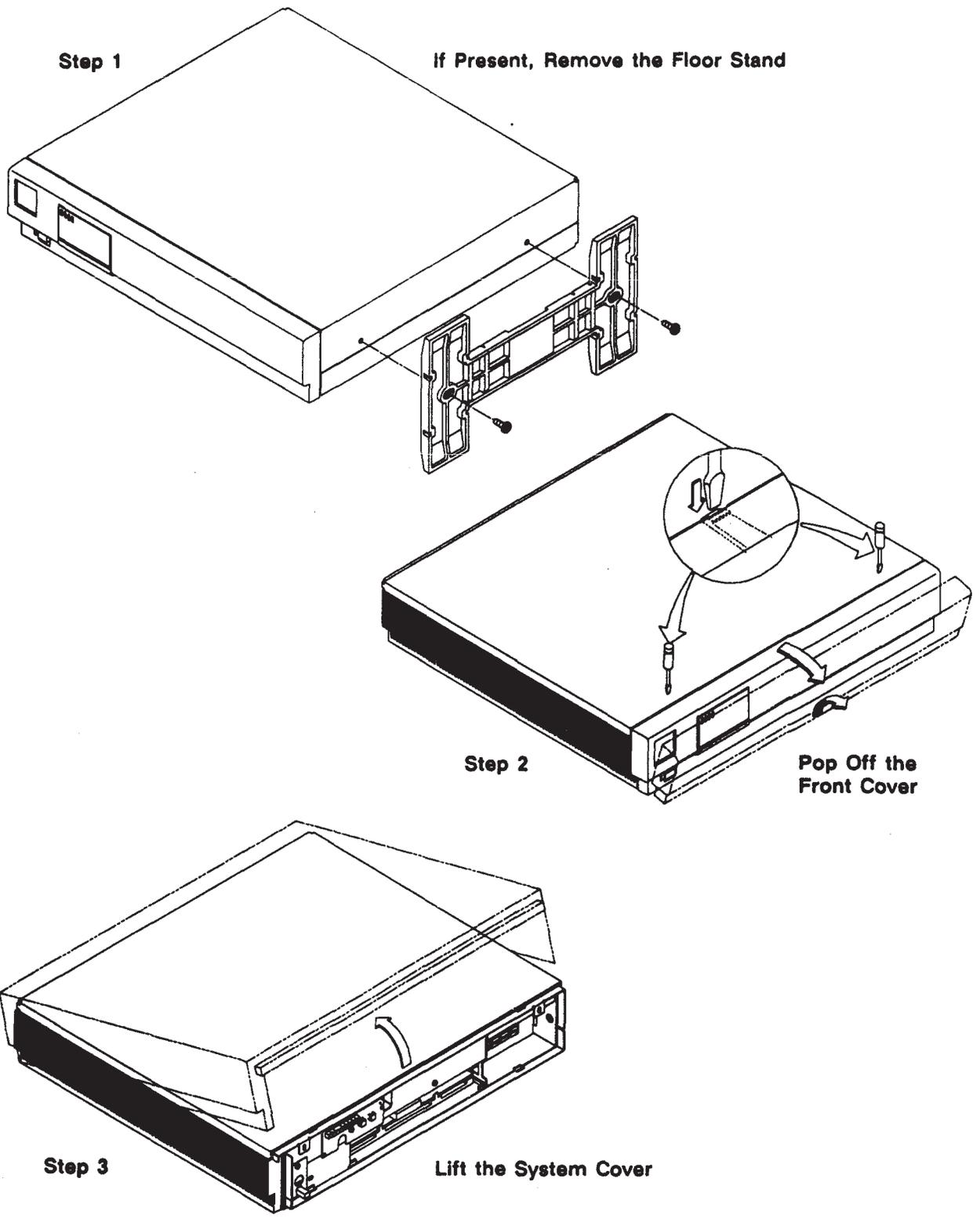


Figure 5-1. System Unit Cover Removal (Model 400t and 400dl)

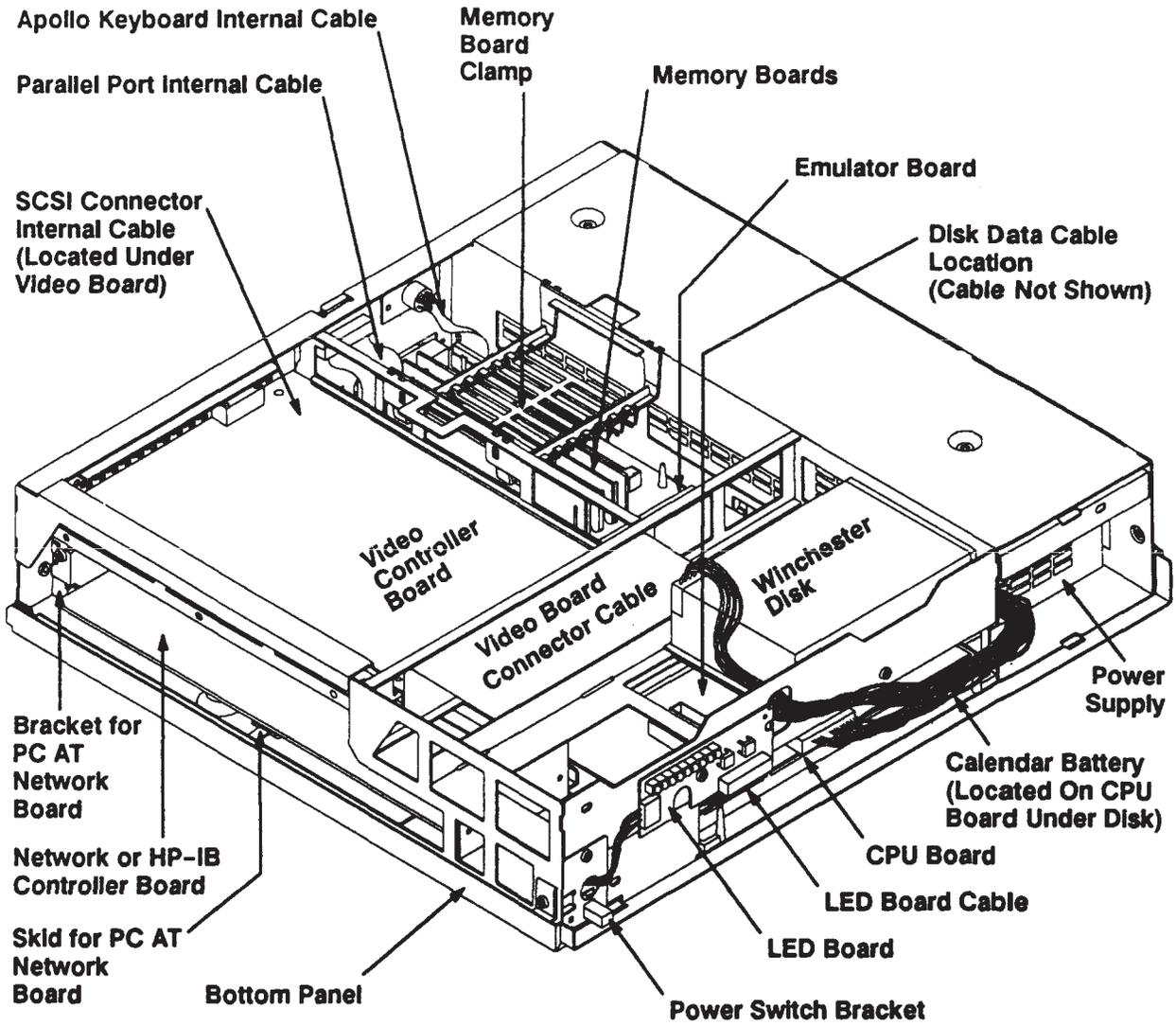
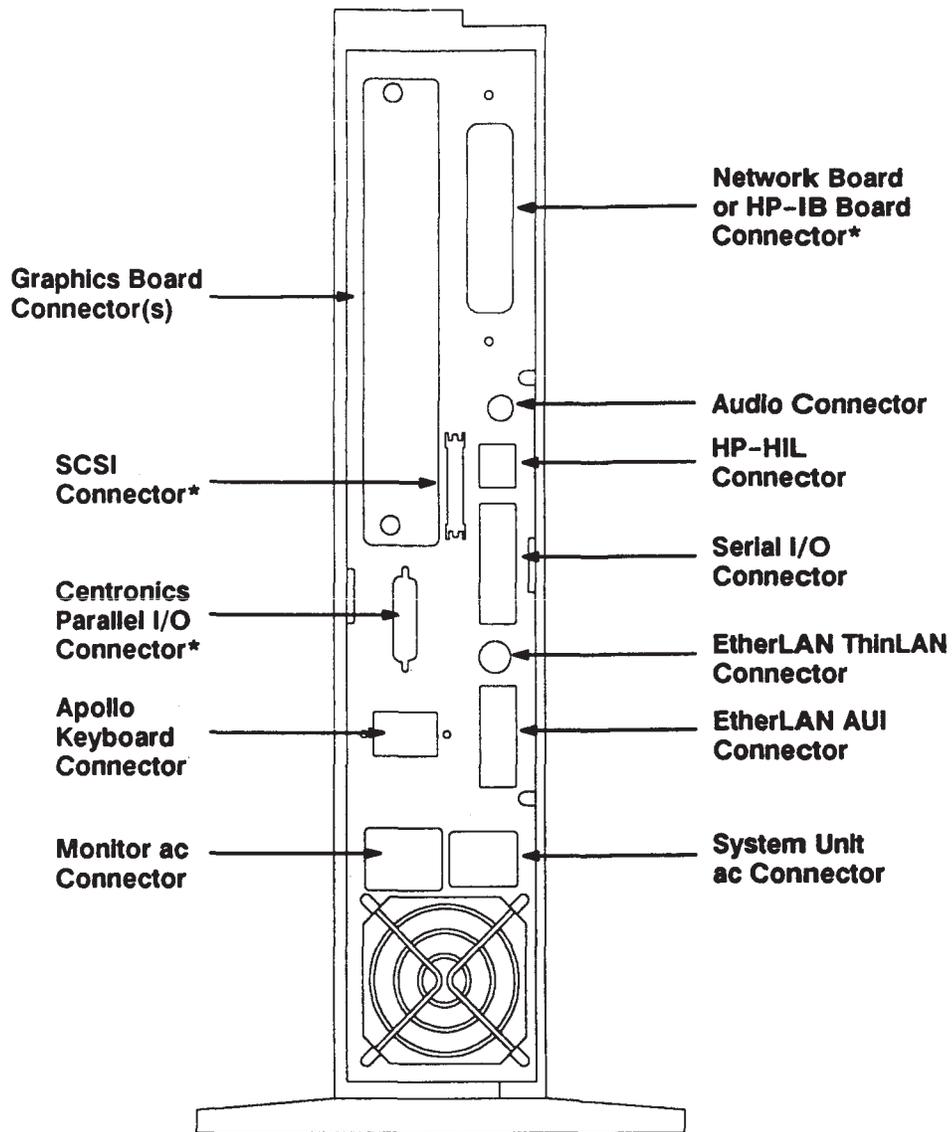


Figure 5-2. System Components (Model 400t and 400dl)



*** Not available on Model 400dl workstations.**

Figure 5-3. Rear View of the Model System Unit (Model 400t and 400dl)

5.3.1 Memory Board Removal and Replacement (Model 400t and 400dl)

Figure 5-4 shows how to remove a memory board. Push in the edges of the hold-down bracket and lift off the bracket. Remove the defective board. To replace a memory board, insert it into the slot and firmly press on the top of the board. Replace the hold-down bracket.

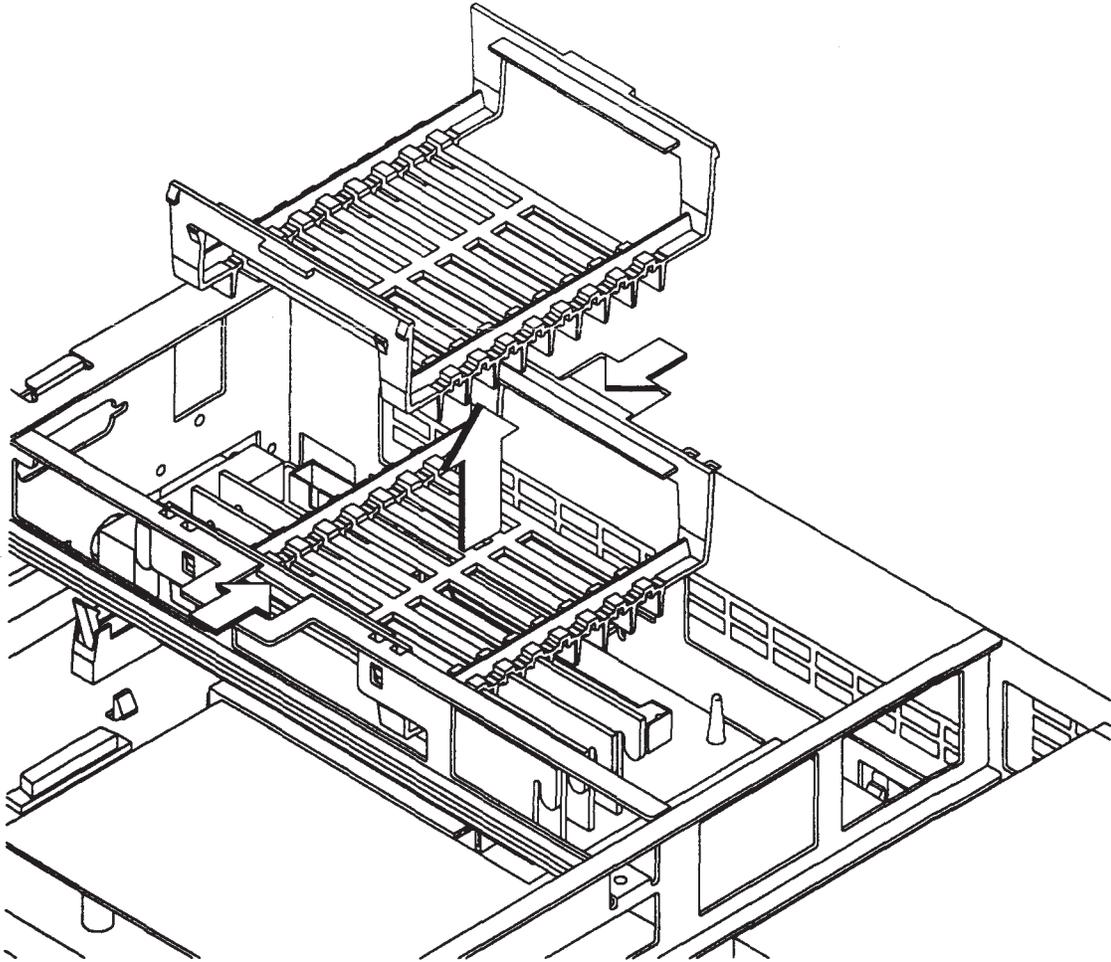


Figure 5-4. Memory Board Removal (Model 400t and 400dl)

5.3.2

Graphics Controller Removal and Replacement (Model 400t and 400dl)

Figure 5-5 shows how to remove a graphics controller board. Unscrew the two screws, and slide the board from the slot. Refer to Appendix A to verify that the board is jumpered correctly. To replace the board, reverse the removal procedure. Be sure that the board's connectors seat securely.

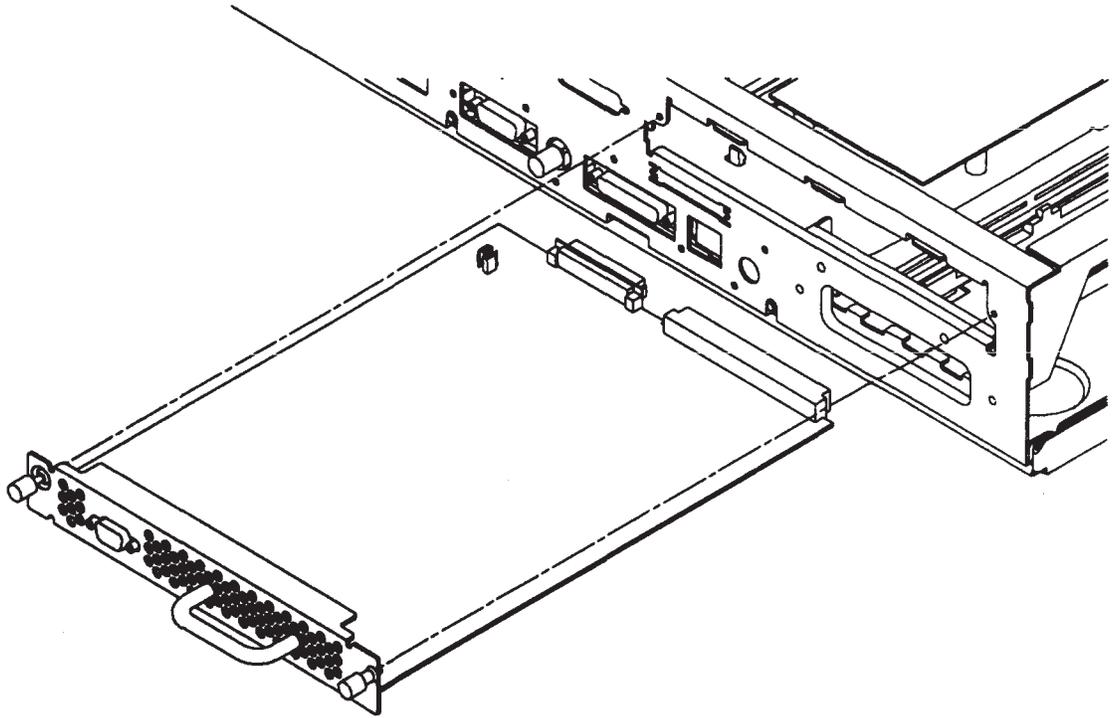


Figure 5-5. Graphics Controller Removal (Model 400t and 400dl)

5.3.3 Network Interface Board Removal and Replacement (Model 400t and 400dl)

Figure 5-6 shows how to remove the network interface board. First remove the graphics board. Then remove the screw from the network board's connector plate. To remove the network board, push the board from the connector side to disengage the board from the CPU board connector. Refer to Appendix A to verify that the replacement board is jumpered correctly. To replace the board, reverse the removal procedure. Be sure that the board's connector plate is seated properly in the chassis.

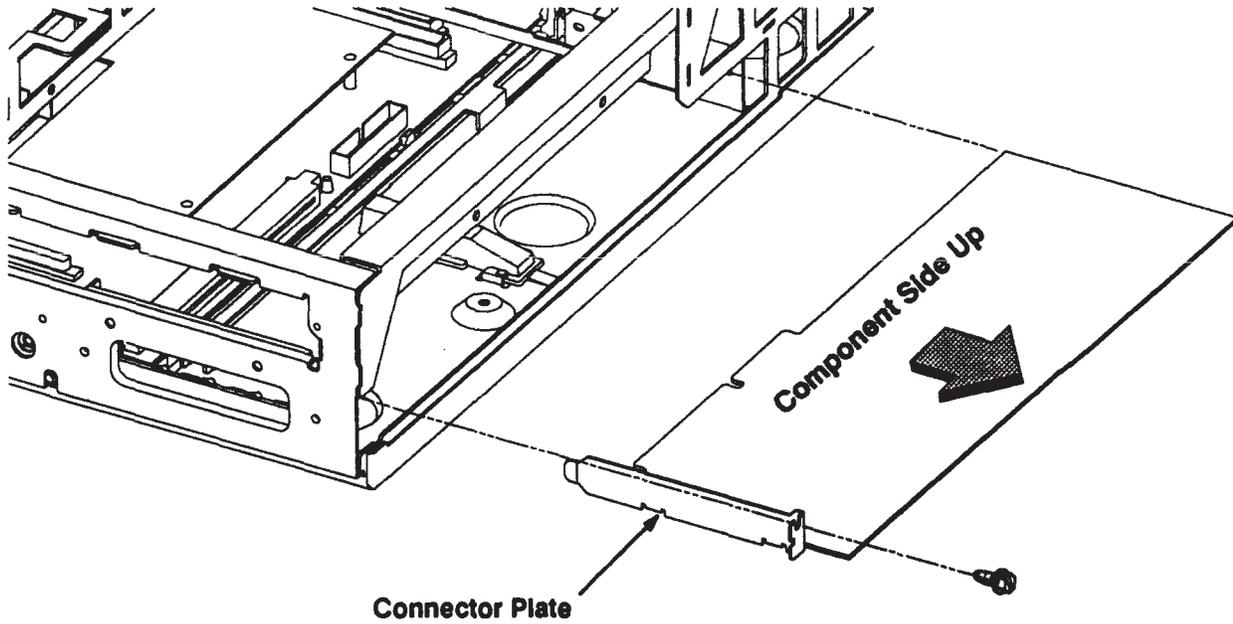


Figure 5-6. Network Interface Board Removal (Model 400t and 400dl)

5.3.4 HP-IB Interface Board Removal and Replacement (Model 400t and 400dl)

Figure 5-7 shows how to remove the HP-IB interface board. First remove the graphics board. Disconnect the cable from the HP-IB board. Remove the two mounting screws, and slide the board from the slot. Remove the mounting plate from the HP-IB board by removing the two mounting plate screws. Attach the mounting plate to the new HP-IB board. To replace the board, reverse the removal procedure.

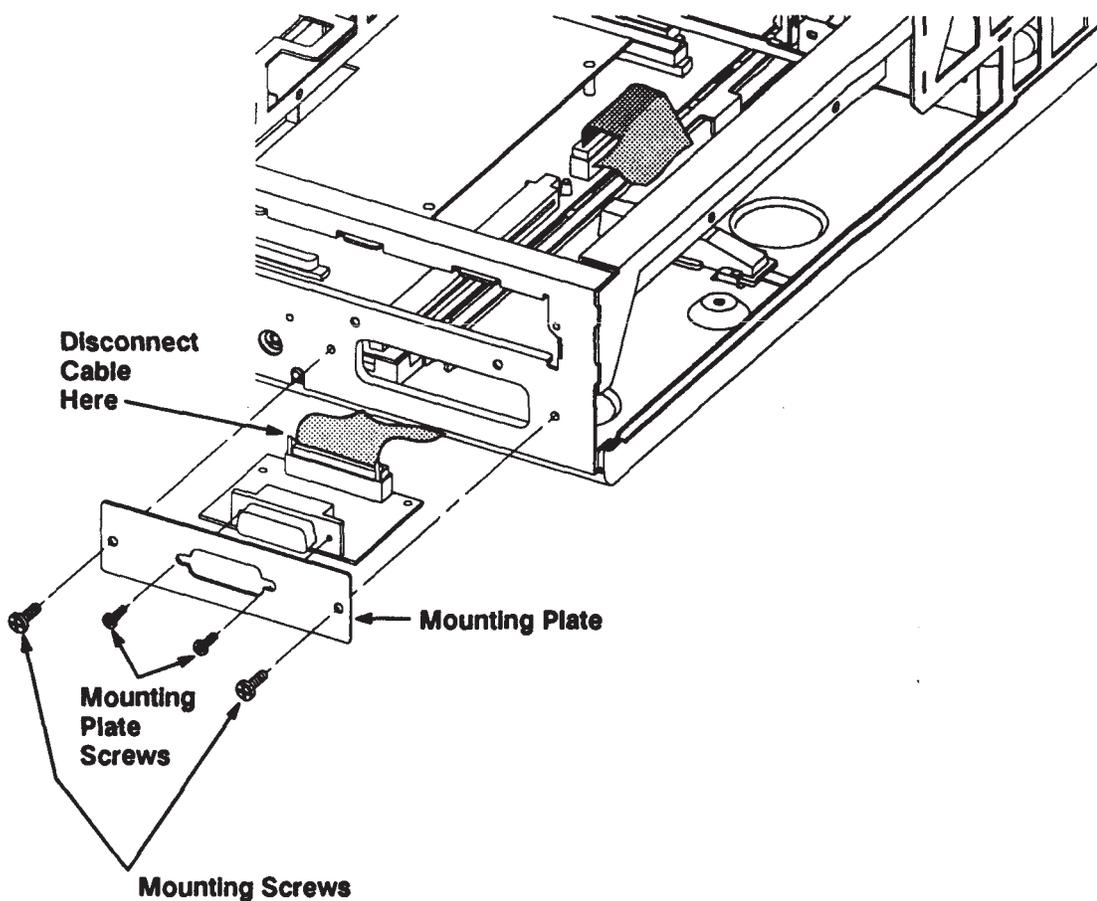


Figure 5-7. HP-IB Interface Board Removal (Model 400t and 400dl)

5.3.5 Winchester Disk Drive Removal and Replacement (Model 400t and 400dl)

Figure 5-8 shows how to remove a Winchester disk drive. Perform the following steps to replace a drive:

1. Remove the screw that secures the drive to the system's front panel.
2. Lift up the side of the drive that's nearest the front of the system unit and slip the two tabs of the disk mounting bracket from their slots.
3. Disconnect the data and power cables from the drive.
4. Reverse these steps to replace the disk drive. Refer to Appendix A to verify that the disk drive is jumpered correctly.
5. After replacing a Domain/OS drive, you must run options 7 and 1 of the **invol** utility to add the badspot list and format the drive. For more information on the **invol** command, see the *Domain Hardware Utilities Reference*.

After replacing an HP-UX drive, you must use the **mediainit** command to format the disk. For more information on the **mediainit** command, see the *HP UX Reference Volume 1: Section 1* manual.

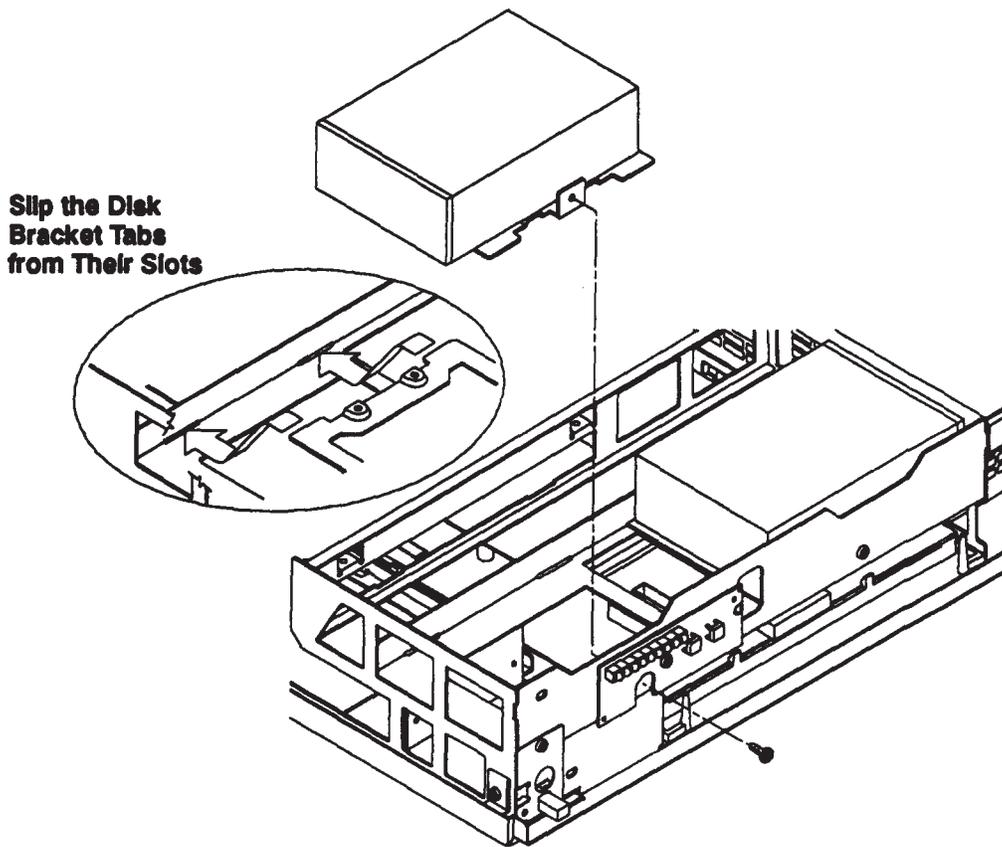


Figure 5-8. Disk Drive Removal (Model 400t and 400dl)

5.3.6 Emulator Board Removal and Replacement (Model 400t and 400dl)

Figure 5-9 shows how to remove the Emulator board. First remove the graphics board. Remove the five screws, then carefully lift the board to disengage the IC pins from the socket on the CPU board. Slide the board through the empty graphics board slot out the top of the system unit.

To replace the Emulator board, reverse the removal procedure. When you seat the Emulator board, carefully insert the Emulator board's IC pins into the socket on the CPU board.

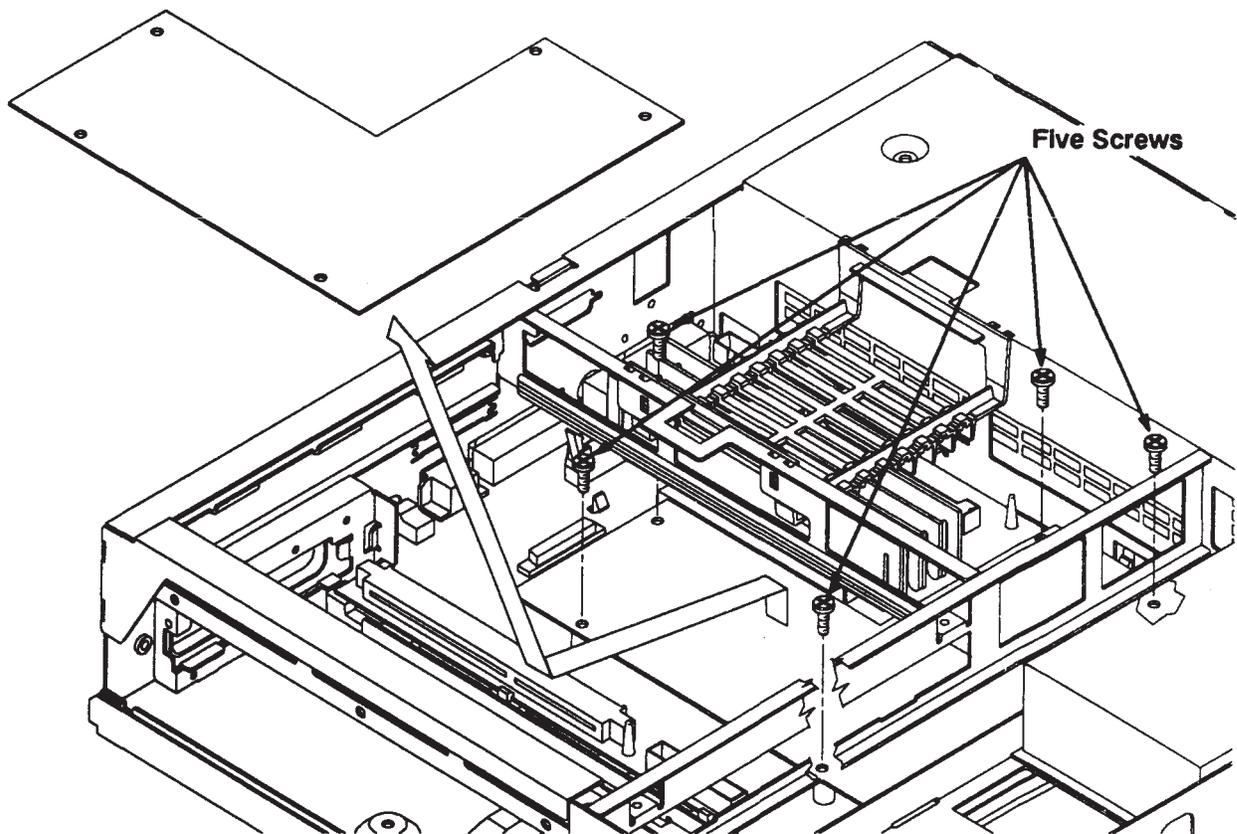


Figure 5-9. Emulator Board Removal (Model 400t and 400dl)

5.3.7 CPU Board Removal and Replacement (Model 400t and 400dl)

Perform the following steps to remove the CPU board:

1. Disconnect all external cables to the system and remove the top cover.
2. Remove the graphics controller board and the memory boards from the system unit.
3. If present, remove the network interface board from the system unit.
4. Disconnect all internal cables connected to the CPU board (see Figure 5-10 for the locations of the cable connectors). If the system has two disk drives, remove one drive so that you can easily disconnect the disk drive data cables from the CPU board.

NOTICE: When you disconnect the graphics cable from the CPU board, note the connector from which you disconnect the cable (SGC or DIO-II) so that you reconnect the graphics cable to the correct connector.

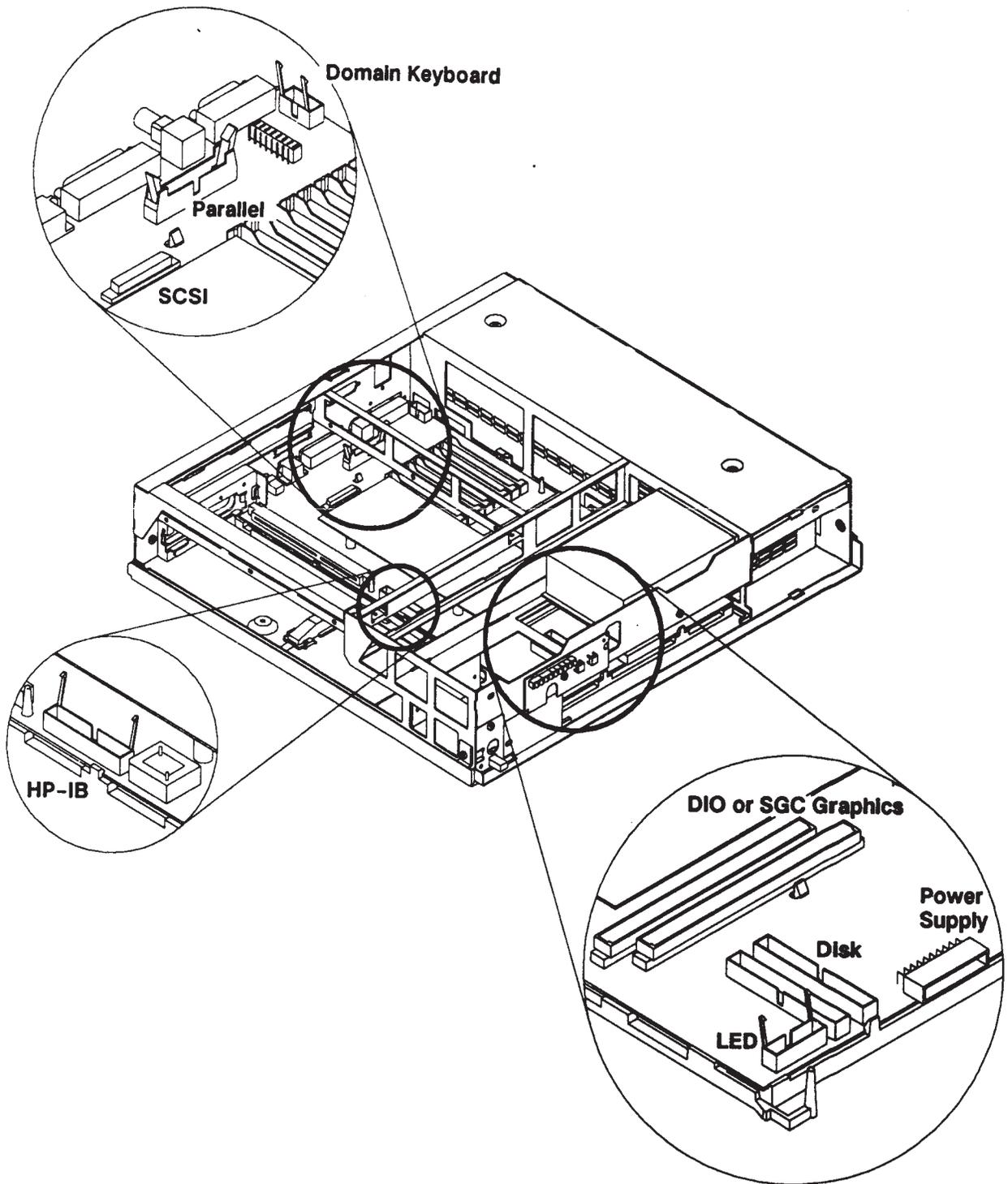


Figure 5-10. Disconnecting Internal Cables from the CPU Board (Model 400t and 400dl)

5. Push in the handles of the CPU board support bracket and slide the CPU board assembly out the front of the unit (see Figure 5-11).

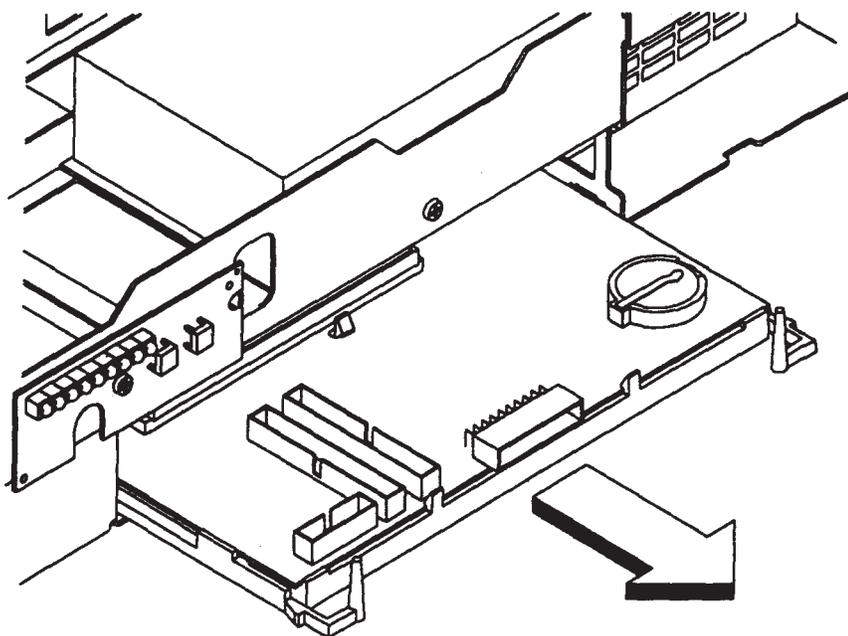
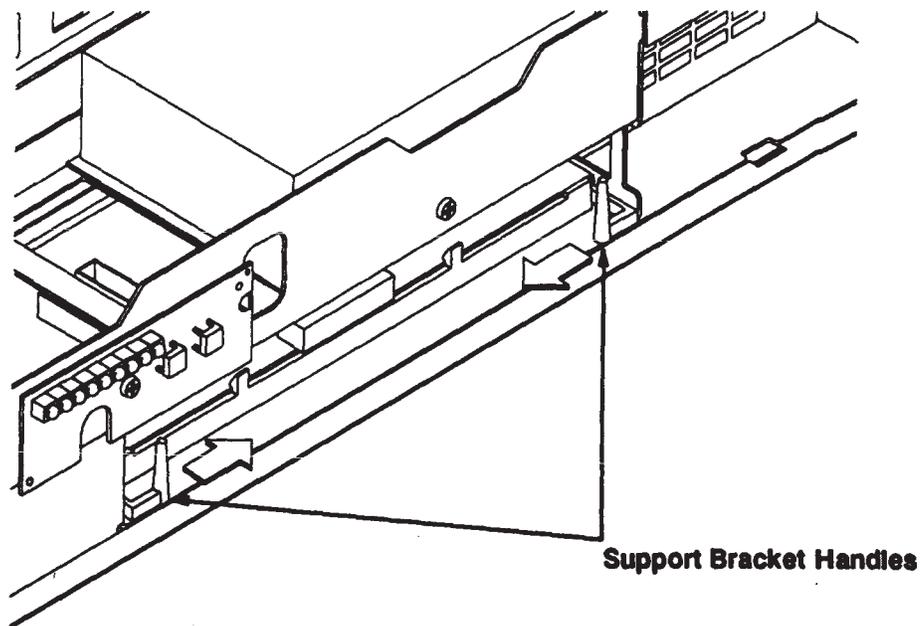


Figure 5-11. Sliding the CPU Board out of the System Unit (Model 400t and 400dl)

6. Note the jumper settings for the EtherLAN port and the clock speed on the CPU board. Set the jumpers on the new CPU board accordingly (see Figure 5-12). For more information about the jumper settings on the CPU board, refer to Appendix A.

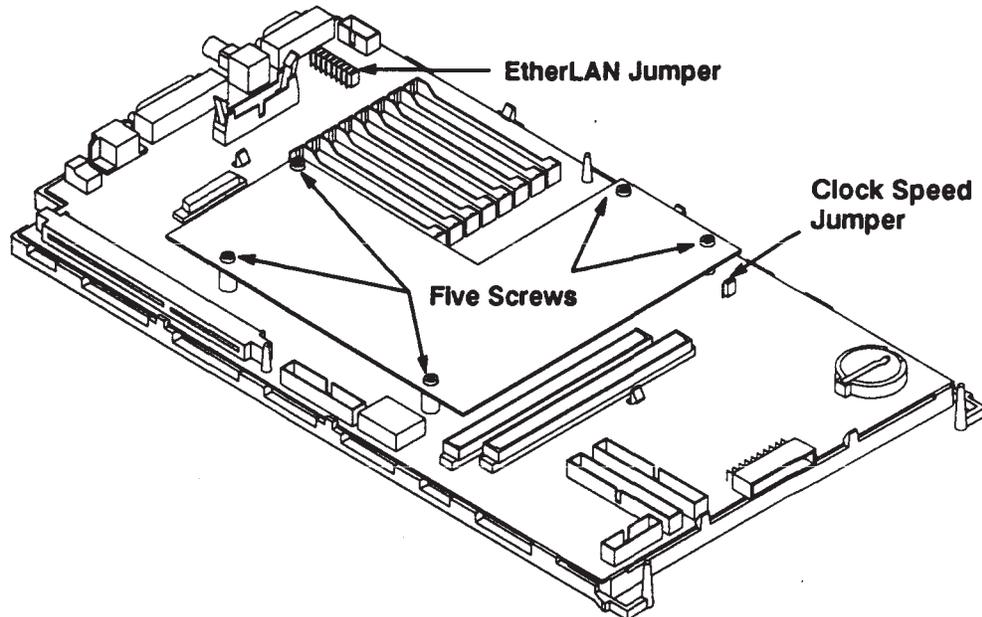


Figure 5-12. CPU Board Component Locations (Model 400t and 400dl)

7. Remove the emulator board from the defective CPU board and install it on the new CPU board. Remove the five screws (see Figure 5-12), then carefully lift the emulator board to disengage the IC pins from the socket on the CPU board. Seat the emulator board on the new CPU board by carefully inserting the IC pins of the emulator board into the socket on the CPU board. Install the five screws.

NOTICE: The EEPROM on the CPU board stores the node id used by Domain Compatible systems, and the I/O configuration information used by HP-UX Compatible systems. To retain this information when you replace a CPU board, move the original EEPROM to the new CPU board.

CAUTION: Use an anti-static strap to prevent electrostatic damage to the EEPROM. Electrostatic damage can destroy the EEPROM or erase configuration information from the EEPROM. If the EEPROM should require reconfiguration, refer to Appendix B for Domain Compatible systems, and to Appendix C for HP-UX Compatible systems.

- Use the EEPROM puller (AMP part no. 821903-1) to remove the EEPROM from the defective CPU board and from the new CPU board (see Figure 5-13). Insert the EEPROM from the defective CPU board into the new CPU board, and insert the new EEPROM into the defective CPU board. When you insert the EEPROMs make sure that you orient the flat corner of the EEPROM to the flat corner of the socket, and that the writing on the EEPROM faces up.

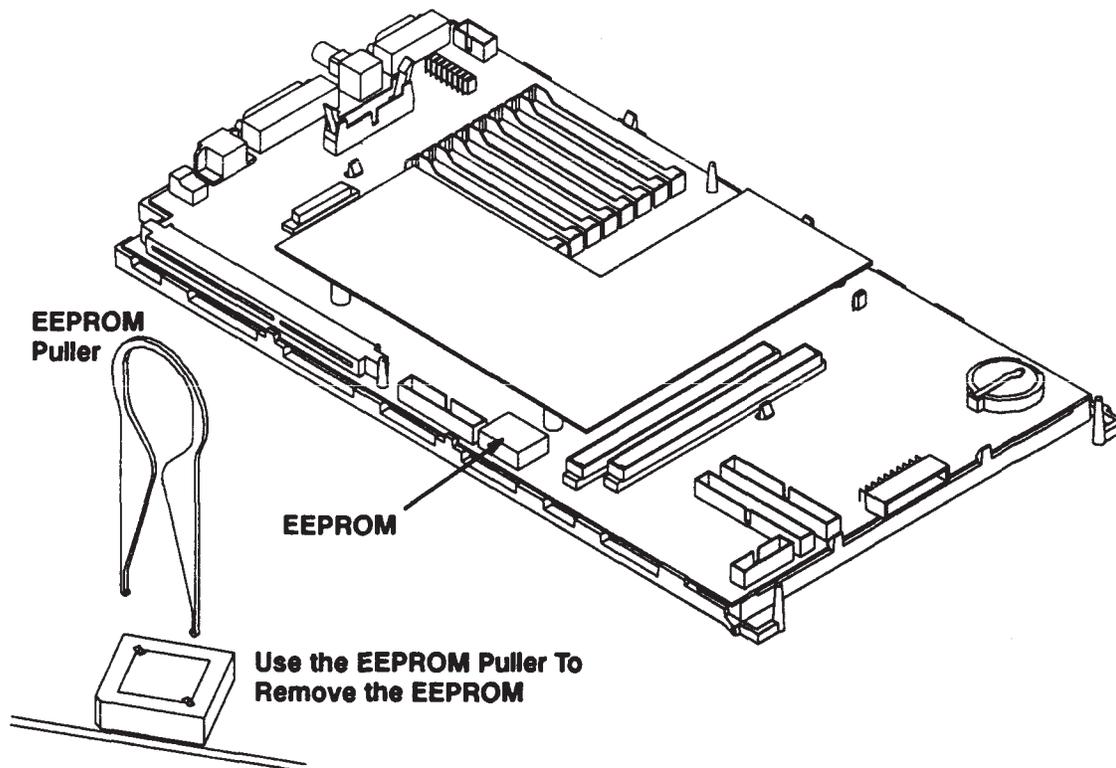


Figure 5-13. Removing the EEPROM (Model 400t and 400dl)

- Install the new CPU board. Make sure that you align the board's external connectors with the slots in the rear of the system unit.
- Install the cables, boards, and memory modules that you removed earlier.
- Replace the top cover.
- Connect the power cord to the system unit and then to the wall outlet.
- Power on the system.

5.3.8

EEPROM Removal and Replacement (Model 400t and 400dl)

Figure 5-14 shows how to remove an EEPROM. When you remove a bad EEPROM, replace it with an EEPROM from a new CPU board. Perform the following steps to remove and replace the EEPROM:

1. Remove the graphics controller board.
2. Use the EEPROM puller (AMP part no. 821903-1) to remove the EEPROM from the two CPU boards.
3. Align the flat corner of the new EEPROM with the flat corner of the EEPROM socket, and press the EEPROM into the socket. Make sure the writing on the EEPROM is facing up.
4. Place the defective EEPROM into the socket of the new CPU board, and return the board to HP.

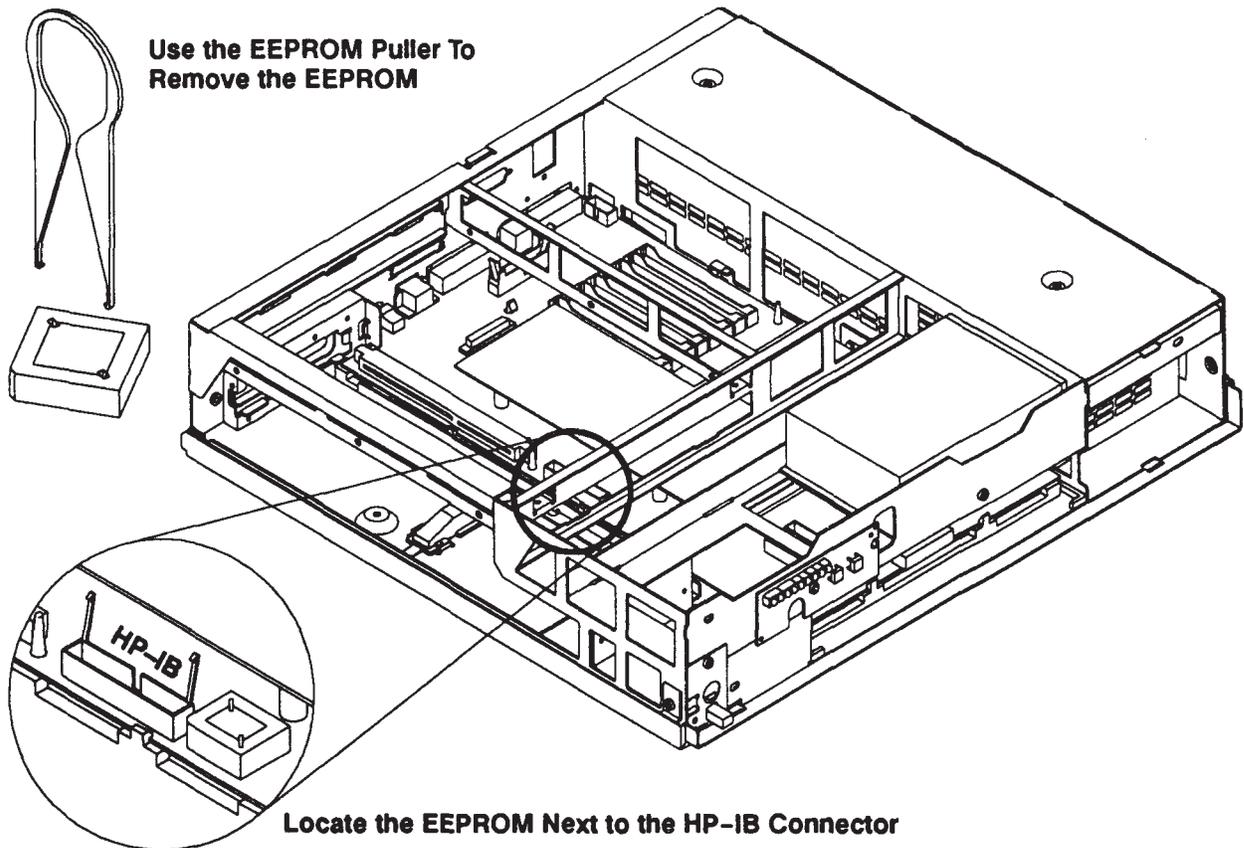


Figure 5-14. Removing the EEPROM from the System Unit (Model 400t and 400dl)

5.3.9 Power Supply Removal and Replacement (Model 400t and 400dl)

Figure 5-15 shows how to remove the power supply. First disconnect the ac power and monitor power cables from the rear of the supply. Disconnect the power supply cables from the CPU board and any disks that are present. Remove the two screws and slide the power supply out of the front of the system unit. To replace the power supply, reverse the removal procedure.

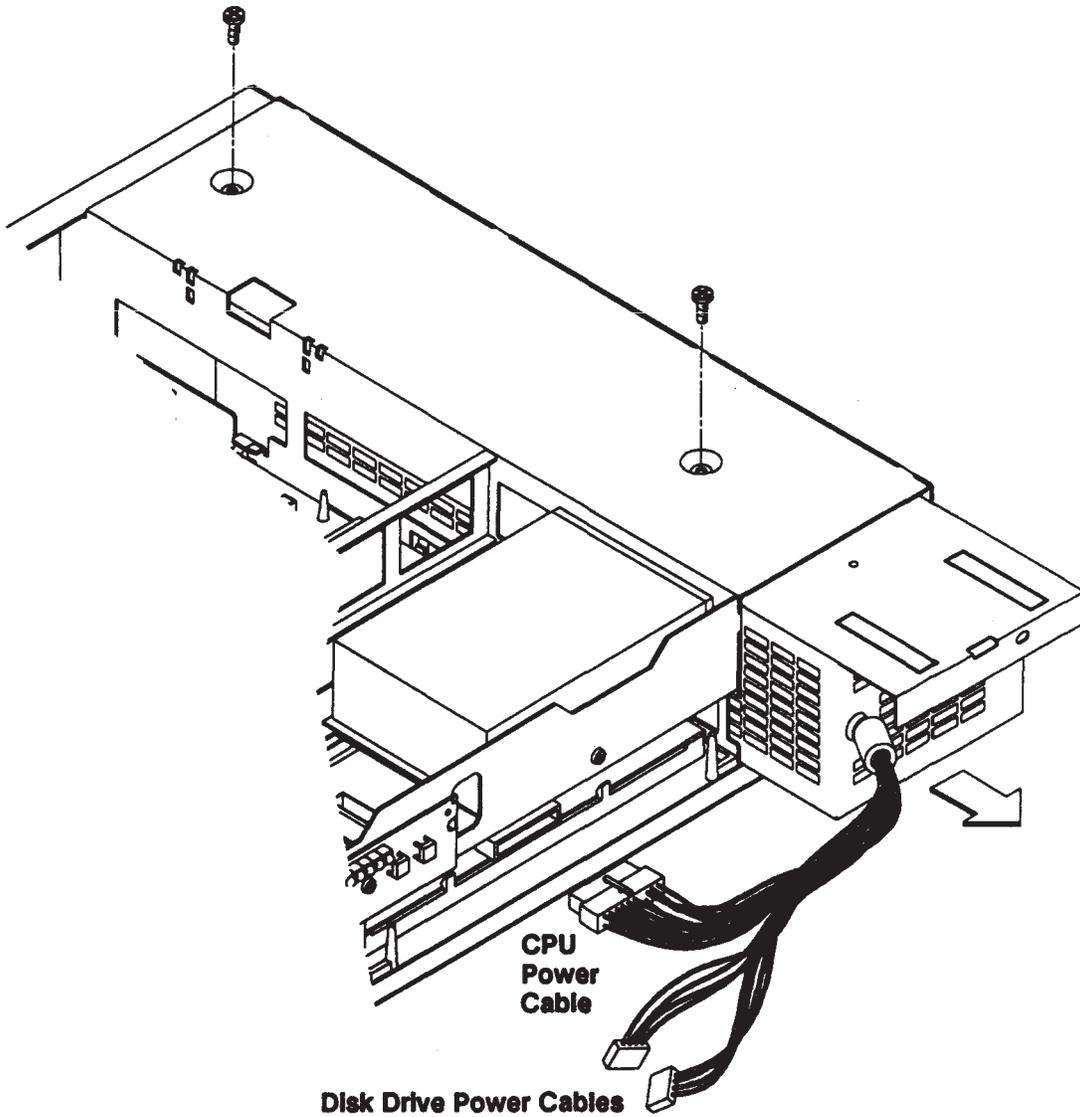


Figure 5-15. Power Supply Removal (Model 400t and 400dl)

5.3.10 Power Switch Panel Removal and Replacement (Model 400t and 400dl)

To remove the power on/off switch panel, disconnect connector J002 and remove the screw as shown in Figure 5-16. To replace the switch panel, reverse the removal procedure.

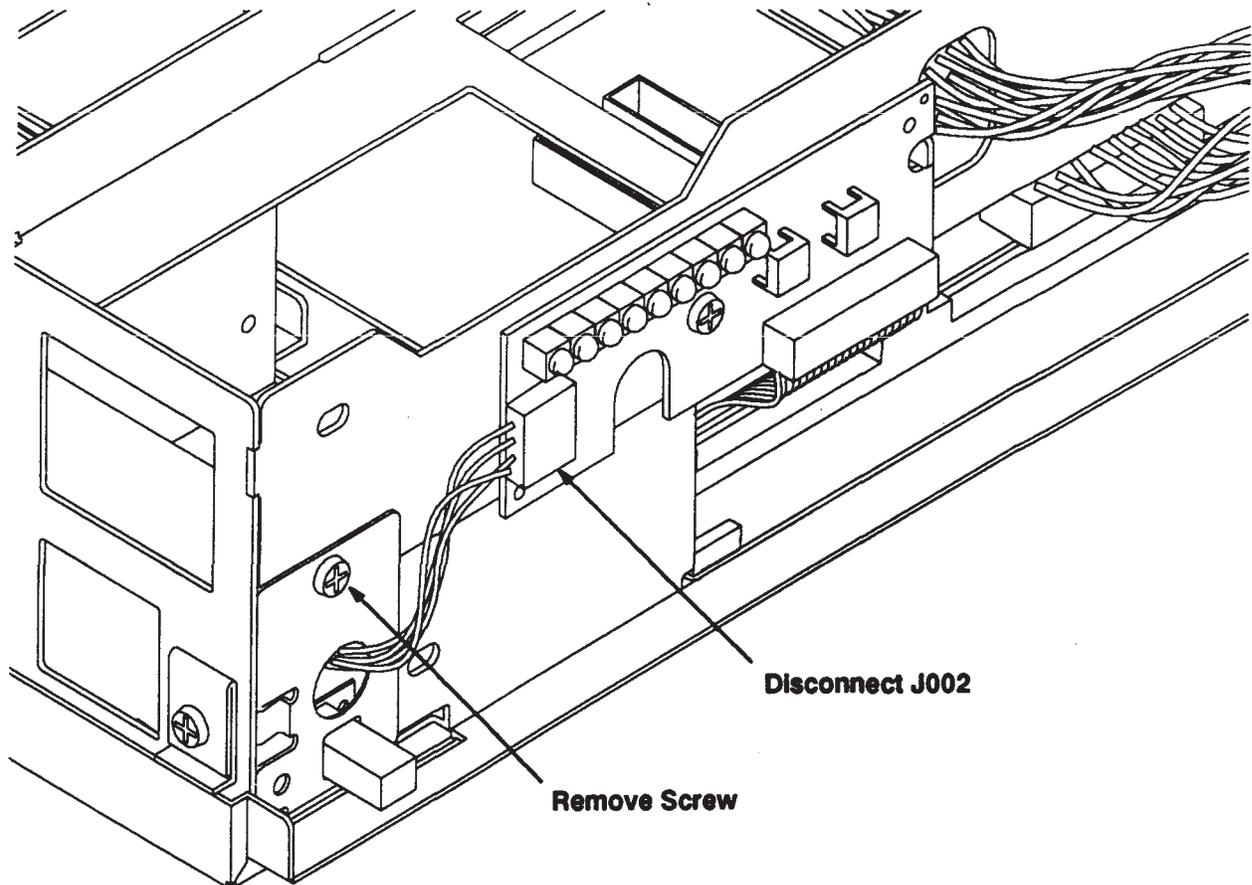


Figure 5-16. Power Switch Panel Removal (Model 400t and 400dl)

5.3.11 LED Board Removal and Replacement (Model 400t and 400dl)

Figure 5-17 shows how to remove the LED board. Disconnect connectors J001 and J002 from the board, then remove the screw. To replace the LED board, reverse the removal procedure.

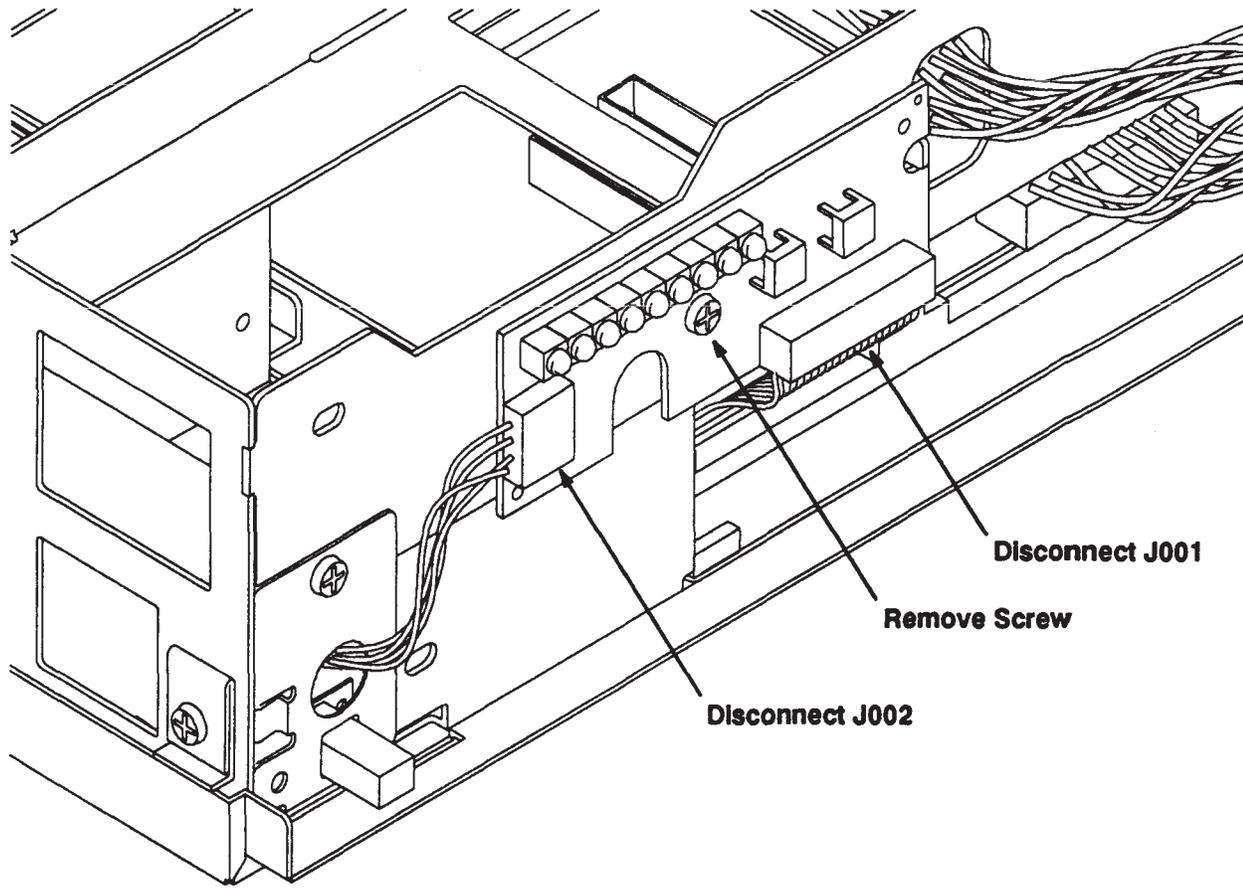


Figure 5-17. LED Board Removal (Model 400t and 400dl)

5.3.12 Calendar Battery Removal and Replacement (Model 400t and 400dl)

Remove the CPU board from the system unit. Lift the edge of the battery at the notch in the socket, and slide the battery from the socket (see Figure 5-18). Slide the new battery into the socket with the positive side facing up. If the system is running Domain/OS, run the **calendar** program after you replace the battery.

WARNINGS: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Discard used battery according to manufacturer's instructions.

Dispose of the defective battery properly. The battery may explode if mistreated. **DO NOT RECHARGE, DISASSEMBLE OR DISPOSE OF IN FIRE.**

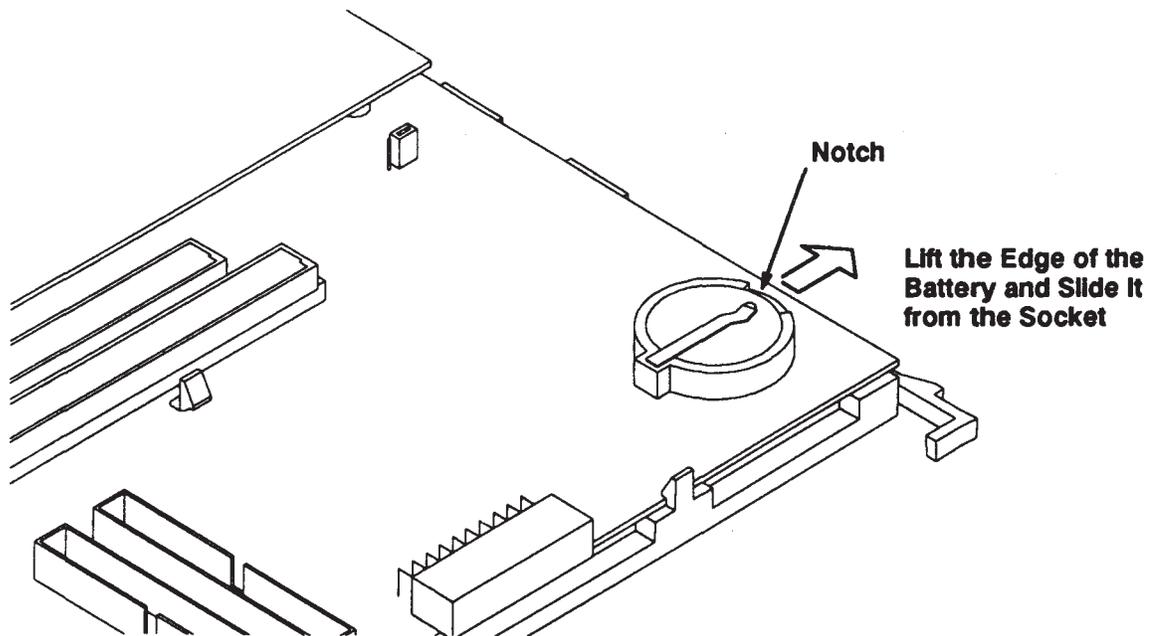


Figure 5-18. Calendar Battery Removal (Model 400t and 400dl)

5.4 FRU List and Illustrated Parts Breakdown (IPB)

This section lists Field Replaceable Units (FRUs) for the Model 400t and 400dl workstations. Figure 5-19 shows an IPB of the Model 400t and 400dl system unit. Match the numbers in the IPB to the FRUs listed in Table 5-1. Refer to Table 5-2 for a list of FRUs that are external to the system unit.

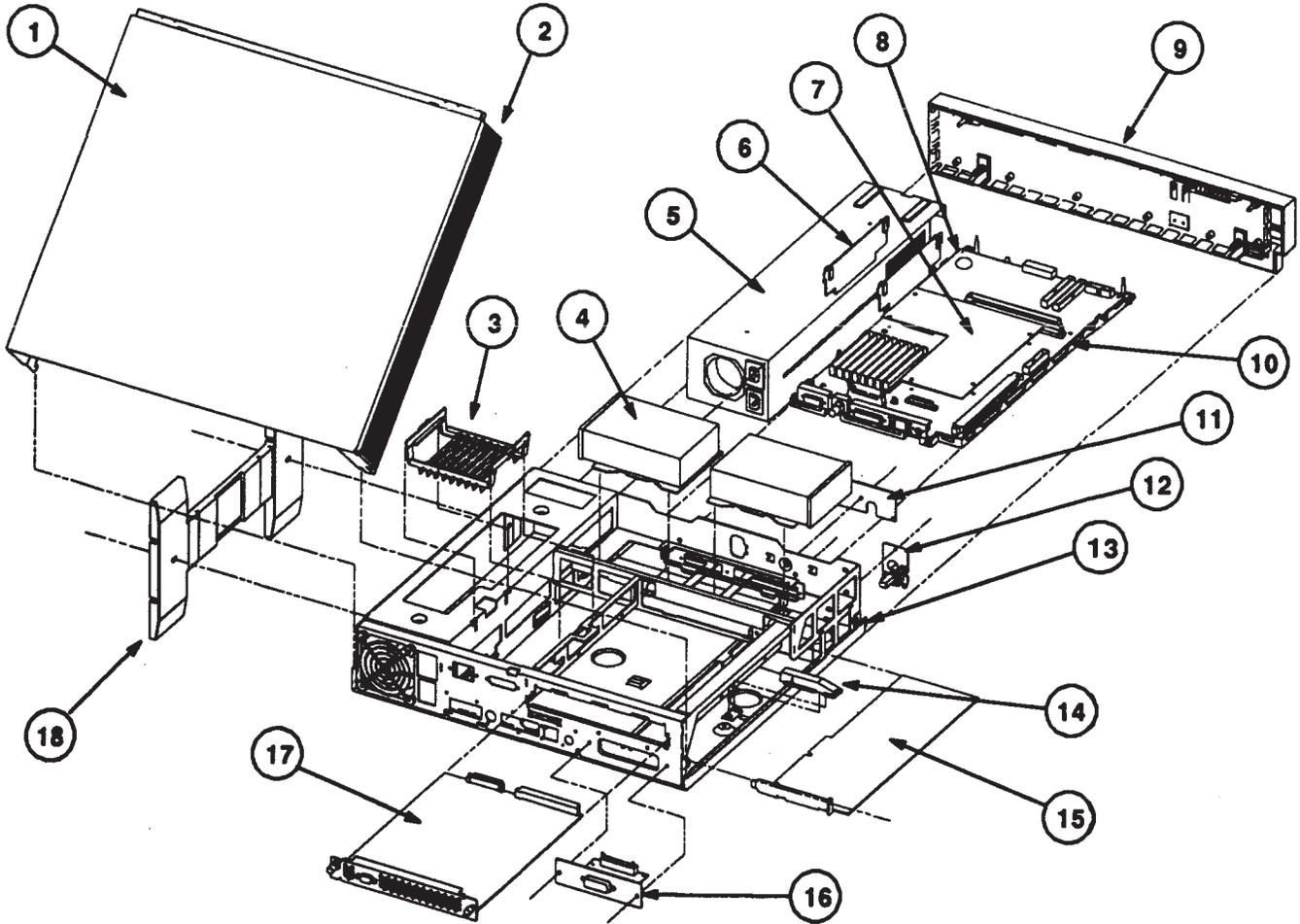


Figure 5-20. Illustrated Parts Breakdown of the System Unit

Table 5-1. Model 400t and 400dl System Unit FRUs

| Item | Description | New Part No. | Exchange Part No. |
|--|-------------------------------|--------------|-------------------|
| 1 | Top Cover | A1630-62007 | |
| 2 | Side Bezel | A1630-40009 | |
| 3 | Memory Clamp | A1630-40024 | |
| 4 | 200 MB Disk * | A1630-60006 | A1630-69006 |
| 5 | Power Supply | 0950-2055 | |
| 6 | Memory Boards | | |
| | 2MB* | 98229-66520 | 98229-69520 |
| | 4MB | 98229-66521 | 98229-69521 |
| 7 | Emulator Board | 98574-66513 | 98574-69513 |
| 8 | Calendar Battery | 1420-0314 | |
| 9 | Front Bezel | A1630-62008 | |
| 10 | CPU Board | A1630-66001 | A1630-69001 |
| 11 | LED Board | A1630-66005 | |
| 12 | Power Switch | A1630-62022 | |
| 13 | Bottom Panel | A1630-60008 | |
| 14 | PC AT Board Skid | A1630-40005 | |
| 15 | PC AT Network Board * | | |
| | Apollo Token Ring | A1658-66004 | |
| | 802.5 Token Ring | A1658-66005 | |
| 16 | HP-IB Controller Board Assy * | | |
| | HP-IB Board | A1421-66545 | |
| | HP-IB Board Mounting Plate | A1630-00005 | |
| 17 | Video Board | | |
| | VRX Monochrome | A1630-456003 | A1630-69003 |
| | VRX Color • | A1416-66571 | A1416-69571 |
| 18 | Floor Stand | 5041-2467 | |
| | Internal Cables (Not Shown) | | |
| | Apollo Keybd Conn. Cable | 62013 | |
| | Disk Data Cable • | A1630-62014 | |
| | Parallel Port Cable * | A1630-62014 | |
| | SCSI Connector Cable * | A1630-62020 | |
| | LED Board Cable | A1630-62021 | |
| | HP-IB Board Cable | A1630-62018 | |
| * Not available on Model 400dl workstations. | | | |

Table 5-2. Model 400t and 400dl Non-System Unit FRUs

| FRU Description | New Part No. | Exchange Part No. |
|---------------------------------|--------------|-------------------|
| 19" Monochrome Monitor | 2090-0235 | 98774-69001 |
| 19" Color Monitor | 2090-0229 | 98754-69001 |
| 16" Color Monitor | 2090-0213 | |
| Signal Cable for Mono. Monitor | 015325 | |
| Signal Cable for Color Monitors | 98700-61603 | |
| Domain Keyboard | 1630-82001 | |
| Domain Mouse | 1630-82009 | |
| HP Keyboard | 46021A | |
| HP Keyboard cable | 46020-60001 | |
| HP Mouse | 46060B | |
| Cable for External SCSI Device | A1630-62019 | |

Part 2 Removing and Replacing Model 400s System Unit FRUs

5.5 System Unit Assemblies

This section explains how to remove the Model 400s system unit's assemblies, including the cables and connectors that link the assemblies. Before you can remove most assemblies, one or more covers must be removed.

Before you remove any assembly, you should safely shut down the system by logging out and turning OFF the system unit. Remove the power cord.

CAUTION: Make sure that you are properly grounded before you attempt any of the following procedures. Use an anti-static mat with static straps and other static prevention devices whenever possible.

NOTICE: Always replace the system unit covers during troubleshooting sessions if the system is to run for an extended period of time. The system unit cover is used to maintain proper air flow cooling within the system unit.

5.5.1 DIO-II Accessory Boards Removal and Replacement (Model 400s)

DIO-II accessory boards include video, graphics, and other types of DIO-II accessories.

Refer to Figure 5-21 and follow these steps. Reverse these steps to replace the board.

1. Remove all cables attached to the board.
2. Loosen the DIO-II board attaching screws.
3. Remove the DIO-II board.
4. Note any configuration switches or jumpers as their settings need to be used on the replacement board.

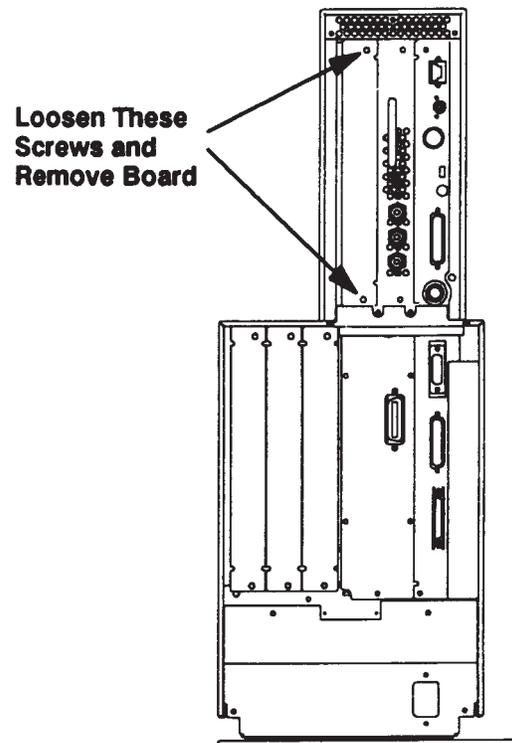


Figure 5-21. Model 400s DIO-II Accessory Board Removal

5.5.2 Power Supply Removal and Replacement (Model 400s)

Refer to Figure 5-22 and follow these steps to remove the supply. Reverse these steps to replace the power supply.

1. Remove the four power supply screws.
2. Pull the power supply out about 4 inches.
3. Disconnect the two power distribution cable connectors from the power supply:
 - A. Use a flat-tipped screwdriver to press the large connector's left and right tabs, then pull the connector out.
 - B. On the small connector, press the tab in and pull the connector out.
4. Remove the power supply.

The entire power supply, including its sheet metal, is replaced with a new one.

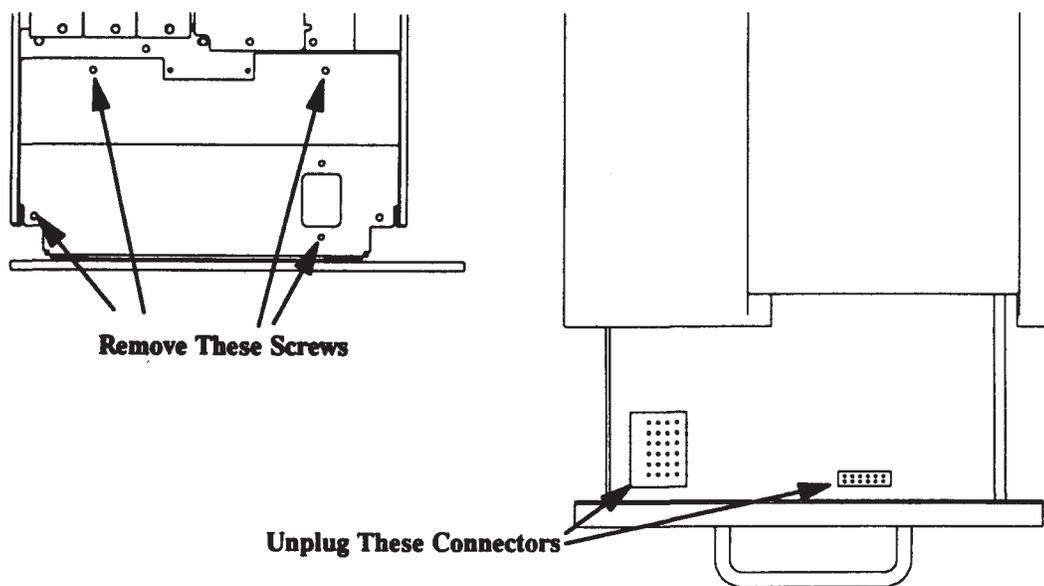


Figure 5-22. Model 400s Power Supply Removal

5.5.3

Top Cover Removal and Replacement (Model 400s)

Refer to Figure 5-23 for removing the top cover. Follow these steps to remove the top cover. Reverse these steps to replace the top cover.

1. Loosen the two screws on the back of the top cover.
2. Lift up the back of the top cover, then pull it back to release the two cover hooks from their catches on each side at the front of the chassis.
3. Lift the top cover up and off the system unit.

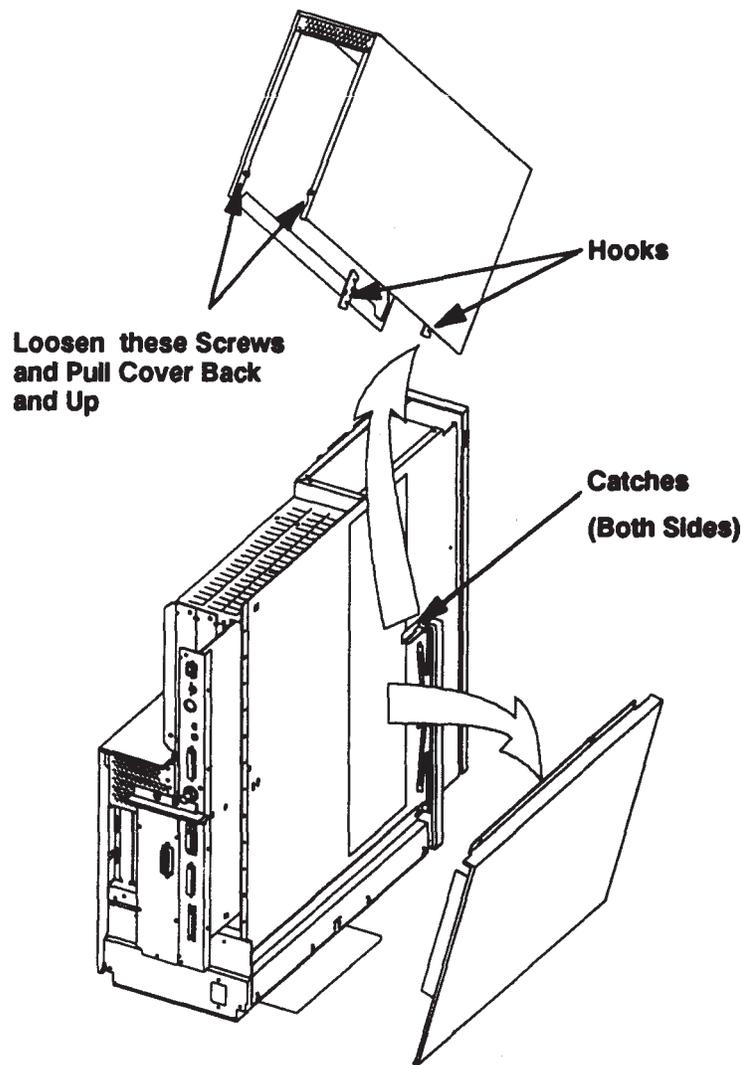


Figure 5-23. Model 400s Top and Left Side Cover Removal

5.5.4 Right Side Cover Removal and Replacement (Model 400s)

Refer to Figure 5-24 to remove the right side cover. Follow these steps to remove the right side cover:

1. Remove the top cover before removing the right side cover.

NOTICE: Both the left and right side covers should be removed even though only one is required for access. These covers are held in place by the top cover. Without the top cover in place, the side covers may easily fall off.

2. Pull out on the cover's top and it snaps out of the chassis.
3. Lower the cover to disengage its lower lip from the chassis at the bottom and remove the cover.

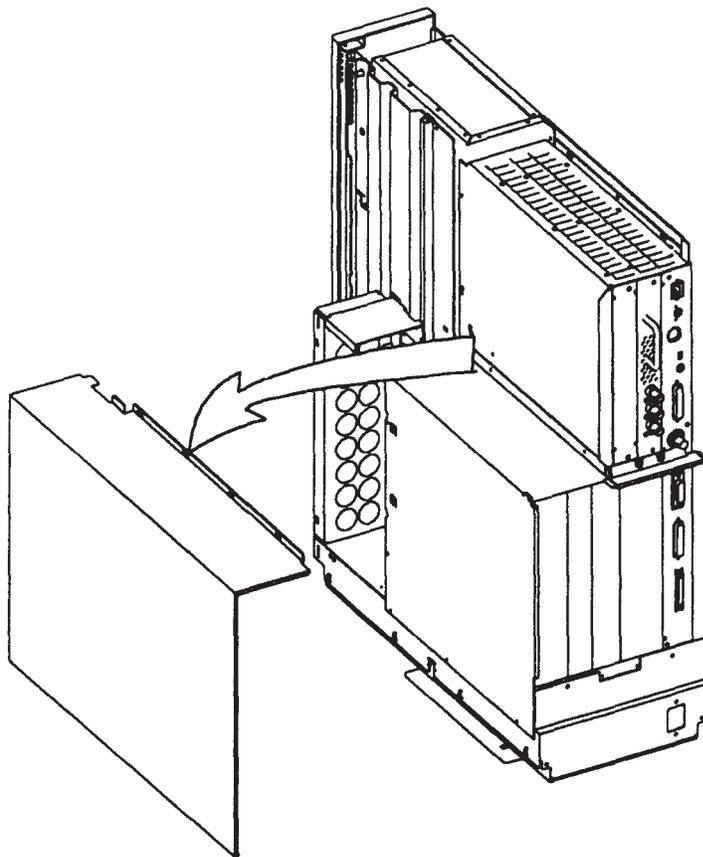


Figure 5-24. Model 400s Right Side Cover Removal

Replace the right side cover by following these steps:

1. If you are replacing the right cover on an ISA system unit, ensure that the RFI cover is properly installed before replacing the right cover.
2. Place the right cover next to the system unit's right side. Then align the tab on the cover's inside bottom edge with the notch on the system unit's right bottom edge.
3. Ensure that the right cover's bottom edge curl is below the edge of the chassis lip. Then, rotate the cover's top toward the chassis and push it into place.
4. Check that the tab on the cover's top, front, inside corner fits in the chassis alignment hole and that the holes in the cover's top, vertical edge fit over the screws holding the card cage to the center wall. The top, back corners must fit over the ends of the lifting handle on the back of the system unit.

5.5.5 Left Side Cover Removal and Replacement (Model 400s)

Follow these steps to remove the left side cover:

1. Remove the top cover before removing the left side cover.

NOTICE: Both the left and right side covers should be removed even though only one is required for access. These covers are held in place by the top cover. Without the top cover in place, the side covers may easily come off.

2. Pull out on the cover's top and it snaps out of the chassis.
3. Lower the cover to disengage its lower lip from the chassis at the bottom and remove the cover.

Replace the left side cover by following these steps:

1. Place the left side cover next to the system unit's left side. Then, align the tab on the cover's inside bottom edge with the notch on the system unit's left bottom edge.
2. Ensure that the left side cover's bottom edge curl is below the edge of the chassis lip. Then, move the cover's top toward the chassis and push it into place.
3. Check that the two tabs on the inside of the cover's top fit in their chassis alignment holes. The top rear corners must fit over the lifting handle edge.

5.5.6 Trim Plates Removal and Replacement (Model 400s)

Both trim plates are identical so they may be used on either side.

Refer to Figure 5-25 and follow these steps to remove the trim plates.

1. Place your thumb on the top front edge of the trim plate, then push the trim plate in. Then, push the trim plate towards the outside of the system unit to unlatch it from the chassis.
2. Repeat step 1 at the bottom of the trim plate.
3. Remove the trim plate by pulling it straight out from the system unit.

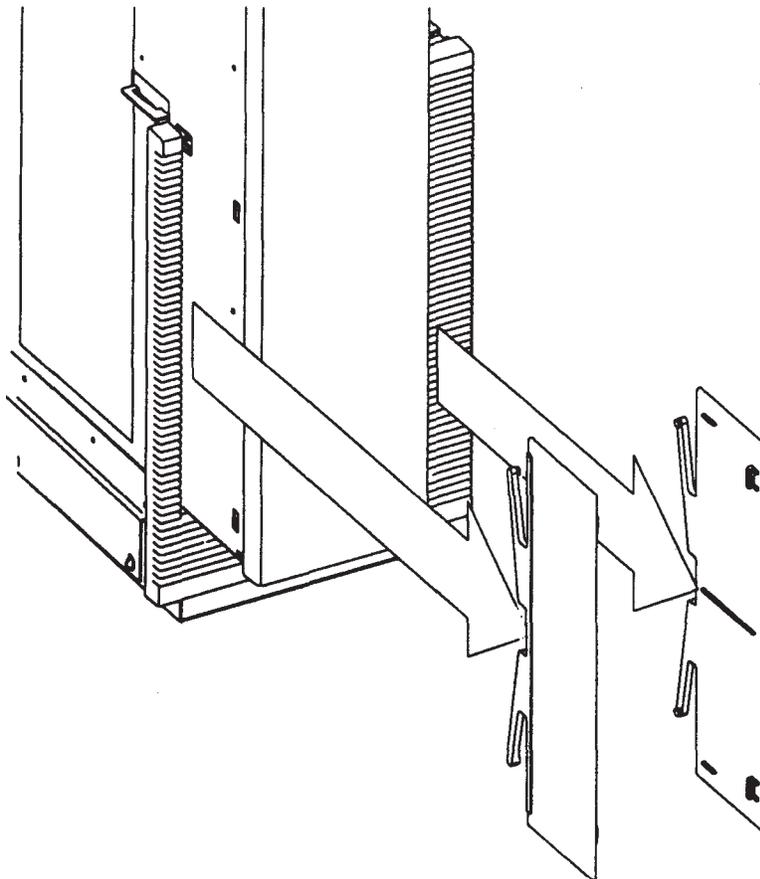


Figure 5-25. Model 400s Trim Plate Removal

5.5.7

Front Door Removal and Replacement

Refer to Figure 5-26 and follow these steps to remove the front door. Reverse these steps to replace the front door.

1. Remove the top cover and right trim plate.
2. Open the front door.
3. Lift the front door up so its top and bottom hinge plates come off their hinge pins. Then, pull the door out to remove it.

Follow these steps to replace the trim plates:

1. With the trim plate's smooth side towards the outside, insert the trim plate into its position on the system unit between the chassis and the bezel.
2. Vertically align the trim plate's catches with their notches in the chassis:
 - On the system unit's right side, there are two notches on the back edge of the chassis trim.
 - On the system unit's left side, there are two rectangular holes on the front left side of the chassis.
3. Push the top of the trim plate back. Then push it towards the inside to hook the top trim plate catch in its chassis notch or hole.
4. Repeat step 3 for the bottom of the trim plate.

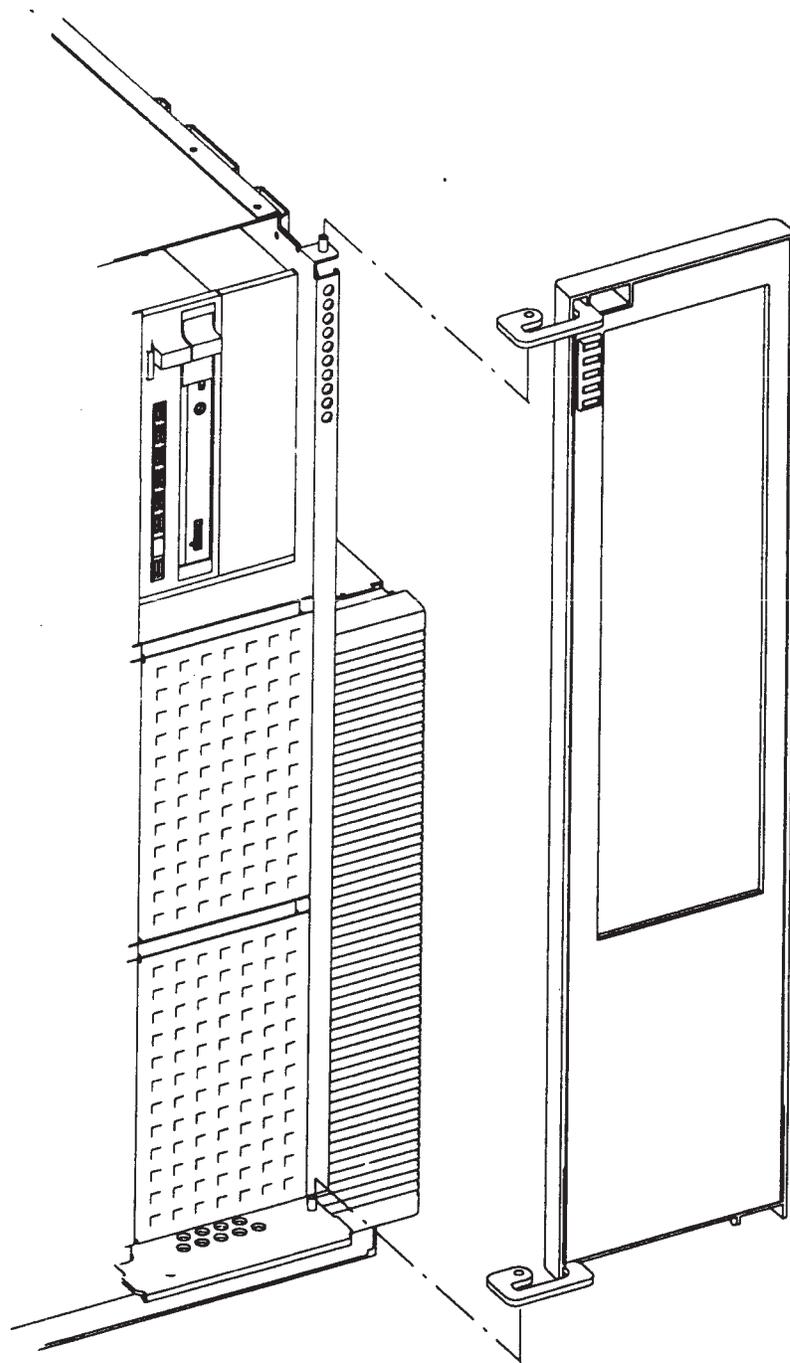


Figure 5-26. Model 400s Front Door Removal

5.5.8 Bezel Replacement (Model 400s)

The bezel is usually not removed for servicing Model 400s system units. If a bezel is damaged, it may be removed by referring to Figure 5-27 and following these steps. However, the catches often break in the process, so you probably cannot reinstall the original bezel.

1. Insert a small, flat-tipped screwdriver into the bezel's left, top catch access hole and push the catch up, then pull out on the bezel's left top side.
2. Insert a small, flat-tipped screwdriver into the bezel's left, bottom catch access hole and push the catch down, then pull out on the bezel's left bottom side.
3. Insert a small, flat-tipped screwdriver into the bezel's right, top catch access hole and push the catch up, then pull out on the bezel's right top side.
4. Insert a small, flat-tipped screwdriver into the bezel's right, bottom catch access hole and push the catch down, then pull out on the bezel's right bottom side.
5. Grasping the bezel's top, right and left sides, pull the bezel off the system unit.

To replace the bezel, follow these steps:

1. Position the bezel on the system unit with its top away from the system unit. Align its two lower catches with their respective holes in the chassis.
2. Rotate the top of the bezel into place, fitting the power switch hole over the power switch pushbutton and the two left catches into place.
3. Push the bezel in and snap it into place. Make sure that the bezel fits correctly into all the chassis parts.

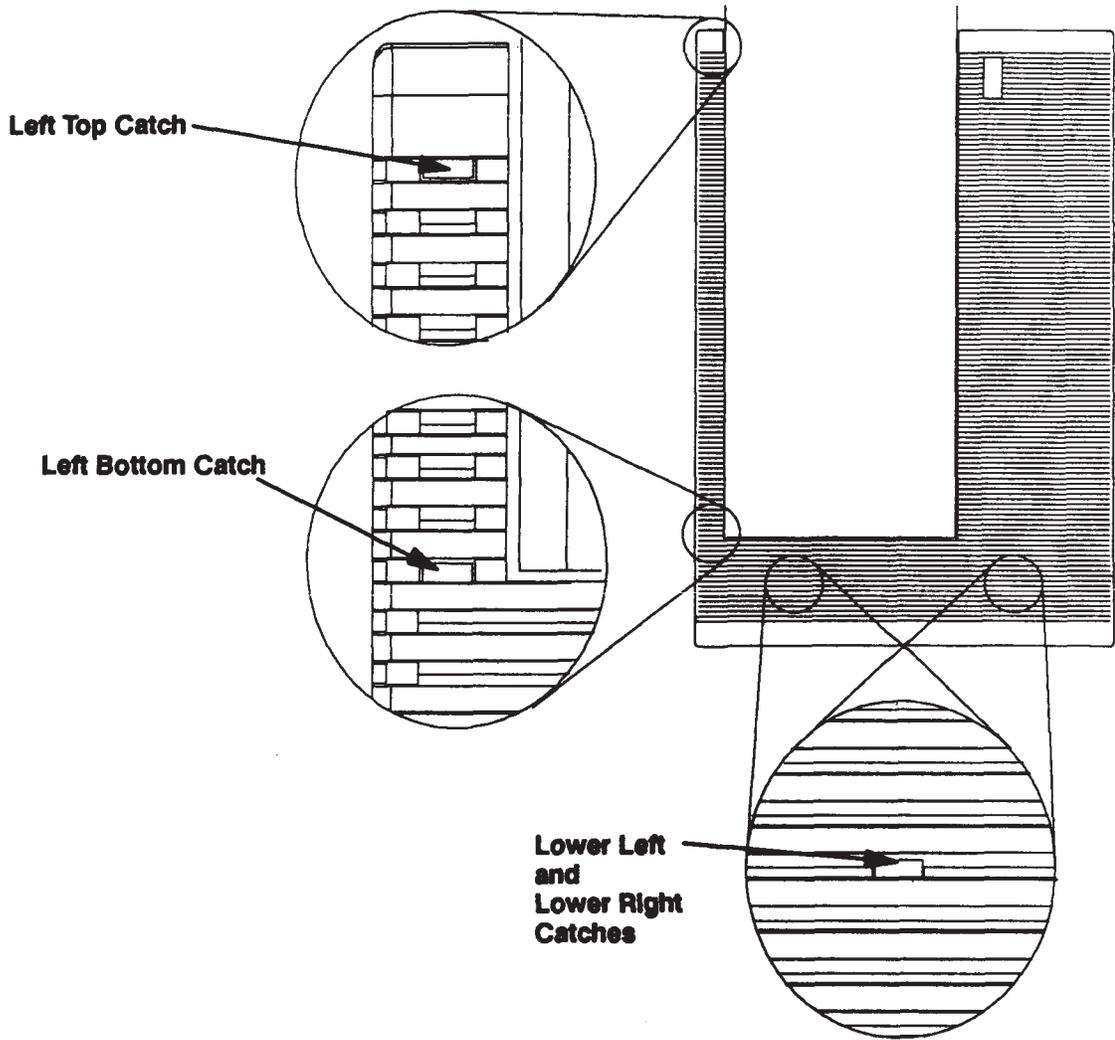


Figure 5-27. Model 400s Bezel Removal

5.5.9 Mass Storage Device Removal and Replacement (Model 400s)

Refer to Figure 5-28 and Figure 5-29 and follow these steps to remove a mass storage device.

1. Remove the top cover, both side covers, and the right trim plate.
2. Remove the screw in each mass storage access cover. Remove the cover from the left side of the chassis.
3. Remove the two screws on the right front edge of the chassis holding the device bracket to the chassis.
4. Slide the device out about two inches. Be careful not to loosen any of the RFI clips attached to the chassis or device.
5. Disconnect the SCSI and power cable connectors from the back of the device.
6. Remove the bracket holding the device by sliding it out of the front of the unit.
7. Remove the screws holding the device in its mounting bracket and remove the device. These screws are different from the other screws in the system unit; keep them separate.
 - For full-height devices, one screw attaches the device to the bracket on each side.
 - For half-height devices, there are two or four screws in the bracket holding the device. Remove these screws and pull the device out of the front of the bracket.
8. Note the configuration jumper locations in Appendix B for setting the device address and other functions.

Reverse these steps to replace a mass storage device.

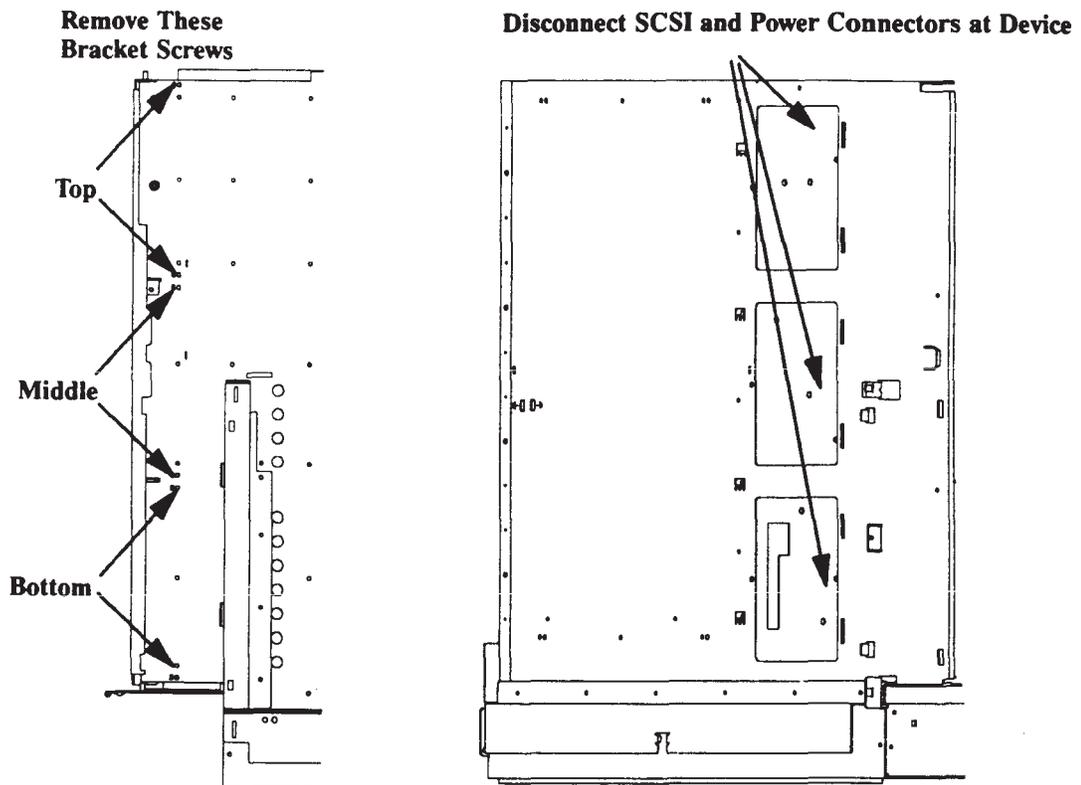


Figure 5-28. Model 400s Mass Storage Device Removal

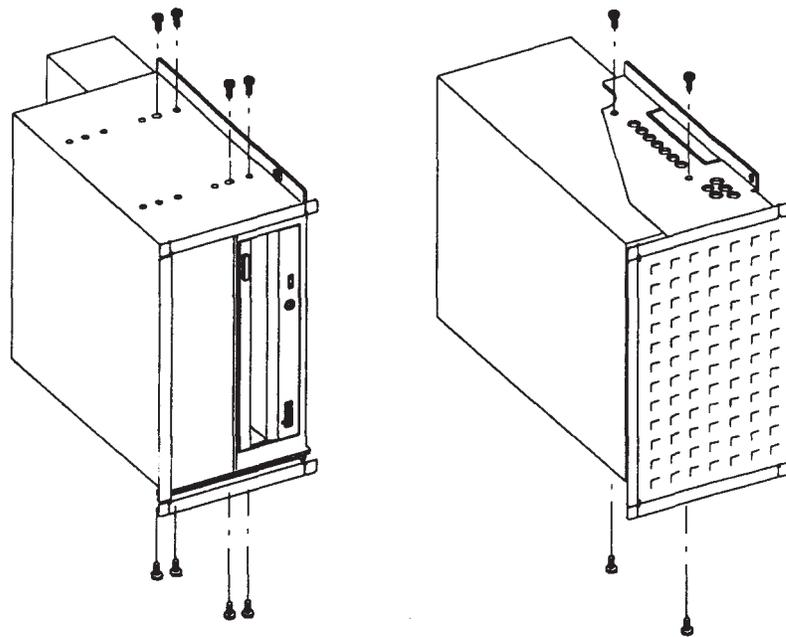


Figure 5-29. Model 400s Mass Storage Device Bracket Removal

5-5.10 HP 330/660 MB Disk Controller Board Removal and Replacement (Model 400s)

The controller board on these disks may be replaced if it is found to be bad. This permits users to save their data on the disk.

Follow these steps to remove the controller board. Reverse these steps to replace the controller board.

1. Remove the disk from its bracket.
2. Remove the two screws from the inside front holding the controller board to the disk housing.
3. Remove the back two screws holding the controller board to the disk housing. Remove the insulator.
4. Lift the controller board from right to left with the drive front facing you and disconnect the three ribbon cables from the board.
5. Remove the controller board.

5.5.11 Internal SCSI Cable Removal and Replacement (Model 400s)

Refer to Figure 5-30 and follow these steps to remove the internal SCSI cable:

1. Remove the top and side covers, right trim plate, and mass storage covers. Slide out all internal mass storage devices about two inches.
2. Disconnect the SCSI cable from the back of the motherboard.
3. Remove the screw holding the SCSI cable's terminator to the top, inside mass storage device cage.
4. Remove the SCSI cable from the cable clips at the back of the mass storage device cage. Then, remove the cable from the unit.

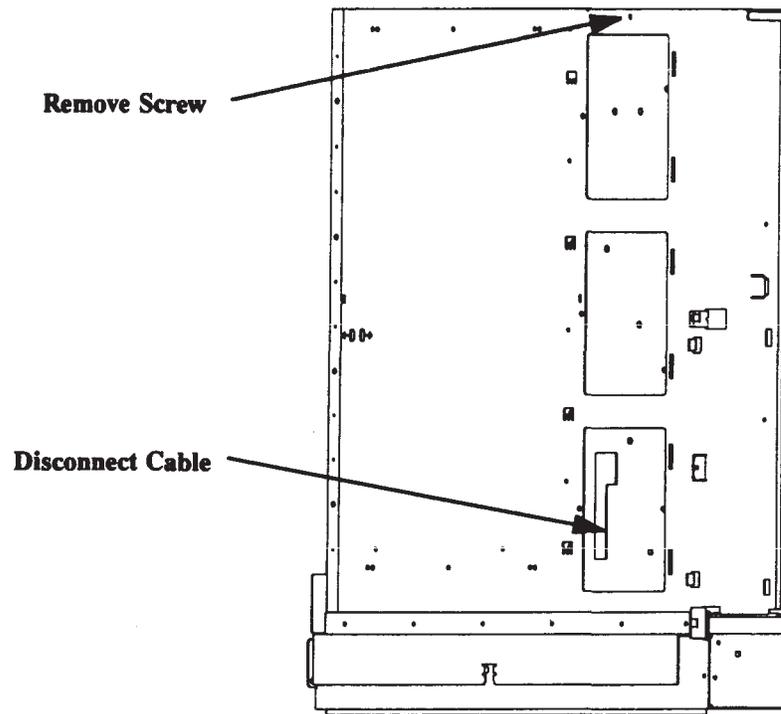


Figure 5-30. Model 400s Internal SCSI Cable Removal

Follow these steps to replace the internal SCSI cable:

1. Position the SCSI cable in the unit with the terminator end at the top. Then, replace the screw to hold the terminator in place.
2. Fit the SCSI cable to the top cable clip with the two top connectors above the top cable clip.
3. Fit the SCSI cable to the bottom cable clip with one cable connector between the top and bottom cable clip.
4. Connect the SCSI cable's end connector to the motherboard SCSI cable connector.
5. Connect the SCSI cable connector to the mass storage devices.
6. Replace the mass storage devices and all other assemblies that you removed earlier.

5.5.12 Mass Storage Power Distribution Cable Removal and Replacement (Model 400s)

Refer to Figure 5-31 and follow these steps to remove the mass storage power distribution cable:

1. Remove the top and side covers, right trim plate, and mass storage covers. Slide out all internal mass storage devices about two inches.
2. Disconnect the mass storage power distribution cable from the back of the motherboard and all mass storage devices.
3. Remove the power cable from the cable clips at the back of the mass storage device cage. Then, remove the cable from the unit.

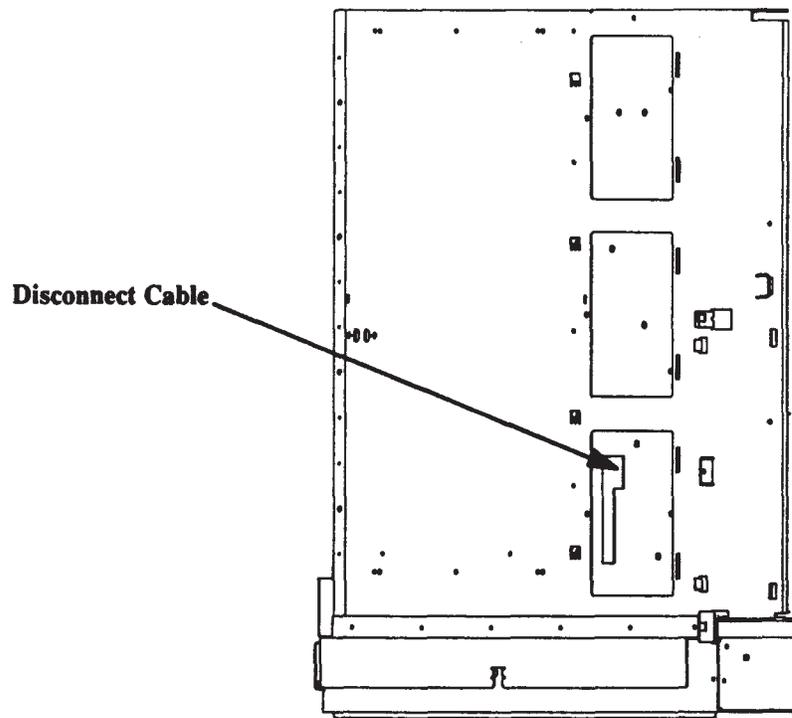


Figure 5-31. Model 400s Mass Storage Power Distribution Cable Removal

Follow these steps to replace the mass storage power distribution cable:

1. Position the power cable in the unit with the end having two connectors close to each other at the top.
2. Fit the power cable to the top cable clip with the two top connectors above the top cable clip.
3. Fit the power cable to the bottom cable clip with one cable connector between the top and bottom cable clip,
4. Connect the power cable's end connector to the motherboard's back power cable connector.
5. Connect the power cable to the mass storage devices.
6. Replace the mass storage devices and all other assemblies that you removed earlier.

5.5.13 RFI Cover Removal and Replacement (Model 400s)

Refer to Figure 5-32 and follow these steps to remove the RFI cover. Reverse these steps to replace the RFI cover.

1. Remove the top and right side cover.
2. On the top inside edge of the RFI cover, press down on the three tabs that fit into the center wall and pull the cover out.
3. Lift the RFI cover up so its three bottom tabs clear their slots in the bottom outside edge of the ISA card cage and remove the RFI cover.

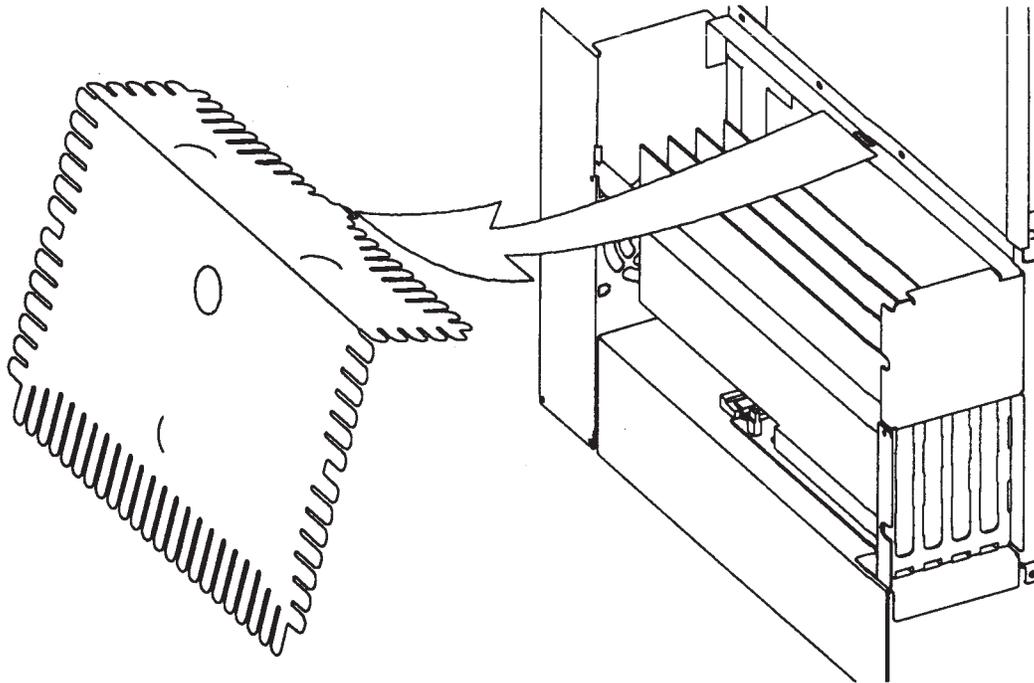


Figure 5-32. Model 400s RFI Cover Removal

5.5.14 ISA Accessory Boards Removal and Replacement (Model 400s)

Refer to Figure 5-33 and follow these steps to remove an ISA board. Reverse these steps to replace an ISA board.

1. Remove the cables connected to the ISA board, the top and right side covers, and the RFI cover.
2. Remove the ISA board clamp.
3. Remove the screw holding the ISA board plate to the card cage.
4. Lift the ISA board up and out of its backplane connector.
5. Remove the ISA board from the card cage.

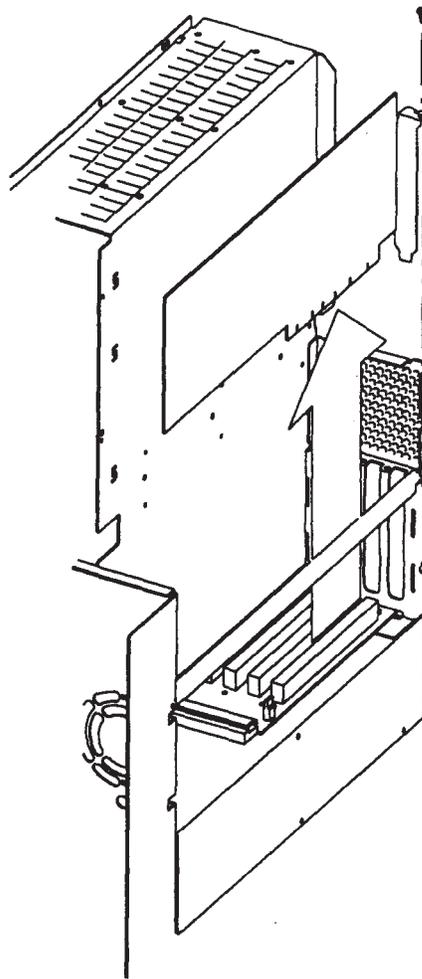


Figure 5-33. Model 400s ISA Board Removal

5.5.15 ISA Backplane Removal and Replacement (Model 400s)

Refer to Figure 5-34 and follow these steps to remove the ISA backplane. Reverse these steps to replace the backplane.

1. Remove the top, side, and RFI covers and all ISA boards.
2. Disconnect the power and card cage fan cables from the ISA backplane.
3. Remove the screw holding the backplane to the chassis.
4. Slide the backplane to the right, disconnecting it from the converter board, until it can be lifted clear of its mounting pins.
5. Remove the backplane.

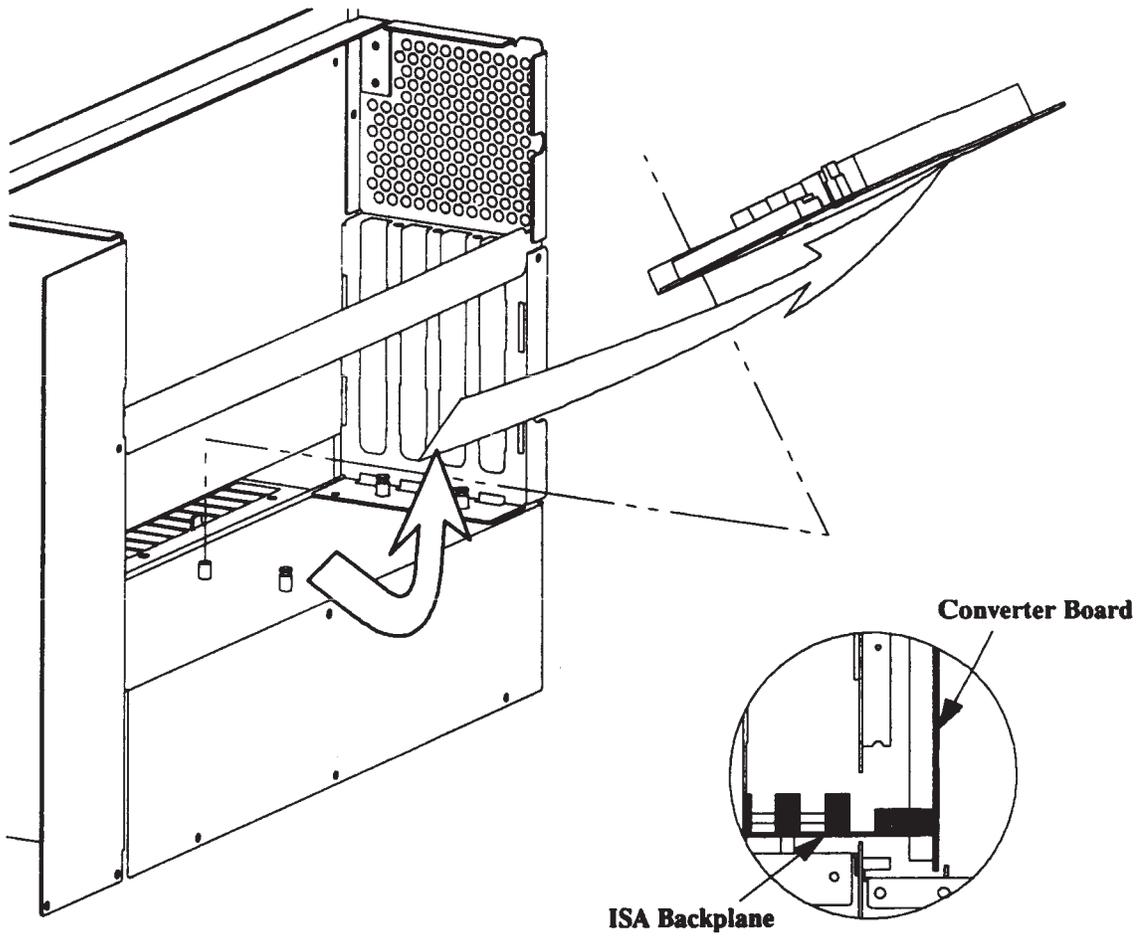


Figure 5-34. Model 400s ISA Backplane Removal

5.5.16 ISA Card Cage Removal and Replacement (Model 400s)

Refer to Figure 5-35 and follow these steps to remove the ISA card cage:

1. Remove the top and side covers, the RFI cover, the HP-IB or blank plate, all ISA cards, and the ISA backplane:
2. Remove the two screws at the rear-bottom of the ISA card cage holding it to the chassis.
3. Remove the screw at the rear, left side of the ISA card cage holding it to the center wall.
4. Remove the five screws at the bottom, right edge of the ISA card cage.
5. Remove the two screws (front and back) on the inside of the ISA card cage.
6. Remove the four screws holding the ISA card cage to the center wall. The ISA card cage is then disconnected from the center wall.
7. Remove the ISA card cage and the ISA power cable connected to the motherboard.

To replace the ISA card cage, follow these steps:

CAUTION: While replacing the ISA card cage, verify that the power switch and LED board cables are clear of their notch in the ISA card cage.

1. Ensure that the RFI clips are correctly installed on the ISA card cage bottom plate.
2. Position the ISA card cage against the center wall, placing the ISA power distribution cable on top of the bottom plate. The back edge must fit outside of the chassis. Align the sheet metal dimples with their holes.
3. Start one screw into the second from the front ISA card cage top hole to hold the ISA card cage in place. Do not tighten the screw.
4. Install the rest of the ISA card cage screws in the bottom, back, inside and top.
5. Look through the front wall and verify that the power switch and LED board cables are clear of their notch in the ISA card cage.
6. Tighten all of the screws.
7. Replace the rest of the assemblies.

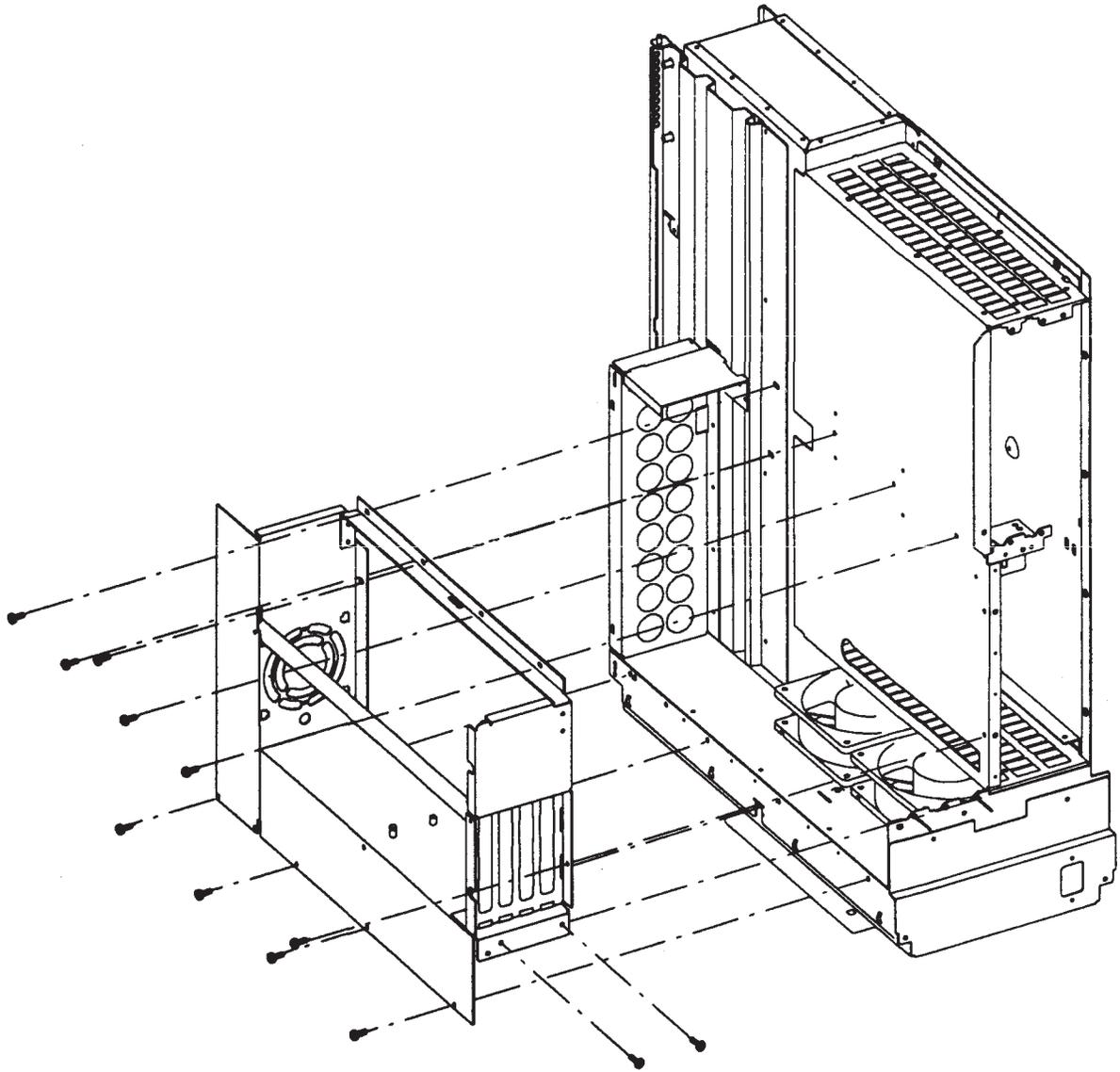


Figure 5-35. Model 400s ISA Card Cage Removal

5.5.17 Card Cage Fan Removal and Replacement (Model 400s)

Refer to Figure 5-36 and follow these steps to remove the card cage fan:

1. Remove the top and right side covers, RFI cover, all ISA cards, ISA backplane, and the ISA card cage.
2. Pry each tab out with a flat-tipped screwdriver. Unhook the fan at each corner.
3. Remove the fan, routing its wires through the hole below the fan.

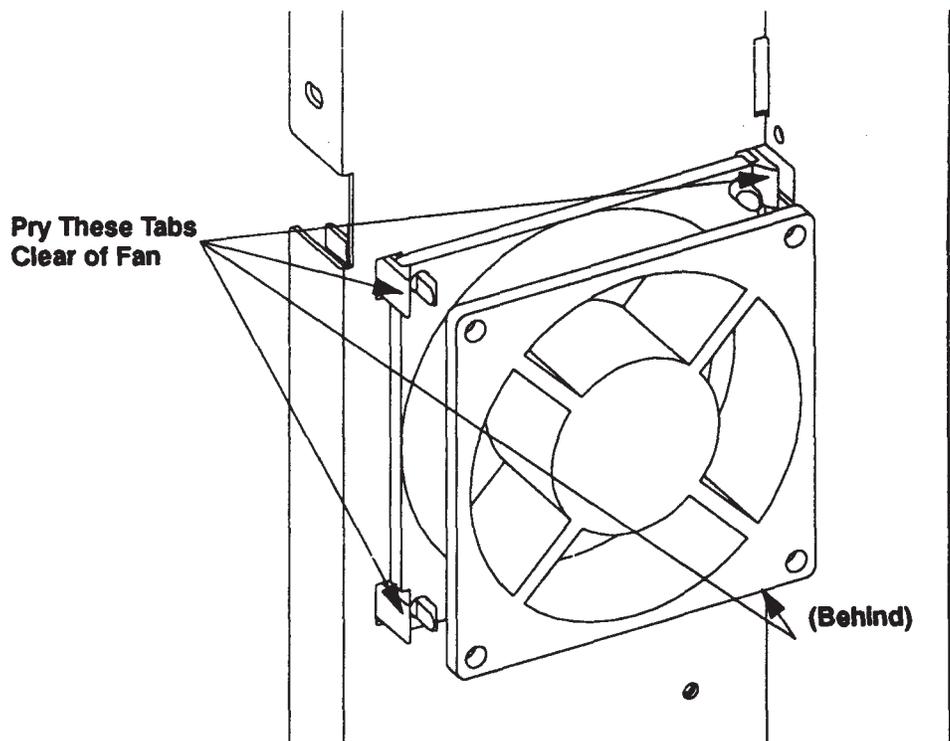


Figure 5-36. Model 400s Card Cage Fan Removal

To replace the card cage fan, follow these steps:

1. Route the fan wires through the card cage's hole below the fan hole.
2. Position the fan in place with its flow direction arrow pointing back towards the inside of the card cage.
3. Snap the fan into place.
4. Replace the assemblies removed earlier.

5.5.18 HP-IB Interface Board Removal and Replacement (Model 400s)

Refer to Figure 5-37 and follow these steps to remove the HP-IB interface board. Reverse these steps to replace the HP-IB interface board.

1. Remove the HP-IB plate.
2. Disconnect the ribbon cable from the HP-IB interface board.
3. Remove the HP-IB interface connector screws from the HP-IB plate.
4. Remove the HP-IB interface board from the HP-IB plate. To replace the HP-IB board, reverse the removal procedures.

NOTICE: When replacing the HP-IB interface board, you must insert it into the HP-IB plate with its component side towards the right side of the system unit.

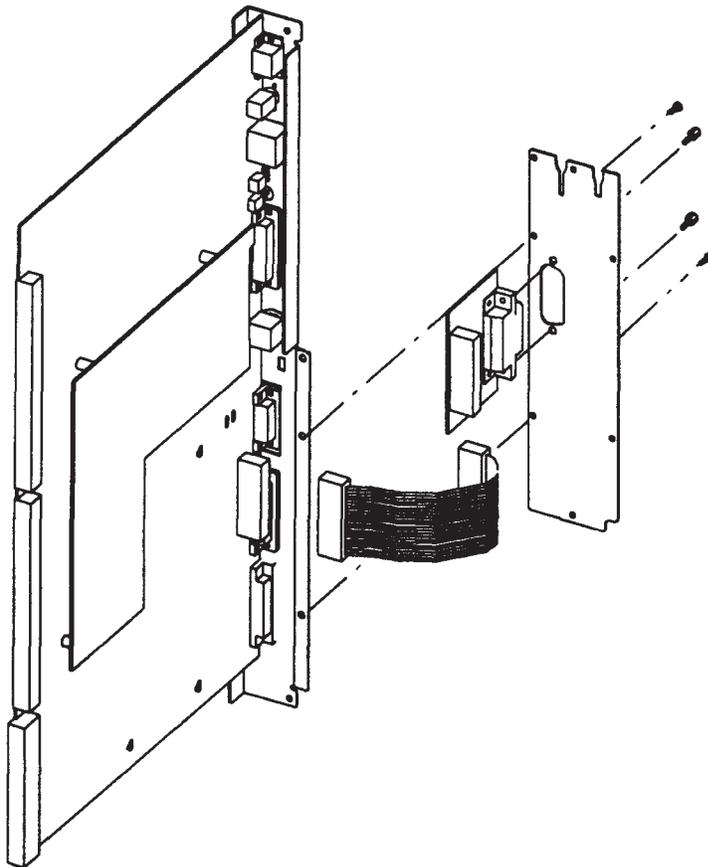


Figure 5-37. Model 400s HP-IB Board Removal

5.5.19 Converter Board Removal and Replacement (Model 400s)

Follow these steps to remove the converter board. Reverse these steps to replace the converter board.

1. Remove the top, side, and RFI covers, all ISA boards, and the ISA backplane.
2. Remove the seven screws from the HP-IB (or blank) plate.
3. If installed, remove the ribbon cable from the HP-IB board, then set the HP-IB plate aside.
4. Remove the converter board by pulling it out of the motherboard.

5.5.20 CPU Board Removal and Replacement (Model 400s)

Refer to Figure 5-38 and follow these steps to remove the CPU board. Reverse these steps to replace the CPU board.

1. Remove the top and side covers. Disconnect all cables connected to the CPU board connectors.
2. If you have already removed the HP-IB (or blank) plate to access the converter board, skip this step.

Remove the HP-IB (or blank) plate's two right side screws, two top screws, and the one bottom screw. Do not remove the two left side screws holding the plate to the CPU board's backplate.

3. Remove the four screws on the chassis' left side holding the CPU board's backplate to the chassis.
4. Remove the two screws (top and bottom) on the CPU board backplate holding it to the chassis.

*

5. Insert a flat-tipped screwdriver through the rear one of the two, large chassis holes on the left side (near the LAN connectors) and put its tip in the CPU board's removal slot. The front hole is used to lever the CPU board into its connectors.
6. Pry the CPU board free from its motherboard connectors, then remove the flat-tipped screwdriver.

NOTICE: Apply mild pressure to unseat the CPU board. If it does not unseat easily, check to see that all the screws are removed.

7. Remove the CPU board.

NOTICE: If the CPU board is being replaced, the EEPROM should be removed from the CPU board being replaced and installed in the new CPU board. This keeps the Boot Mode Selection, Auto System Select, and Internal I/O Configuration information intact and does not have to be reconfigured. System Unit identification is maintained for operating system and application requirements. The EEPROM from the new CPU board should be installed on the failed CPU board.

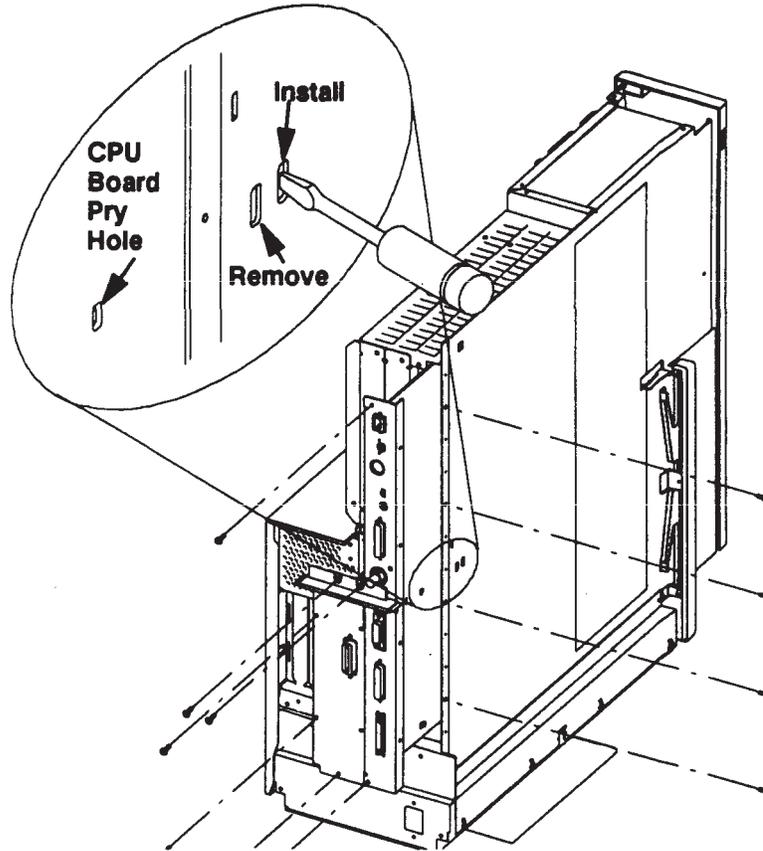


Figure 5-38. Model 400s CPU Board Removal

After the CPU board has been removed, you may remove these FRUs:

- EEPROM. You can only obtain a replacement EEPROM by using the EEPROM that ships on a new CPU board. You cannot order new EEPROMs as separate FRUs.
- Memory modules.
- Emulator board.
- HP-IB board and ribbon cable.
- Real-Time clock battery.
- The LAN jumper. You can also change its position to enable the other LAN connector. LAN selection is accomplished by setting the LAN jumper as shown in Appendix A.

5.5.21 EEPROM Removal and Replacement

The EEPROM from a failed CPU board must be installed in a new CPU board if the CPU board fails. If the existing EEPROM has failed, it should be replaced with a new one and the system unit's Configure Mode reconfigured for the application.

To obtain a new EEPROM, order a new CPU board.

To remove and replace the EEPROM, refer to Figure 5-39 and follow these steps:

1. Find the EEPROM (U54) on the CPU board.
2. Using an EEPROM puller (part no. 821903-1), remove the EEPROM, noting its orientation in its socket.
3. If you are replacing the CPU board, remove the EEPROM from the new CPU board. Otherwise, skip this step.
4. If you are replacing the CPU board, install the EEPROM from the failed CPU board in the new CPU board. Otherwise, skip this step.
5. If you are replacing the EEPROM, install the new EEPROM in the CPU board.

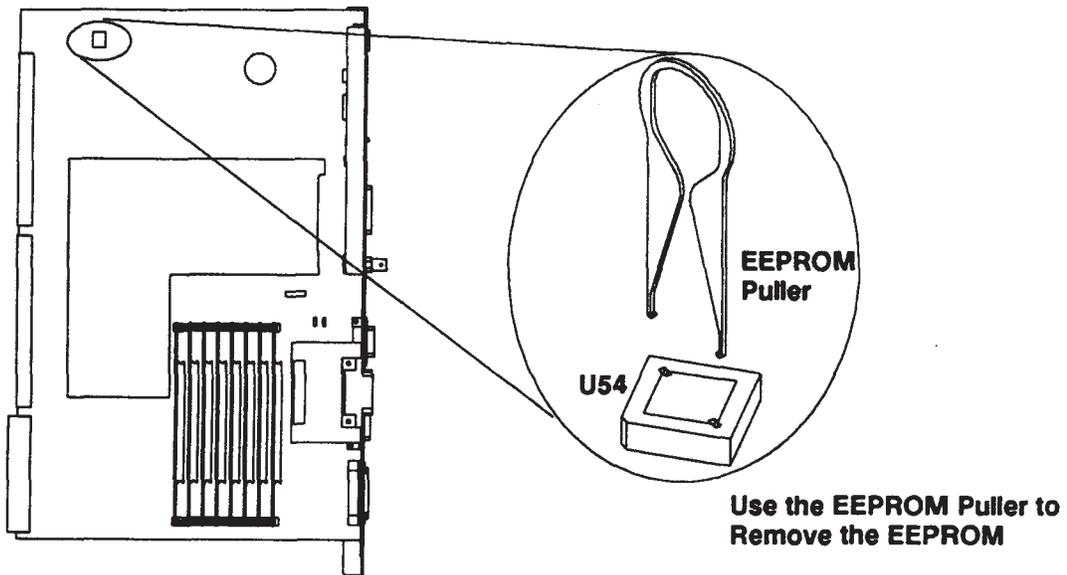


Figure 5-39. Model 400s EEPROM Removal

6. Reinstall the CPU board and other removed assemblies.
7. If you are using HP-UX operating systems and have replaced the EEPROM with a new one, follow these procedures:
 - A. Power up the workstation and enter Configuration Control Mode.
 - B. Reconfigure the Boot Mode Selection, Auto System Select, and I/O Configure Modes as they were previously set.
 - C. Reset the system unit and note the LAN ID number listed after the LAN interface information in the power-up display.
 - D. Reconfigure the system software to match the new LAN ID number.
8. If you are using the Domain operating system and have replaced the EEPROM with a new one, follow these procedures:
 - A. Power up the workstation and enter Configuration Control Mode.
 - B. Enter the Boot Mode Selection Mode and set the Boot Mode to Domain compatible. The system unit should now be able to boot the Domain/OS.
 - C. Run the CHUVOL utility.

NOTICE: Because the EEPROM stores the node ID, application software for Domain/OS systems that rely on the node ID for licensing requirements may not function after you replace the EEPROM.

5.5.22 Memory Board Removal and Replacement (Model 400s)

Refer to Figure 5-40 and follow these steps to remove a memory board:

1. Remove the top and left side cover. Then, remove the CPU board.
2. Identify (using the failing memory address) the specific memory board to remove. Refer to chapter 4.
3. Using a flat-tipped screwdriver, pry each end of the memory board up a little at a time until it is clear of the card guide.
4. Remove the memory board.
5. If you are replacing the CPU board, remove the memory board guides by sliding them toward the back. Then, lift their tabs out of the CPU board's holes.

If you have replaced the CPU board and are moving the memory modules from the old CPU board to a new one, place the memory modules in the same slots on the new CPU board as they were on the old CPU board.

Memory modules have several restrictions regarding their installation:

- You may replace one module of a pair, but modules of the same size must be installed in pairs.
- There can be no empty slots between modules or module pairs.
- The largest size pair must be in slots 0A and 0B.
- Each higher numbered slot pairs must have equal sized or next smaller sized memory boards used in the system unit.

Follow these steps to replace a memory board:

1. If you are replacing the CPU board, install the memory board guides by placing their tabs in the CPU board holes. Then, sliding them towards the front, locking them in place.
2. Insert the memory board, with its connector side towards the back, into the connector.
3. Firmly seat the memory board in its CPU board connector.
4. Ensure the board guides are straight and correctly holding the sides of the memory boards.

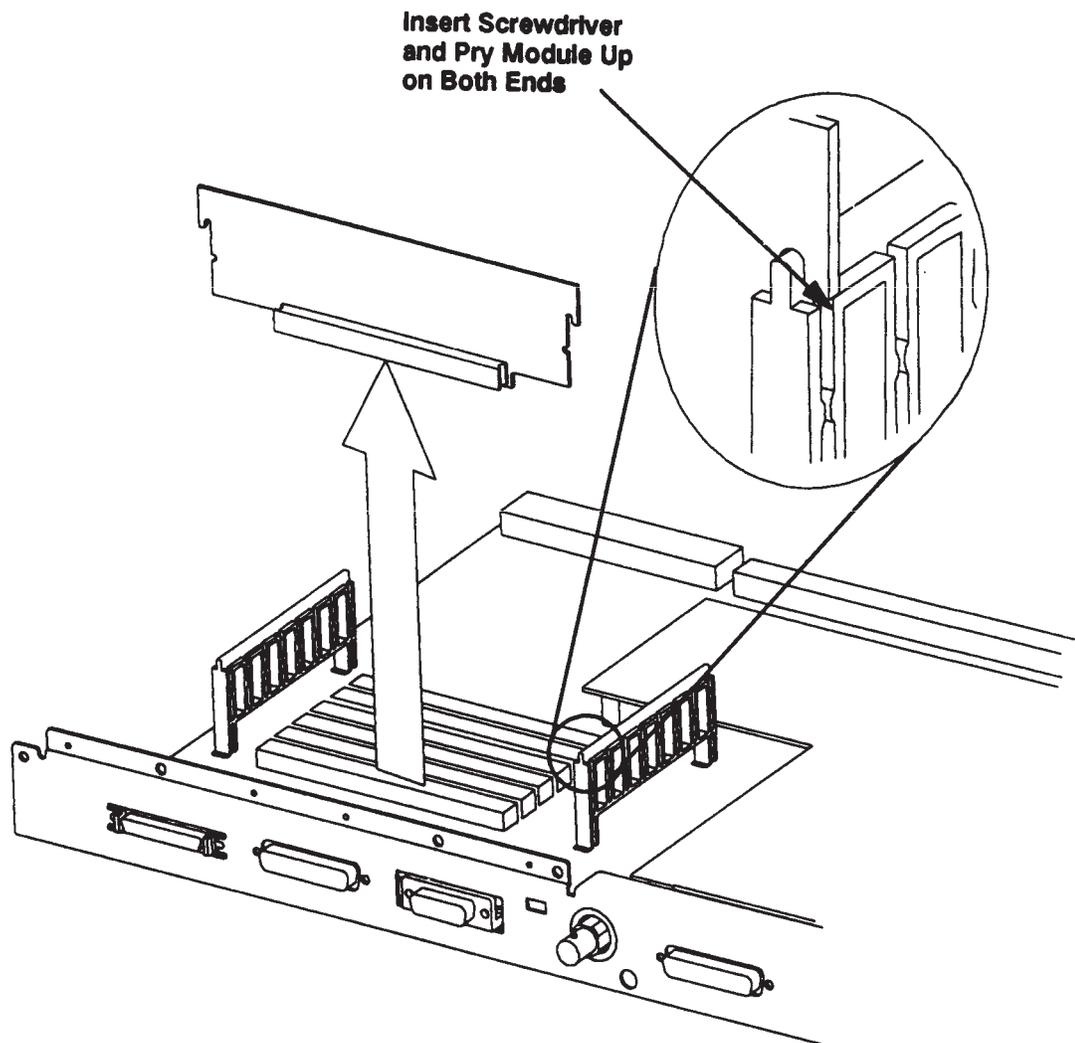


Figure 5-40. Model 400s Memory Board Removal

5.5.23 Emulator Board Removal and Replacement (Model 400s)

Refer to Figure 5-41 and follow these steps to remove the emulator board. Reverse these steps to replace the emulator board.

1. Remove the five screws from the back of the CPU board that hold the emulator board in place.
2. Hold the emulator board at its front edge next to the CPU board edge connectors close to U35.
3. Carefully lift the emulator board from the CPU board.

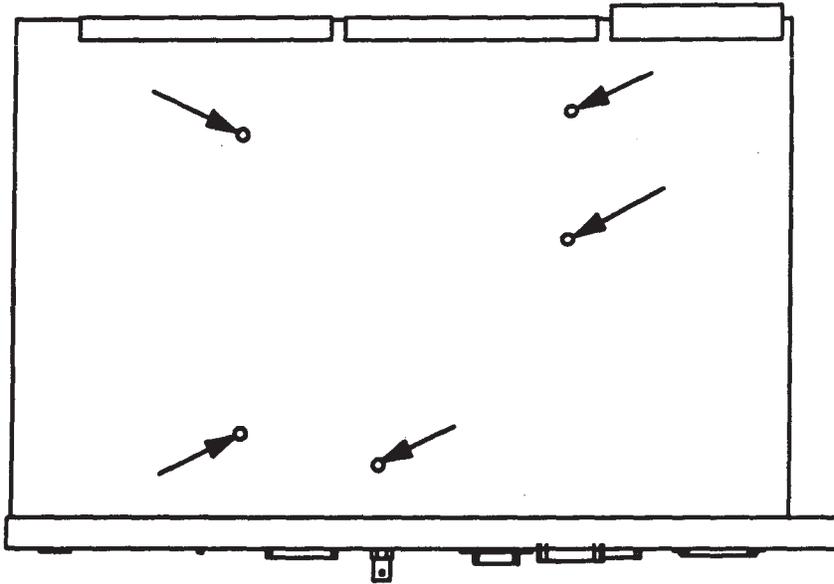


Figure 5-41. Model 400s Emulator Board Screws

5.5.24

Real-Time Clock Battery Removal and Replacement (Model 400s)

To remove the real-time clock battery, refer to Figure 5-42 and follow these steps:

1. Remove the top and left side cover and the CPU board.
2. Hold the CPU board upside down with the end holding the battery at the bottom.
3. Lift the tab holding the battery in place and the battery should drop out.

To replace the battery, lift the tab and insert the battery with its plus side (marked with a “+”) toward the tab.

WARNING: Lithium batteries may explode if mistreated. Do not put lithium batteries in fires, try to recharge or disassemble them.

Replace battery with only a Matsushita Electric BR-2325, 3-volt, lithium battery (part number 1420-0314)! Use of any other battery may cause fire or explosion.

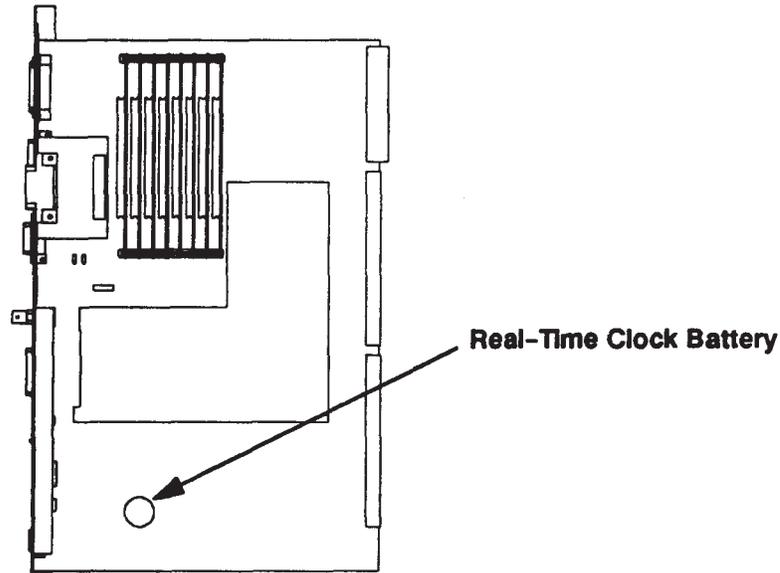


Figure 5-42. Model 400s Real-Time Clock Battery Removal

5.5.25 ISA Center Wall Removal and Replacement (Model 400s)

To remove the ISA center wall, refer to Figure 5-43 and follow these steps:

1. Remove the top and side covers, RFI cover, all ISA and DIO cards, ISA back-plane and cardcage, and the converter board.
2. Remove the LED cable clamp from the chassis.
3. Remove the screw at the back right-hand corner of the center wall.
4. Remove the four screws on the right, front edge of the center wall.
5. Remove the three screws on the left, bottom edge of the center wall.
6. Remove the three screws on the left, top edge of the center wall.
7. Remove the center wall towards the right side, routing the power distribution and ribbon cables clear of the center wall

To replace the ISA center wall, follow these steps:

1. Ensure the main power distribution and main fan cables are wedged under the chassis' cable tab above the front main fan.
2. Place the center wall on the chassis ensuring the ISA power distribution cable is routed through its center wall slot.

NOTICE: Ensure the motherboard tabs fit into their slots on the center wall.

3. A tab at the chassis' upper rear corner should fit into a hole on the center wall to hold the center wall in place while you install the screw. Start one screw in a left, top, center hole in the chassis to the center wall. Do not tighten the screw.
4. Start another screw in the oval hole in the back of the chassis just below the right edge of the center wall. Do not tighten the screw.
5. Verify that the power switch and LED board cables are clear of their notch in the ISA center wall.
6. Install the remaining screws for the center wall.
7. Verify that all cables are not pinched and that the center wall fits correctly.
8. Tighten all of the screws.
9. Replace the LED cable clamp and the other assemblies.

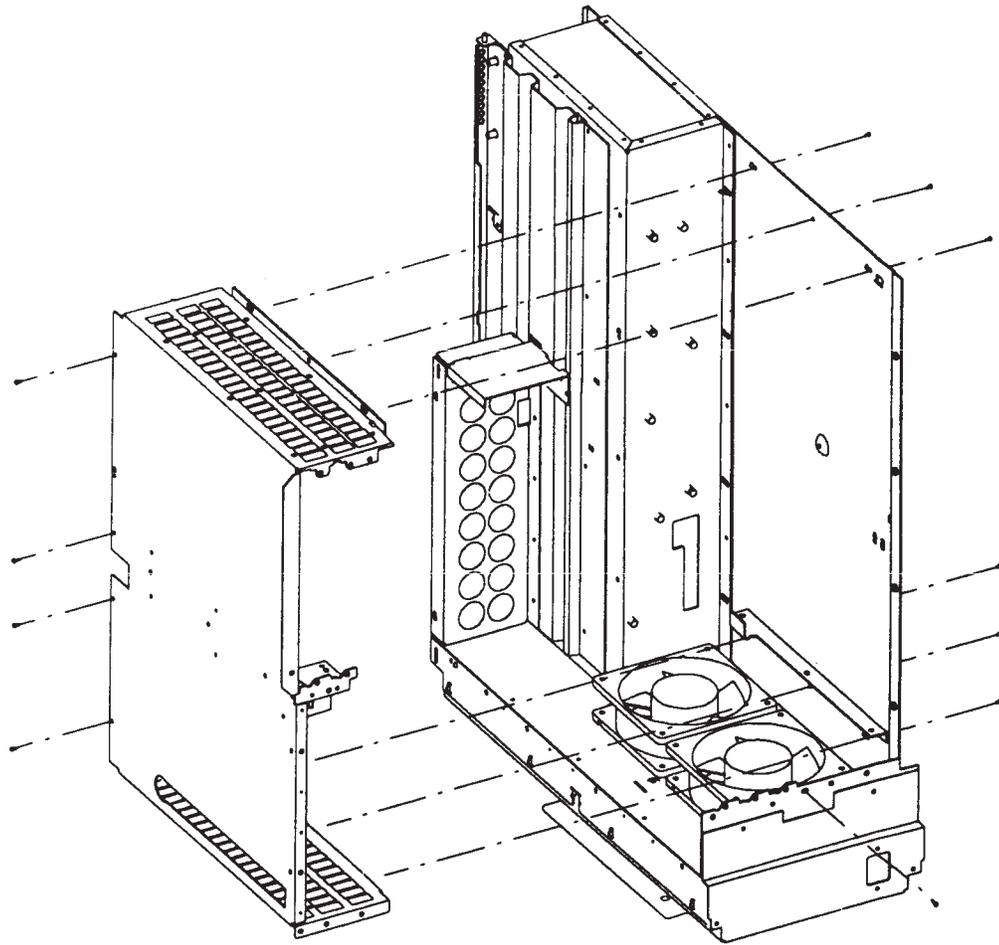


Figure 5-43. Model 400s ISA Center Wall Removal

5.5.26 Standard/ISA Motherboard Removal and Replacement (Model 400s)

Refer to Figure 5-44 and follow these steps to remove the motherboard.

1. Remove the top and side covers, CPU board with plate, all DIO boards, RFI cover, all ISA cards and backplane, card cage, center wall, and right trim plate.
2. Disconnect the following cable connectors from the component side of the motherboard:
 - Main power distribution cable connector. Use a flat-tipped screwdriver to press in on each side clip. Then, pull the connector out.
 - Power switch cable connector.
 - Main fans cable connector.
3. Remove the eight screws from the mass storage cover plate on the left side of the chassis. Remove the mass storage cover plate.
4. Remove the lower mass storage mounting screws from the right side of the chassis. Pull the mass storage device out four inches.
5. Disconnect the mass storage power distribution and SCSI cable from the back side of the motherboard.
6. Remove the four screws holding the motherboard to the chassis.
7. Remove the motherboard by sliding it to the right so that its mounting pins clear their holes. Then, pull it out.

Follow these steps to replace the standard/ISA motherboard:

1. Position the motherboard by placing it on its mounting pins. Then, slide it to the left so that its tabs fit into their slots in the chassis.
2. Install the four motherboard screws to hold the motherboard to the chassis.
3. Connect the mass storage power distribution and SCSI cable to their connectors on the back side of the motherboard.
4. Reinstall the lower mass storage device, if necessary.
5. Reinstall the mass storage cover plate.
6. Reconnect all cable connectors to the component side of the motherboard.
7. Replace the remaining assemblies.

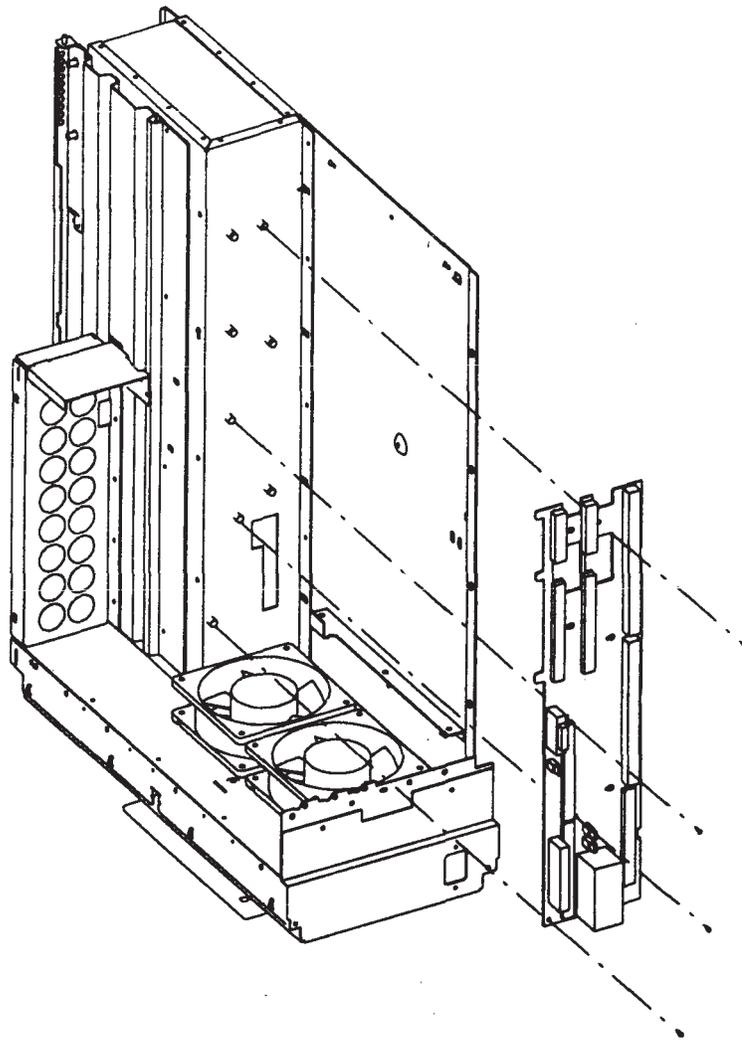


Figure 5-44. Model 400s Standard/ISA Motherboard Removal

5.5.27 3-Slot DIO-II Card Cage Removal and Replacement (Model 400s)

Refer to Figure 5-45 and follow these steps to remove the 3-slot DIO-II card cage:

1. Remove the top and side covers and all DIO cards in the 3-slot DIO-II card cage.
2. Remove the screw at the rear, bottom side of the DIO-II card cage holding it to the chassis.
3. Remove the three screws at the bottom right edge of the DIO-II card cage.
4. Remove the two screws on the front right edge of the DIO-II card cage.
5. Remove the three screws holding the DIO-II card cage to the center wall. The DIO-II card cage is then disconnected from the center wall.
6. Remove the DIO-II card cage.

To replace the 3-slot DIO-II card cage, follow these steps:

1. Position the DIO-II card cage against the center wall. Make sure that the motherboard tabs fit into their notches in the card cage.
2. Start one screw into the DIO-II card cage top edge to hold the card cage in place. Do not completely tighten the screw.
3. Start a screw in the right bottom edge of the DIO-II card cage. Do not tighten the screw.
4. Install the rest of the DIO-II card cage screws in the bottom, front, top and back.
5. Verify that the card cage has proper fit.
6. Tighten all of the screws.
7. Replace the remaining assemblies.

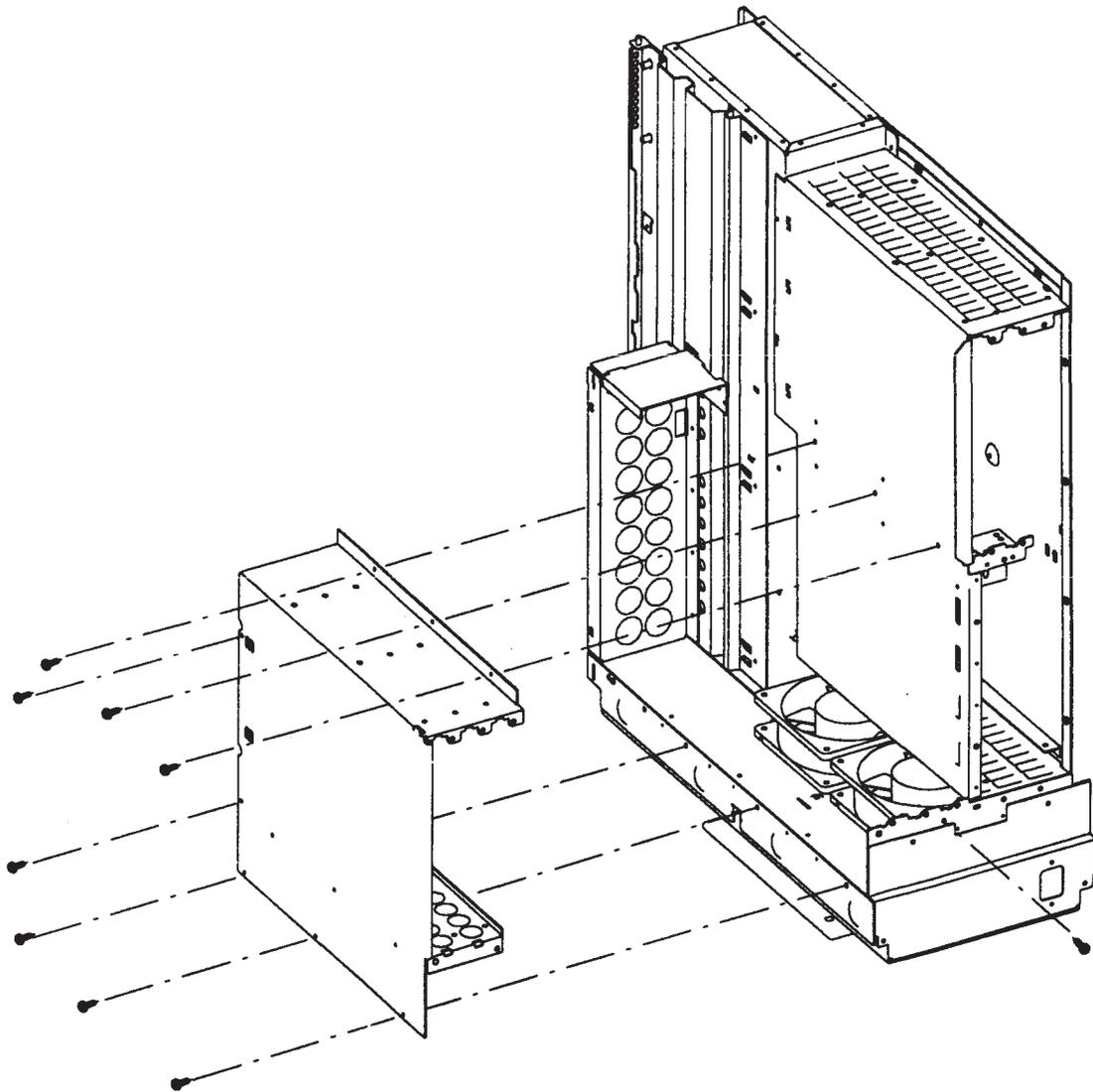


Figure 5-45. Model 400s 3-Slot DIO-II Card Cage Removal

5.5.28 DIO-II Center Wall Removal and Replacement (Model 400s)

Refer to Figure 5-46 and follow these steps to remove the DIO-II center wall:

1. Remove the top and side covers, CPU board with plate attached, all DIO cards and the 3-slot DIO-II card cage.
2. Remove the LED cable clamp from the chassis.
3. Remove the screw at the back, right-hand corner of the center wall.
4. Remove the two screws on the right, front edge of the center wall.
5. Remove the three screws on the left, bottom edge of the chassis to the center wall.
6. Remove the three screws on the left, top edge of the chassis to the center wall.
7. Remove the center wall towards the right side.

To replace the DIO-II center wall, follow these steps:

1. Ensure that the main power distribution and main fan cables are wedged under the chassis' cable tab above the front main fan. Ensure that the cables are not pinched anywhere.
2. Place the center wall on the chassis ensuring that the motherboard's tabs fit into their slots on the center wall. The back lower edge must fit inside the chassis.
3. Start one screw in a left, top, center hole in the chassis to the DIO-II center wall. A tab at the chassis' upper, rear corner should fit into a hole on the center wall to hold the center wall in place while you install the screw. Do not completely tighten the screw.
4. Start another screw in the oval hole in the back of the chassis just below the right edge of the center wall. Do not completely tighten the screw.
5. Install the remaining screws for the center wall.
6. Verify all cables are not pinched and that the center wall fits correctly.
7. Tighten all of the screws.
8. Replace the LED cable clamp and the other assemblies.

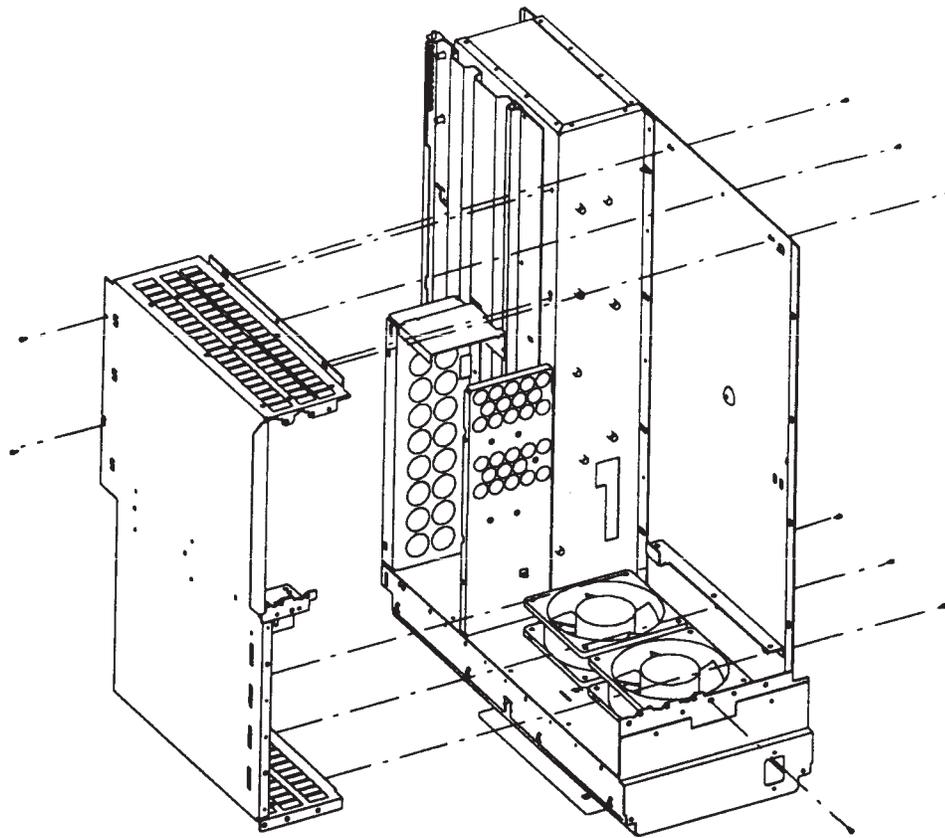


Figure 5-46. Model 400s DIO-II Center Wall Removal

5.5.29 DIO-II Motherboard Removal and Replacement (Model 400s)

To remove the DIO-II motherboard, refer to Figure 5-44 and follow these steps:

1. Remove the top and side covers, CPU board with plate, all DIO-II boards, DIO-II card cage and center wall, and the right trim plate.
2. Disconnect all cable connectors from the component side of the motherboard.
3. Remove the mass storage cover plate on the left side of the chassis.
4. Remove the lower mass storage mounting screws from the right side of the chassis and pull the mass storage device out four inches.
5. Disconnect the mass storage power distribution and SCSI cable from the back of the motherboard.
6. Remove the five screws that hold the motherboard to the chassis and to the 3-slot DIO-II card cage front wall.
7. Remove the motherboard by sliding it to the right so that its mounting pins clear their holes. Then, pull it out.

Follow these steps to replace the DIO-II motherboard:

1. Position the motherboard by placing it on its mounting pins. Then slide it to the left so that its tabs fit into their slots in the chassis. Ensure that the LED board ribbon cable and power switch cables are clear of the motherboard.
2. Install the five motherboard screws to hold the motherboard to the chassis and the 3-slot DIO-II card cage front wall.
3. Connect the mass storage power distribution and SCSI cable to their connectors on the back of the motherboard.
4. Reinstall the lower mass storage device.
5. Reinstall the mass storage cover plate.
6. Reconnect all cable connectors to the component side of the motherboard.
7. Replace the remaining assemblies.

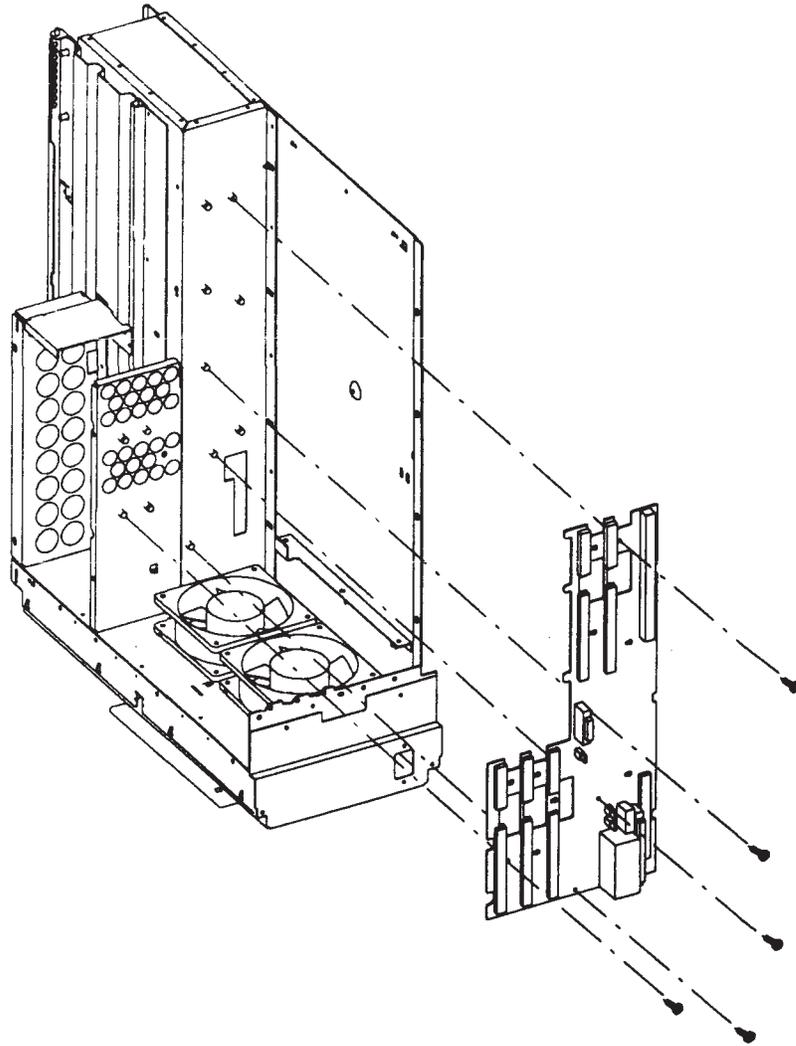


Figure 5-47. Model 400s DIO-II Motherboard Removal

5.5.30 Main Fans Removal and Replacement (Model 400s)

Refer to Figure 5-48 and follow these steps to remove the main fans:

1. Remove the top and side covers, CPU board with plate, RFI cover, all ISA and DIO cards, RFI cover, ISA or DIO-II card cage, and center wall.
2. Disconnect the fan cable from the motherboard.
3. Cut and remove the tiewraps from around the main power distribution cable and fan cables.
4. Remove the fan bracket screw and remove the fan bracket.
5. Slide the fan out from its clips.

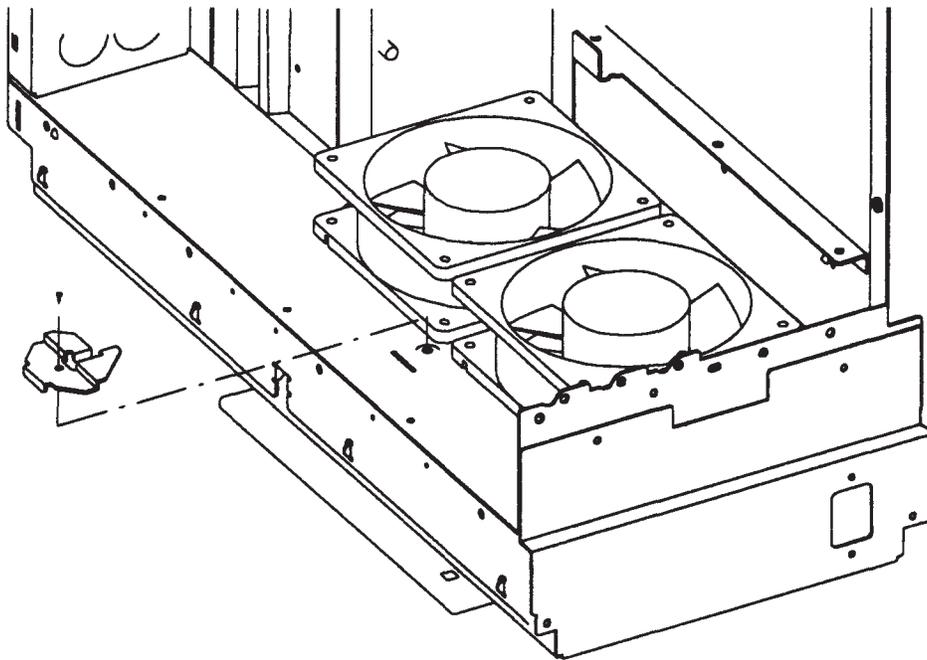


Figure 5-48. Model 400s Main Fans Removal

Replacement of the main fans involves these steps:

1. With the fan's air flow arrow pointing down, and oriented with its corner next to its cable to be next to the chassis wall and between both fans, slide the fan into its clips.
2. Replace the fan bracket and its screw.
3. Reconnect the fan cable to its motherboard connector.
4. Install new tiewraps around the fan and main power distribution cables. Then, ensure that those cables are routed behind the fans and under the cable tab.
5. Replace the assemblies removed earlier.

5.5.31 LED Board Removal and Replacement (Model 400s)

Refer to Figure 5-49 and follow these steps to remove the LED board. Reverse these steps to replace the LED board.

1. Remove the top and side covers.
2. Insert a flat-tipped screwdriver behind the LED ribbon cable protector. Pry its dips from the chassis. Remove the ribbon cable shield.
3. Remove the two screws that hold the LED board and its RFI cover to the chassis. Remove the LED board and its RFI cover.
4. Disconnect the LED ribbon cable from the LED board.

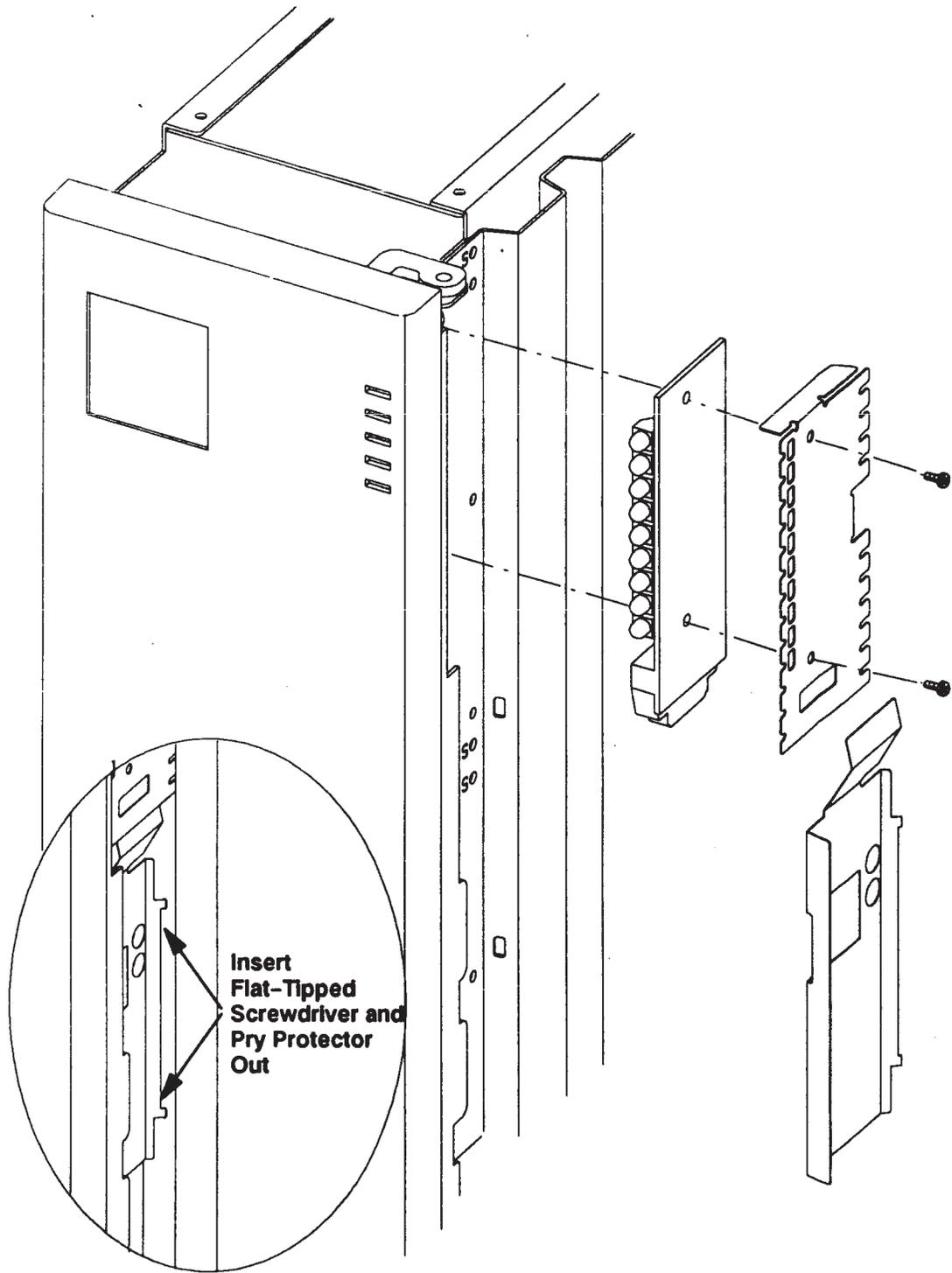


Figure 5-49. Model 400s LED Board Removal

5.5.32 LED Ribbon Cable Removal and Replacement (Model 400s)

Follow these steps to remove the LED ribbon cable:

1. Remove the top and side covers, RFI cover, LED cable protector and LED cable clamp.
2. Disconnect the LED ribbon cable from the motherboard.
3. Disconnect the LED ribbon cable from the LED board.
4. Lift the LED ribbon cable clear of its slot in the card cage next to the chassis.

Follow these steps to replace the LED ribbon cable:

1. A replacement ribbon cable has one end further from the fold than the other. Connect the short end to the LED board.
2. Replace the LED cable protector.
3. Route the long end of the replacement ribbon cable through the slot in the card cage next to the chassis.
4. Connect the ribbon cable's long end connector to its connector on the motherboard.
5. Reinstall the LED ribbon cable clamp.
6. Replace the assemblies removed earlier.

5.5.33 Main Power Switch Removal and Replacement (Model 400s)

Follow these steps to remove the main power switch:

1. Remove the top and side covers, all ISA and DIO boards, card cage, converter board, and center wall.
2. Remove the LED ribbon cable clamp from the chassis.
3. Disconnect the main power switch cable from the motherboard. You may need to maneuver it around the LED ribbon cable.
4. On the back of the power switch, pinch the two catches together. Pull the power switch back out of the front plate and remove it, guiding its cable around the sheet metal.

To replace the main power switch, follow these steps:

1. Insert the power switch into its slot in the front wall and snap the tabs into place.
2. Route the main power switch cable to the motherboard through the notch in the card cage. You may need to maneuver it around the LED board ribbon cable.
3. Connect the power switch cable to the motherboard.
4. Replace the LED cable clamp.
5. Replace all assemblies removed.

5.5.34 Main Power Distribution Cable Removal and Replacement (Model 400s)

Follow these steps to remove the main power distribution cable:

1. Remove the top and side covers, all DIO-II and ISA boards, card cage and center wall, and the rear main fan.
2. Disconnect the main power distribution cable connectors from the motherboard.
3. Cut the tiewraps from around the main power distribution cable. Separate the main fan cables from the main power distribution cable.
4. Remove the power distribution cable from around the front main fan, then remove the power distribution cable by pulling its power supply end forward through the rear chassis hole.

Follow these steps to replace the main power distribution cable:

1. Install the main power distribution cable by passing its two-connector end through the rear chassis hold from front to back. Then fit it into the notch above the power supply compartment.
2. Connect the main power distribution cable to its motherboard connector.
3. Slide the power supply part way into its compartment. Connect the two main power distribution cable connectors to the power supply. Then slide the power supply the rest of the way into its compartment.
4. Install the rear main fan.
5. Fit the main power distribution cable around the left side of the main fans, wedging it under the cable tab. Make sure that the fit is tight so that the center wall fits correctly.
6. Put new tiewraps around the main power distribution cable and the two main fan cables to hold them in place.
7. Replace the other assemblies earlier removed.

5.6 Model 400s Illustrated Parts Breakdown (IPB)

This section presents information for the Model 400s:

- Main system unit
- DIO-II card cage
- ISA card cage
- Mass storage/Motherboard
- Chassis

Table 5-3. Model 400s Main System Unit Part Numbers

| Item | Description | New Part Number | Exchange Part Number |
|--|---|-----------------|----------------------|
| 1 | Power Supply | 0950-2107 | |
| 2 | CPU Board ¹ | A1421-66510 | A1421-69510 |
| 3 | Memory Boards | | |
| | 4 MB Memory Board | 98229-66521 | 98229-69521 |
| | 16 MB Memory Board | 98229-66524 | 98229-69524 9 |
| 4 | Emulator Board | 98574-66513 | 8574-69513 |
| 5 | HP-IB Interface Board | A1421-66545 | |
| 6 | Real-Time Clock Battery | 1420-0314 | |
| 7 | Video/Graphics Boards ¹ | | |
| | Color Video Board | A1416-66580 | A1416-69580 |
| | Mono. Video Board | A1630-60003 | A1630-69003 |
| | GAD Bus Interface | 98702-66501 | 98702-69501 |
| | PDMA Interface | 98735-66580 | 98735-69580 |
| | VDMA Interface | 98735-66581 | 98735-69581 |
| 8 | LED Board | A1421-66540 | |
| 9 | Mass Storage Devices ¹ | | |
| | CD ROM Disk Drive | 1150-1832 | |
| | QIC Tape Drive | 011778-001 | 011778-001R |
| | HP 330 MB Hard Drive | C2212-60061 | C2212-69061 |
| | HP 660 MB Hard Drive | C2213-60061 | C2213-69061 |
| | Mic 660 MB Hard Drive | 017163-001 | 017163-001R |
| | HP 330/660 MB Drive Controller Board | 97548-61107 | 98548-69107 |
| 10 | Standard/ISA Motherboard | A1421-66501 | |
| 11 | DIO-II Motherboard | A1421-66504 | |
| 12 | Main Fan | 5180-5246 | |
| | (Parts Not Shown) | | |
| | LED Ribbon Cable | A1421-61602 | |
| | Power Switch/Cable Assy. | A1421-61608 | |
| | HP-IB Ribbon Cable | 98574-61600 | |
| | Mass Stwg. Pwr. Dist. Cbl. | A1421-61604 | |
| | SCSI Interface Cable | A1421-61603 | |
| ¹ Refer to Appendix A for Configuration Information | | | |

(Continued)

Table 5-3. Model 400s Main System Unit Part Numbers (Cont.)

| Item | Description | New Part Number | Exchange Part Number |
|------|--|-----------------|----------------------|
| 13 | Chassis | 5001-9096 | |
| 14 | DIO-II Front Wall (DIO-II Version Only) | 5001-9096 | |
| 15a | HP-IB Plate | 5001-9072 | |
| 15b | Blank Plate | 5001-9071 | |
| 16 | Disk Cover | 5001-7423 | |
| 17 | Hard Disk Bracket Assy. | 5001-9087 | |
| 18 | Removable Media Bkt. Assy. | 5001-9095 | |
| 19 | Fan Bracket | 5001-9092 | |
| 20 | LED Cable Protector | 5001-7431 | |
| 21 | LED RFI Shield | 5001-7428 | |
| 22 | LED Cable Cover | 5001-7432 | |
| 23 | Front Trim (Right/Left) | 5041-2471 | |
| 24 | Front Door | A1421-87908 | |
| | (Parts Not Shown) | | |
| | Top Cover | 5001-9068 | |
| | Left Side Cover | 5001-9069 | |
| | Right Side Cover | 5001-9070 | |
| | Bezel | 5041-2435 | |
| | Rear Trim | 5041-2470 | |
| | Disk Bracket Filler Plate | 5001-90% | |
| | DIO-II Bd. Card Guide | 0403-0397 | |
| | Memory Bd. Card Guide | 5041-2434 | |
| | Mass Stwg. Cable Clamp | 1400-1549 | |

Figure 5-51 shows the parts of the Model 400s DIO-II card cage. Match the numbers in this figure to Table 5-4 for descriptions and part numbers.

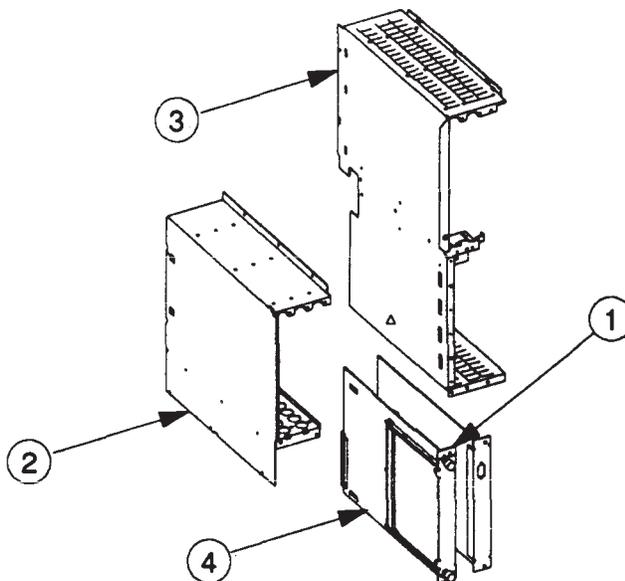


Figure 5-51. Model 400s DIO-II Card Cage Illustrated Parts Breakdown

Table 5-4. Model 400s DIO-II Card Cage Part Numbers

| Item | Description | New Part Number | Exchange Part Number |
|------------|---------------------------|-----------------|----------------------|
| 1 | DIO Board | | |
| | 16-Bit Parallel | 98622-66504 | |
| | HP-IB Interface | 98624-66501 | |
| | High-Speed HP-IB | 98625-66502 | 98625-69502 |
| | Datacomm | 98628-66504 | 98628-69504 |
| | 4-Port MUX | 98642-66501 | 98642-69501 |
| | EtherNET 802.3 LAN | 98643-66501 | 98643-69501 |
| | Serial RS-232 | 98644-66502 | 98644-69502 |
| | VMEbus | 98646-66502 | 98646-69502 |
| | SDLC Interface | 98649-66502 | 98649-69502 |
| | SCSI Interface | 98658-66501 | 98658-69501 |
| 8-Port MUX | 98638-60001 | 98638-69001 | |
| 2 | DIO-II Cardcage | 5001-9075 | |
| 3 | DIO-II Center Wall | 5001-9098 | |
| 4 | DIO-II to DIO-I Converter | A1421-66512 | |

Figure 5-52 shows the parts of the Model 400s ISA card cage. Match the numbers in this figure to Table 5-5 for descriptions and part numbers.

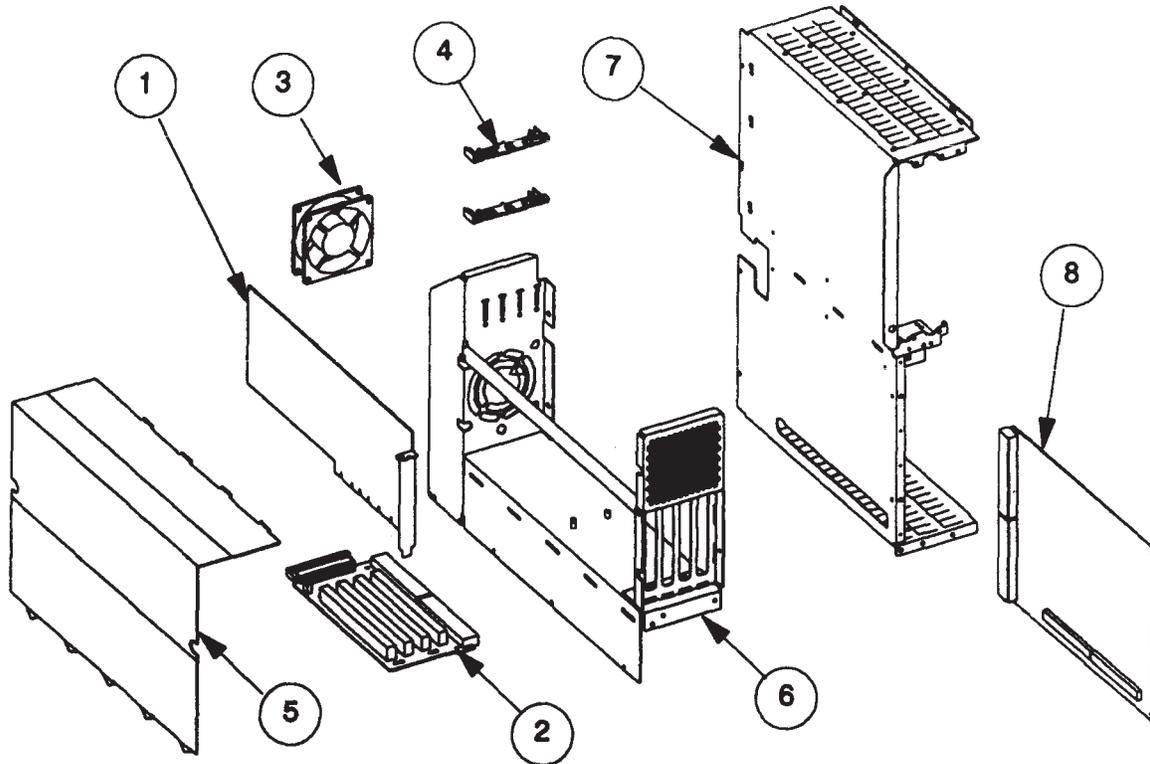


Figure 5-52. Model 400s ISA Card Cage Illustrated Parts Breakdown

Table 5-5. Model 400s ISA Card Cage Part Numbers

| Item | Description | Part Number |
|-------------|-----------------------------|--------------------|
| 1 | ISA Boards | |
| | Apollo Token Ring | 015892 |
| | IBM Token Ring | SK015290 |
| | Centronics Interface | KTT-ATBUS-CENT |
| | X.25 Serial Interface | A-ADD-SCAT |
| | Domain DOS Co-proc. | A-ADD-PCC |
| | Serial/Parallel | A-ADD-SPE |
| 2 | ISA Backplane | A1421-66507 |
| 3 | Cardcage Fan | 5180-5247 |
| 4 | ISA Card Guide/Fan Clip | 5041-2469 |
| 5 | RFI Cover | 5001-9092 |
| 6 | ISA Cardcage | 5001-9074 |
| 7 | ISA Center Wall | 5001-9067 |
| 8 | DIO-II to ISA Converter Bd. | A1421-66512 |
| | (Part not Shown) | |
| | ISA Pwr. Dist. Cable | A1421-61607 |

Table 5-6 lists the part numbers and descriptions of the FRUs in the Model 400s mass storage/Motherboard.

Table 5-6. Model 400s Mass Storage/Motherboard Part Numbers

| Item | Description | New Part Number | Exchange Part Number |
|-------------|--------------------------------|------------------------|-----------------------------|
| 1 | Standard/ISA Motherboard | A1421-66501 | |
| 2 | DIO-II Motherboard | A1421-66504 | |
| 3 | Mass Storage Cover Plate | 5001-7423 | |
| 4 | Mass Storage Devices | | |
| | CD ROM Disk Drive | 1150-1832 | |
| | QIC Tape Drive | 011778-001 | 011778-001R |
| | 330 MB Hard Disk Drive | C2212-60061 | C2212-69061 |
| | HP 660 MB Hard Disk Drive | C2213-60061 | C2213-69061 |
| | Mic 660 MB Hard Disk Drive | 017163-001 | 017163-001R |
| | HP 330/660 MB Drive Ctlr Bd | 97548-61107 | 98548-69107 |
| | DAT Tape Drive | C1502A | |
| 5 | Hard Disk Bracket Assembly | 5001-9087 | |
| 6 | Removable Media Bracket Assy | 5001-9095 | |
| 7 | Filler Plate | 5001-9096 | |
| 8 | Disk Cover | 5001-7423 | |
| 9 | Internal SCSI Cable | A1421-61603 | |
| 10 | Mass Storage Power Dist. Cable | A1421-61604 | |
| 11 | LED Ribbon Cable | A1421-61602 | |
| 12 | Power Switch/Cable Assy. | A1421-61608 | |

Figure 5-53. Model 400s Mass Storage/Motherboard Illustrated Parts Breakdown

Table 5-7 lists the part numbers and descriptions of the FRUs in the Model 400s chassis.

Table 5-7. Model 400s Chassis Part Numbers

| Item | Description | New Part Number | Exchange Part Number |
|-------------|-------------------------------|------------------------|-----------------------------|
| 1 | Top Cover | 5001-9066 | |
| 2 | Right Side Cover | 5001-9070 | |
| 3 | Left Side Cover | 5001-9069 | |
| 4 | Rear Trim/Handle | 5041-2470 | |
| 5 | Bezel | 5041-2435 | |
| 6 | Right/Left Front Trim | 5041-2471 | |
| 7 | Front Door Assembly | A1421-87908 | |
| 8 | LED RFI Shield | 5001-7428 | |
| 9 | LED Cable Protector | 5001-7431 | |
| 10 | LED Cable Clamp | 5001-7432 | |
| 11 | Fan Bracket | 5001-9091 | |
| 12 | Main Power Distribution Cable | A1421-61601 | |
| 13 | HP-IB Plate | 5001-9072 | |
| 14 | Blank Plate | 5001-9071 | |
| 15 | Chassis | 5001-9066 | |



Appendix A

Jumper and Switch Configurations

This appendix provides jumper and switch configurations for Series 400 circuit boards and storage devices. When you replace one of these boards (as instructed in Chapter 5), make sure that the jumpers or switches are set as shown in this appendix.

A.1 Configurations for Circuit Boards

This section defines the jumper and switch configurations for system boards. Refer to the appropriate figure for configuration information for the board that you're replacing.

NOTICE: If you are replacing an accessory board that has configuration switches and is not listed in this appendix, set the switches on the replacement board the same as the original board. Refer to the accessory board's installation or service documentation for more configuration details.

A.1.1 CPU Boards

Figure A-1 shows the jumper configurations for Series 400 CPU boards.

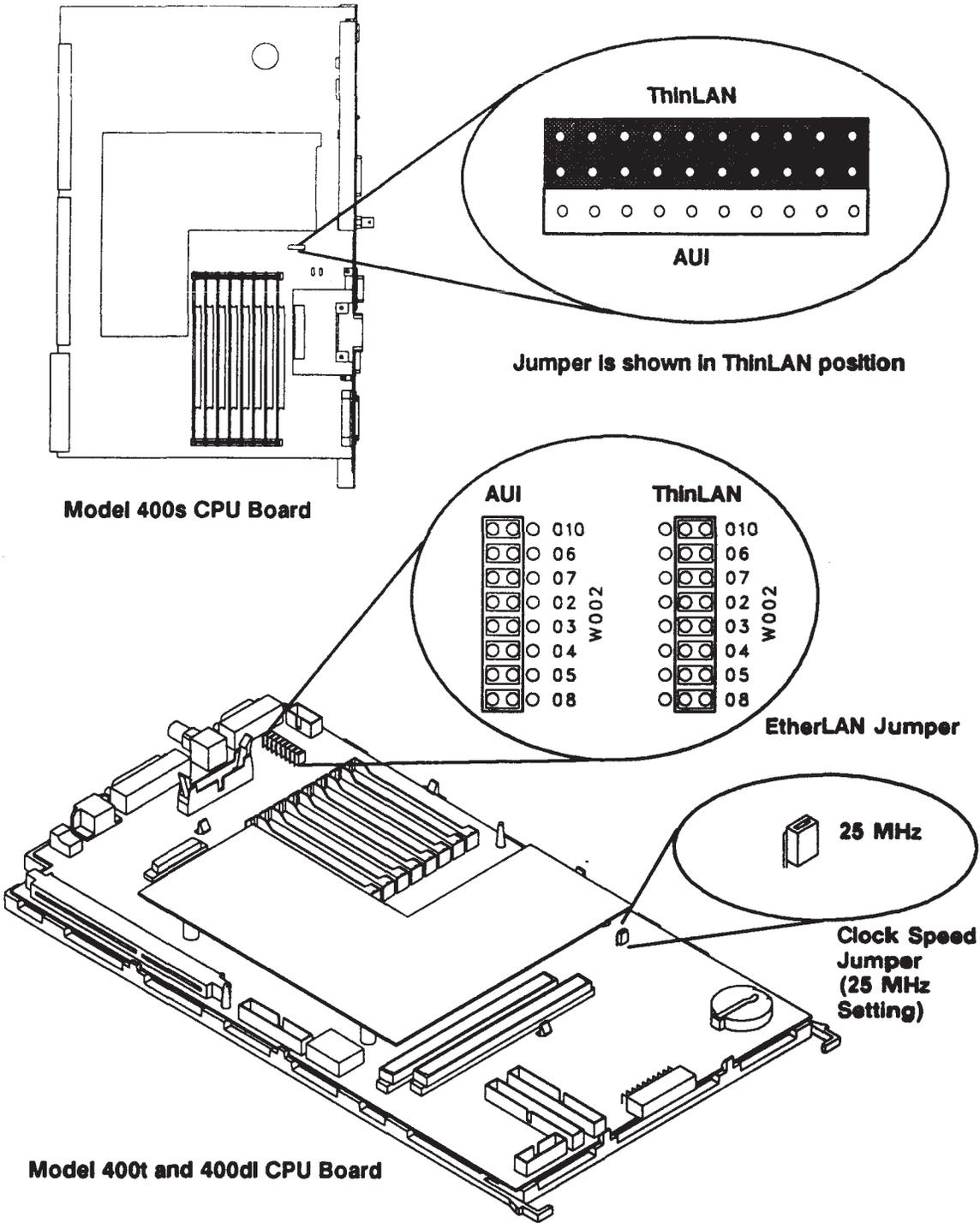


Figure A-1. CPU Board Configurations

A.1.2 HPA1416A VRX Color Graphics Controller

Figure A-2 shows the default switch configuration for the VRX Color Graphics Controller board. For alternative switch configurations, refer to the *HP A1416A Graphics Interface Familiarization Guide*.

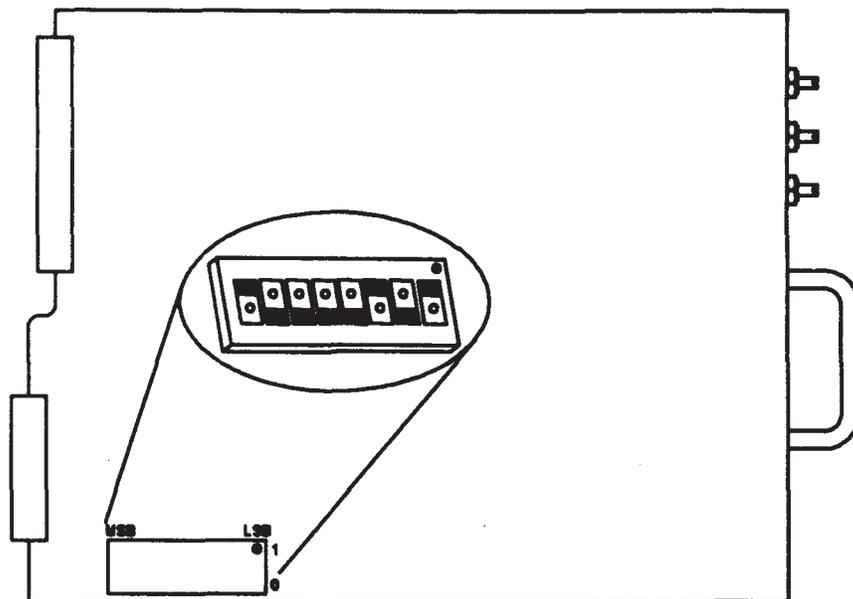


Figure A-2. HP A1416A Color Graphics Controller Switch Configuration

A.1.3 HPA1096A VRX Monochrome Graphics Controller

Figure A-3 shows the jumper locations for the VRX Monochrome Graphics Controller board. Table A-1 lists the jumper configurations.

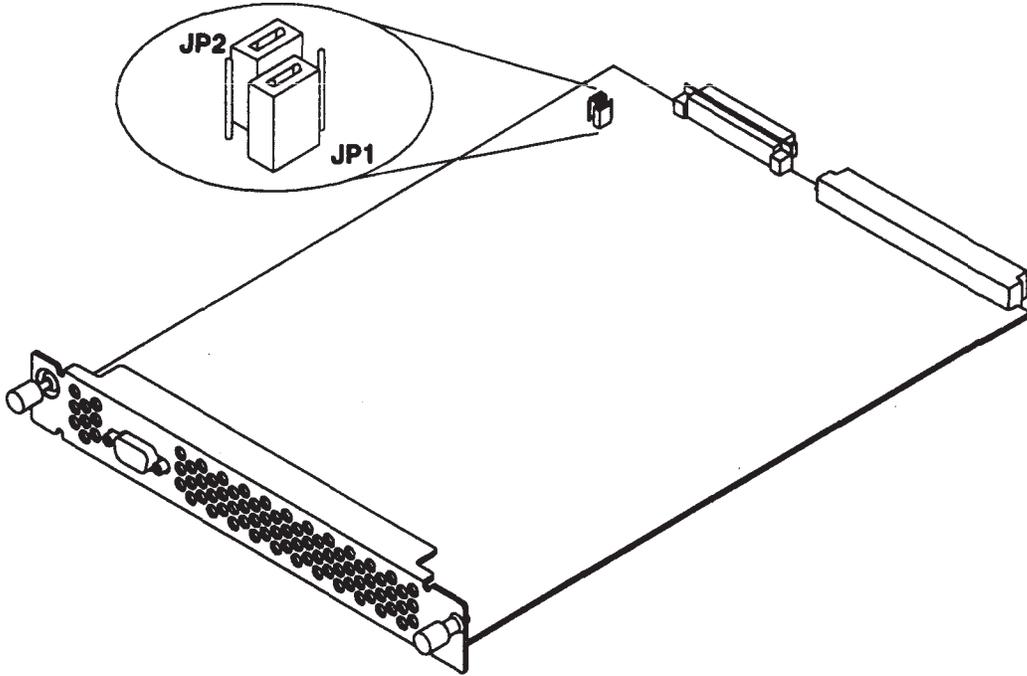


Figure A-3. VRX Monochrome Graphics Controller Jumpers

Table A-1. Jumper Configurations for VRX Monochrome Controller

| JP2 | JP1 | Address (Hex) |
|-----|-----|---------------|
| | | 1000000 |
| | | 1400000 |
| | | 1800000 |
| | | 1C00000 |

A.1.4

802.5 Network Controller-AT

Figure A-4 shows the standard jumper configuration for the 802.5 Network Controller-AT. Figure A-5 shows the alternate jumper configuration. Use the standard jumper configuration for the first or only 802.5 controller in the system. Use the alternate jumper configuration for a second 802.5 controller, or for the only 802.5 controller if another option board in the system uses the standard configuration parameters.

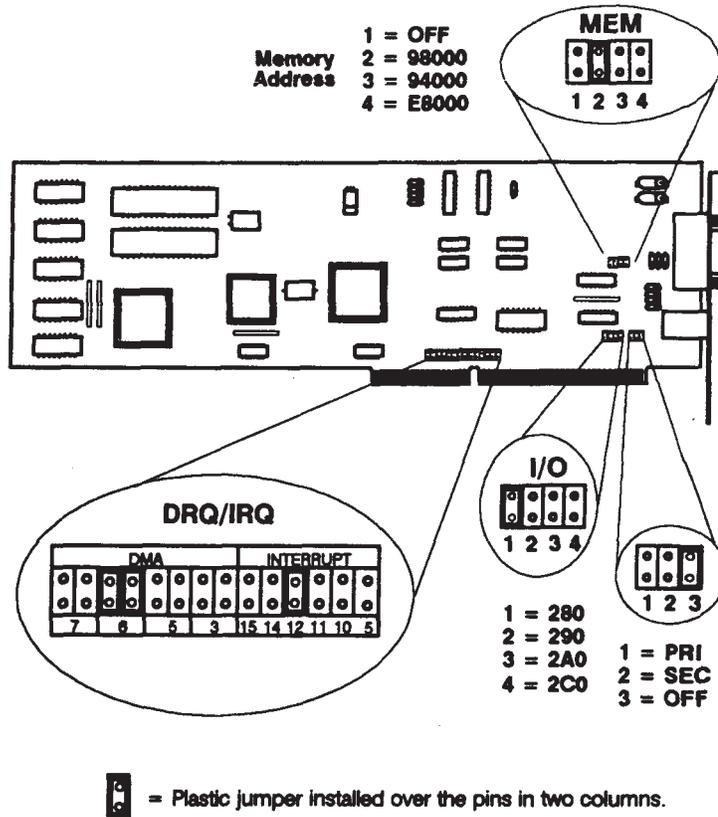


Figure A-4. Standard 802.5 Network Controller-AT Jumper Configuration

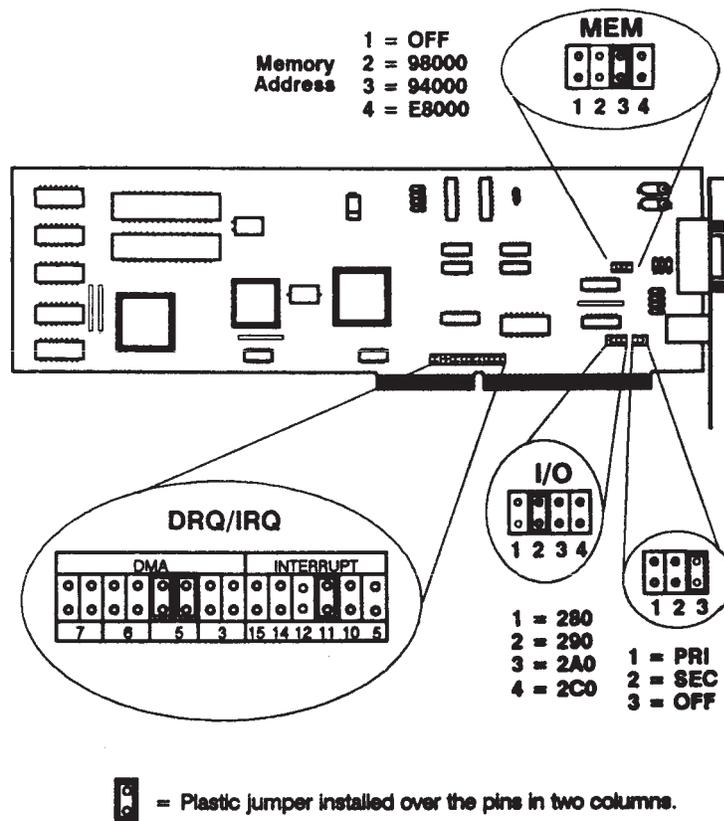
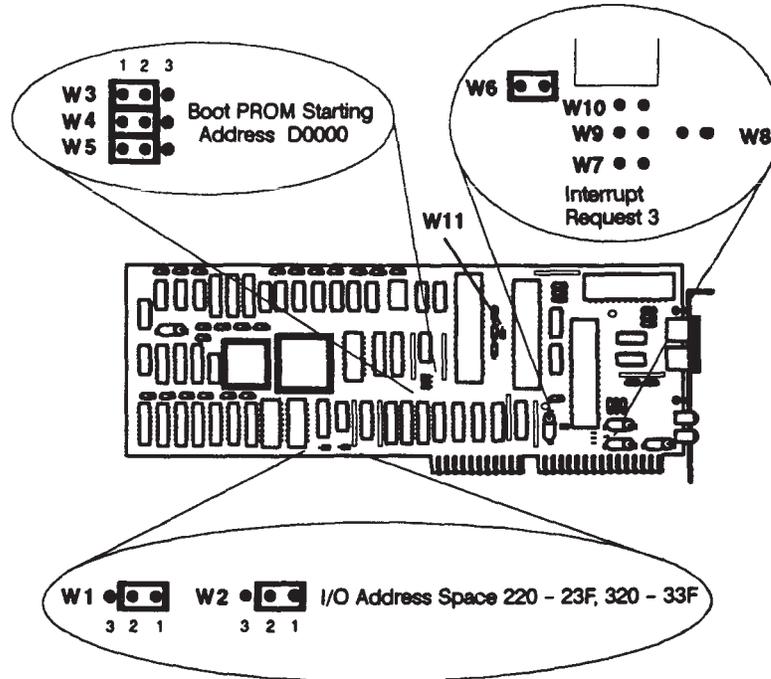


Figure A-5. Alternate 802.5 Network Controller-AT Jumper Configuration

A.1.5

Apollo Token Ring Network Controller-AT

Figure A-6 shows the jumper settings for the Apollo Token Ring Network Controller-AT.



Notice: W11 is factory selected; do not remove.

Figure A-6. Apollo Token Ring Network Controller-AT Jumper Settings

A.1.6 PC Coprocessor Board

Figure A-7 shows the standard jumper configurations for the PC Coprocessor board. Figure A-8 shows the alternate jumper configurations for the PC Coprocessor board.

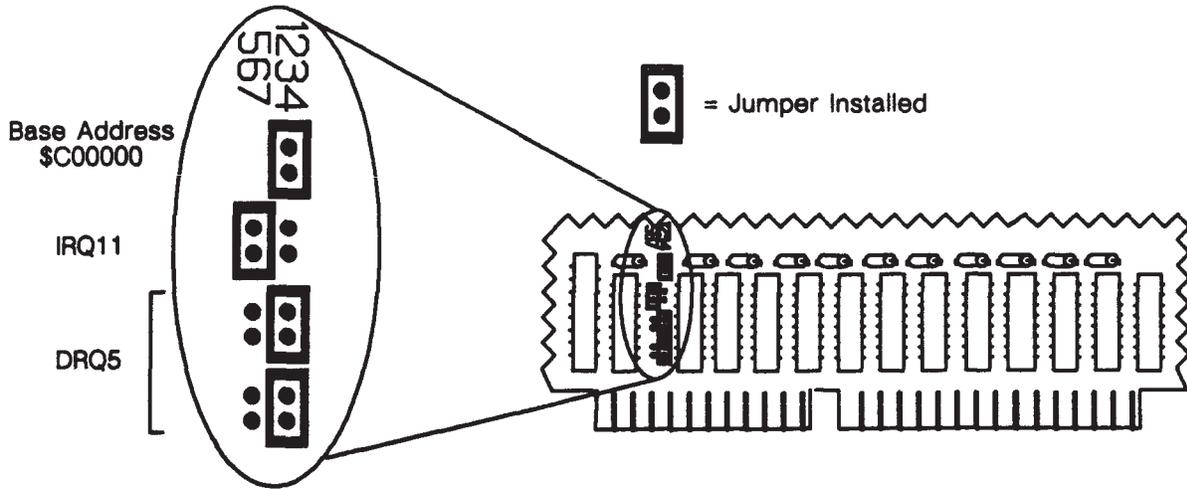


Figure A-7. PC Coprocessor Standard Jumper Configurations

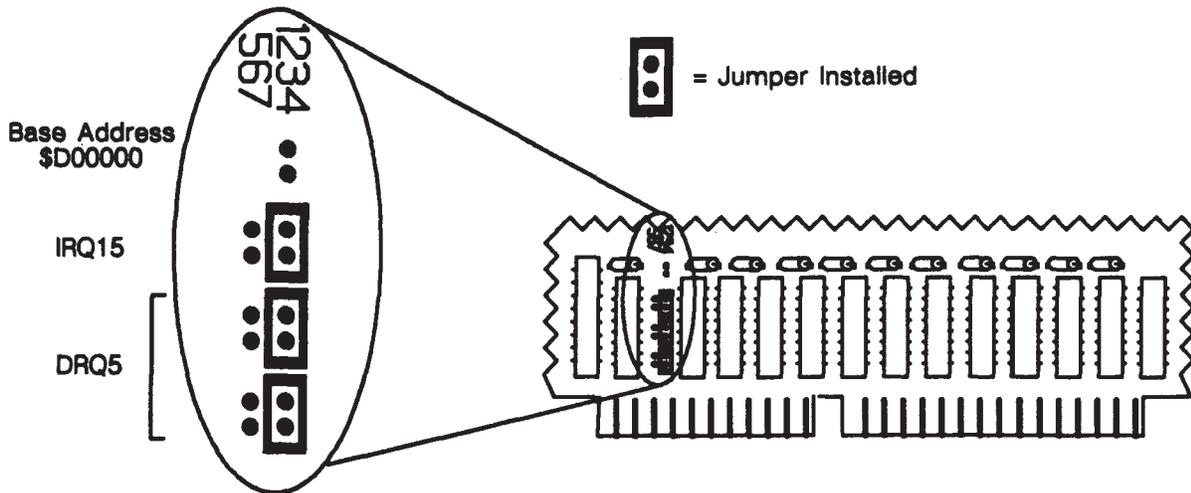


Figure A-8. PC Coprocessor Alternate Jumper Configurations

A.2 Internal Mass Storage Devices

Internal mass storage devices have SCSI configuration jumpers. Each device on the internal and external SCSI interface must use a unique address. Subsections A.2.1 through A.2.6 show the devices and their configuration functions.

NOTICE: Series 400 system units do not use SCSI bus terminators on internal storage drives. No third-party internal storage devices can use terminators because other storage drives may not function properly. Refer to the third-party mass storage device's documentation for instructions.

A.2.1 200 MB Winchester Disk Drive

Figure A-9 shows the jumper configurations for the 200 MB Winchester Disk Drive.

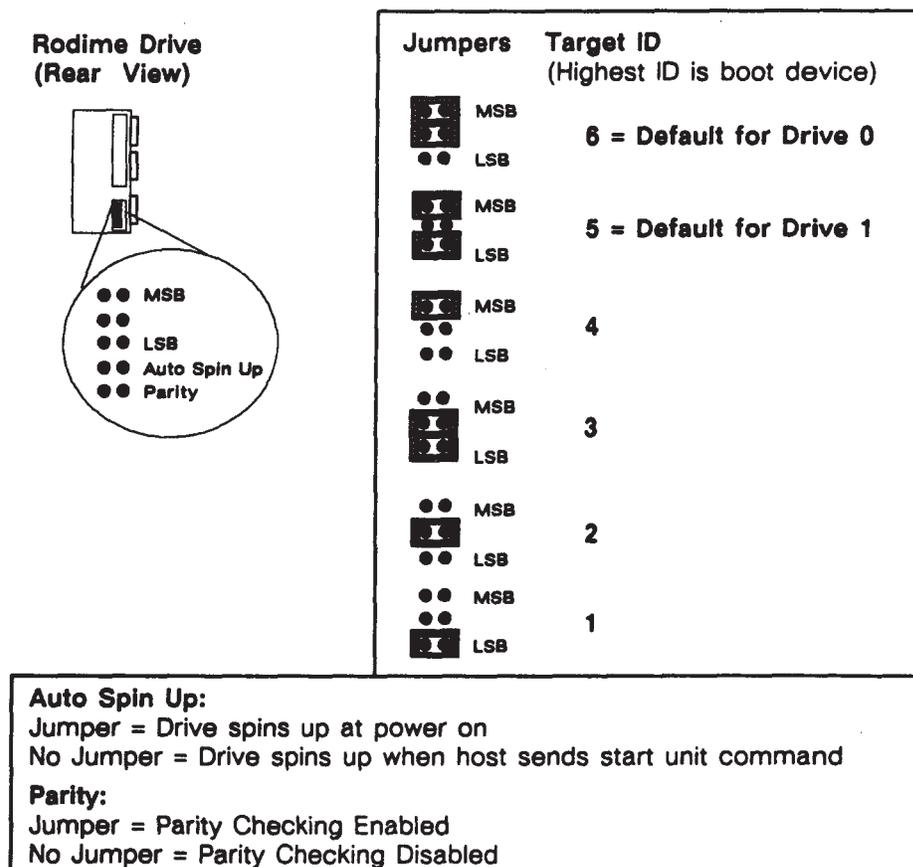


Figure A-9. 200 MB Winchester Disk Drive

A.2.2 HP A1442A 330 MB and HP A1443A 660 MB Winchester Disk Drives

Figure A-10 shows the jumper configurations for the HP A1442A 330 MB and HP A1443A 660 MB Winchester Disk Drives.

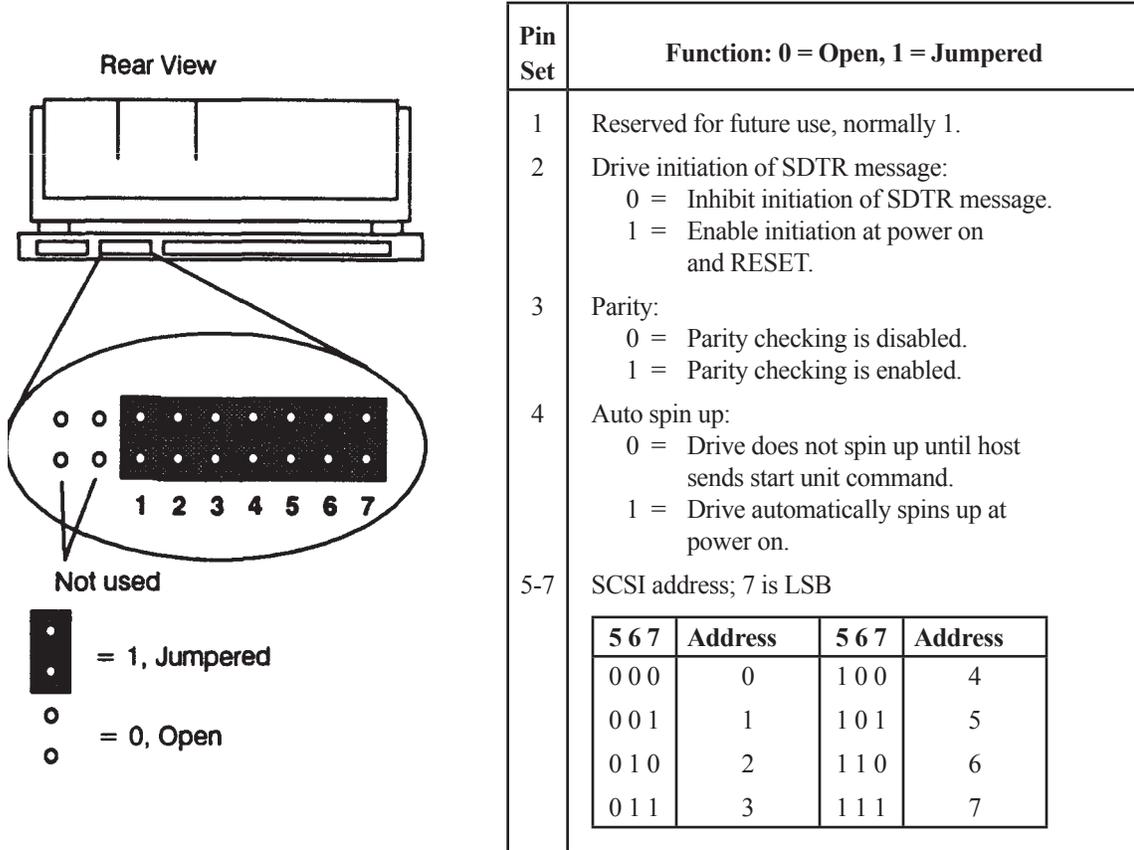
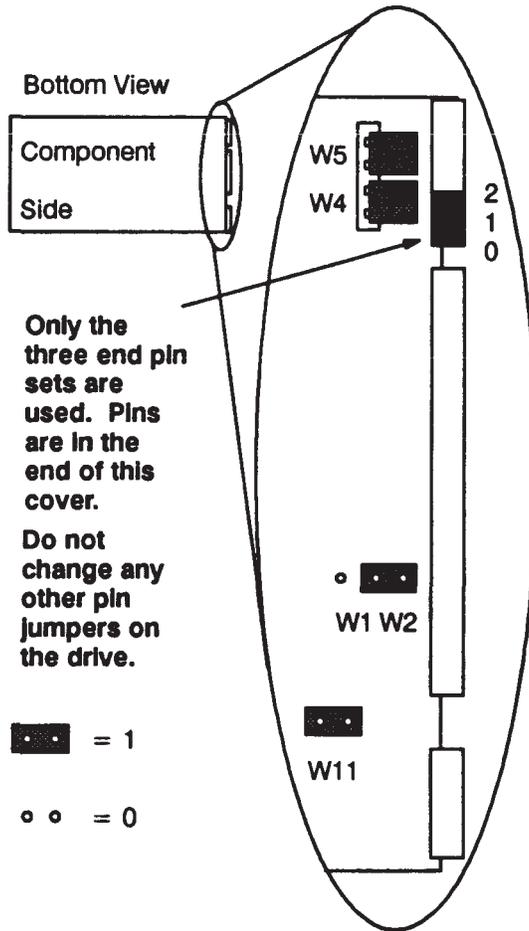


Figure A-10. HP A1442A 330 MB and HP A1443A 660 MB Winchester Disk Drive

A.2.3

HP A1444A 660 MB Micropolis Hard Disk Drive

Figure A-11 shows the jumper configurations for the HP A1444A 660 MB Micropolis Hard Disk Drive.



| Pin Set | Function: 0 = Open, 1 = Jumpered | | | |
|---------|---|---------|-------|---|
| W1 | Bus termination power source: | | | |
| W2 | W1 | W2 | W3 | Power Source |
| W11 | 1 | 0 | 0 | Drive supplies power. |
| | 0 | 1 | 0 | Host supplies power. |
| | 0 | 1 | 1 | Drive supplies power to drive and SCSI bus termination. |
| W4 | Parity: 1 = Parity checking is disabled. 0 = Parity checking is enabled. | | | |
| W5 | Auto spin up: 1 = Drive does not spin up until host sends start unit command. 0 = Drive automatically spins up at power on. | | | |
| 2-0 | SCSI address; 0 is LSB | | | |
| | 2 1 0 | Address | 2 1 0 | Address |
| | 0 0 0 | 0 | 1 0 0 | 4 |
| | 0 0 1 | 1 | 1 0 1 | 5 |
| | 0 1 0 | 2 | 1 1 0 | 6 |
| | 0 1 1 | 3 | 1 1 1 | 7 |

Figure A-11. HP A1444A 660 MB Micropolis Hard Disk Drive

A.2.4 HP A1449A 0.25-Inch QIC 60 MB Tape Drive

Figure A-12 shows the jumper configurations for the HP A1449A 0.25-in. QIC MB Tape Drive.

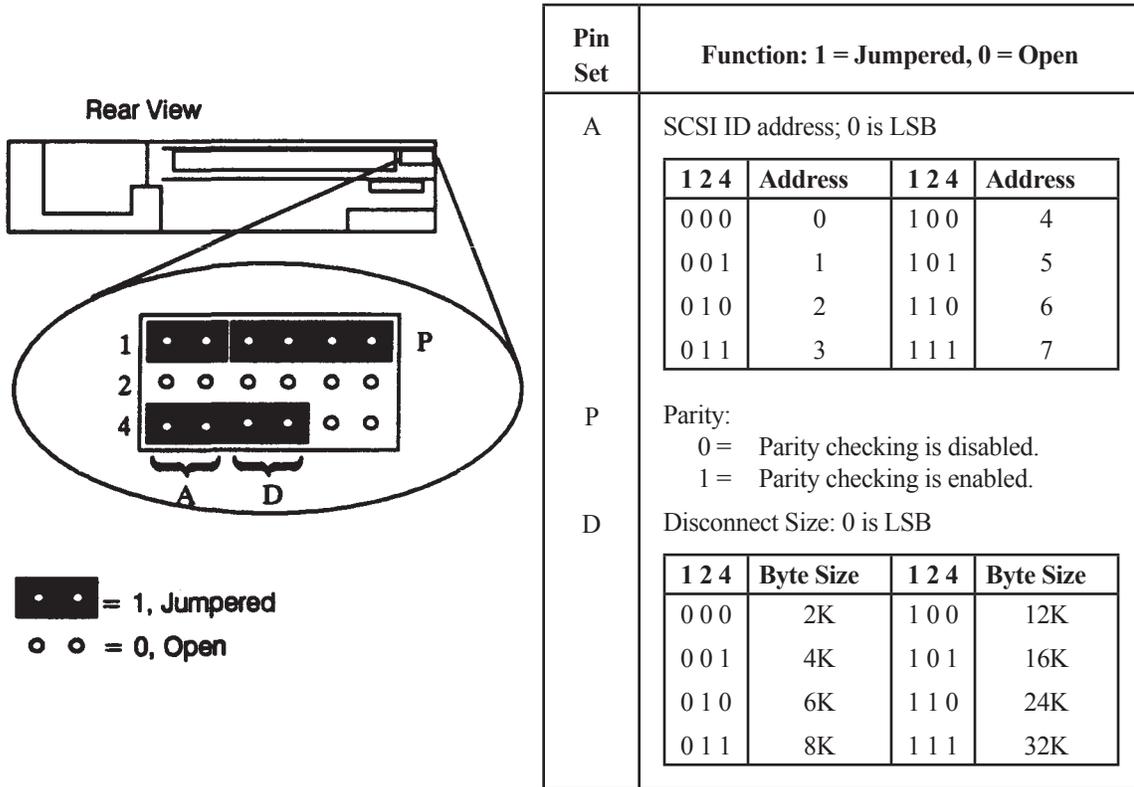


Figure A-12. HP A1449A 0.25-in. QIC 60 MB Tape Drive

A.2.5 HP A1448A CD ROM Disk Drive

Figure A-13 shows the jumper configurations for the HP A1448A CD ROM Disk Drive.

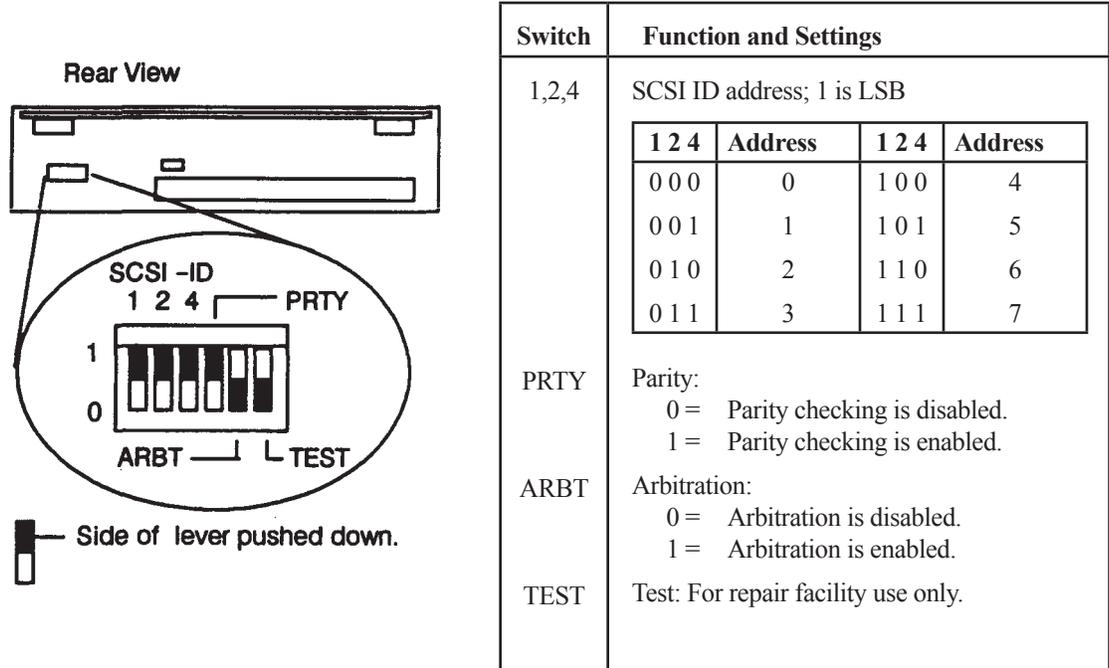


Figure A-13. HP A1448A CD ROM Disk Drive

A.2.6 HPA1447A DAT Tape Drive

Figure A-14 shows the jumper configurations for the HP A1446A DAT Tape Drive.

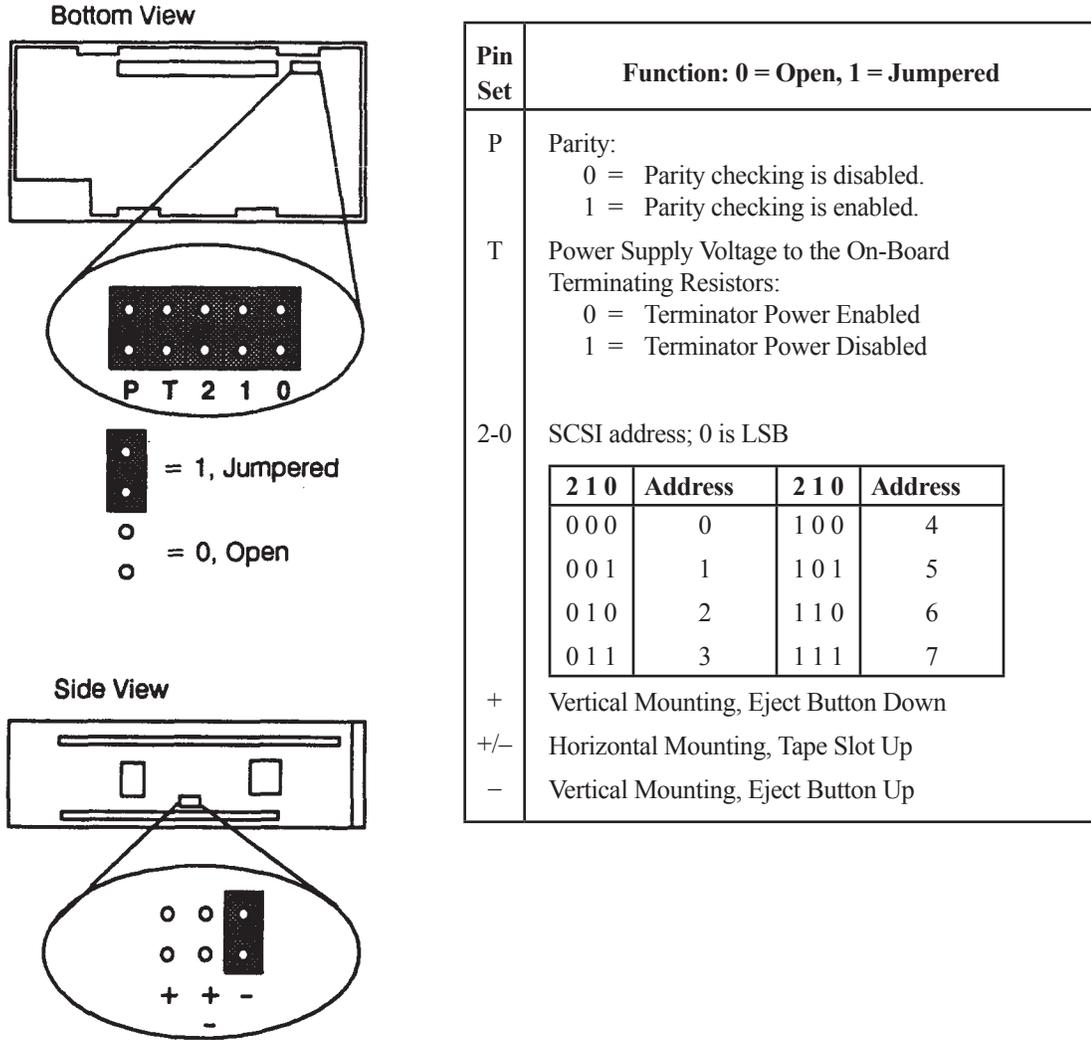


Figure A-14. HP A1447A DAT Tape Drive



Appendix B

Selecting the Operating Mode and Network Priority on Domain/OS Systems

This appendix describes how to select the Domain Compatible mode and network priority for systems that run Domain/OS. The system EEPROM stores this information.

B.1 **Selecting Domain Compatible Mode**

Perform the following procedure to configure the system to run in Domain Compatible mode. You must perform Procedure B-1 if any of the following occur:

- You have replaced the system EEPROM with a new EEPROM that is configured in HP-UX Compatible mode or Undefined mode.
- The EEPROM mode configuration is corrupted, possibly because of electrostatic discharge when handled without using a grounding strap.
- A Domain/OS system ships from the factory with an incorrect operating mode set.

Procedure B-1. *Selecting Domain Compatible Mode*

1. Turn on the system unit.
2. Perform the appropriate step according to the type of display on the screen:
 - A. If you see the following display (the undefined mode display), go to Step 5.

| | |
|---|--|
| Copyright 1990, Hewlett-Packard Company, All Rights Reserved. Series 400 Rev. <i>n, dd/mm/yy</i> md <i>mm rev n.nn, yyyy/mm/dd.hh:mm:ss</i> MC680n0 Processor . . . | Configuration Control Keys Mode Name Class ----- 1 I/O Configuration 2 Boot Mode Selection R use Remote terminal L use Local display A Abort without changes ----- Type [key] Return ? |
|---|--|

Configuration Mode
RESET to Power-up

- B. If you see the following display (the HP-UX Compatible mode display), go to Step 3.

| | |
|---|--|
| Copyright 1990, Hewlett-Packard Company, All Rights Reserved. Series 400 Rev. <i>n, dd/mm/yy</i> md <i>mm rev n.nn, yyyy/mm/dd.hh:mm:ss</i> MC680n0 Processor . . . | |
|---|--|

System Search Mode
RESET to Power-up

3. When the system displays `system search` mode on the bottom of the screen, display the Configuration Control menu by typing

`<c> <RETURN>`

4. Select the Boot Mode Selection menu by typing the following at the prompt:

Type [key] Return ? `<3> <RETURN>`

Go to Step 6.

5. Select the Boot Mode Selection menu by typing the following at the prompt:

Type [key] Return ? `<2> <RETURN>`

6. Select Domain Compatible mode by typing the following at the prompt:

Type [key] Return ? `<1> <RETURN>`

7. Permanently select Domain Compatible mode by typing the following command at the prompt:

Type T or P Return ? `<p> <RETURN>`

If you select permanent the system retains its Domain Compatible mode configuration if turned off.

8. Store the Domain Compatible mode selection in the EEPROM by typing

`<e> <RETURN> <RETURN>`

If in SERVICE mode, the system displays the MD header and MD prompt. If in NORMAL mode, the system executes Self Test diagnostics and boots Domain/OS. Refer to the *Series 400 Workstation Domain/OS Owner's Guide* for more detailed information about selecting operating modes.

B.2 Selecting the Primary Network

Perform Procedure B-2 to select the primary network for the system. If you are selecting a primary network for a diskless system, select the same primary network used by the partner node.

Procedure B-2. *Selecting the Primary Network*

1. Stop any user processes and log out.
2. Shut down to the MD prompt by typing the following at the `login:` prompt:

```
login: shut <RETURN>
```

3. From the MD prompt `>` type

```
> pnet x <RETURN >
```

where *x* corresponds to one of the following values:

e for 802.3 network

r for Apollo Token Ring network

t0 for 802.5 network with network controller 0

t1 for 802.5 network with network controller 1

If the system uses two 802.5 network controller boards, you must specify controller 0 (**t0**) or controller 1 (**t1**) as the primary controller. The default is 0.

4. Use the **pnet** command to confirm the primary network:

```
> pnet <RETURN >
```

and you receive the following system message:

```
APOLLO TOKEN RING: CONTROLLER = 0
```

The example display shows the primary network is set to controller 0 for the Apollo Token Ring network.



Appendix C

Configuring the EEPROM for HP-UX Systems

This appendix explains how to use Configuration Control Mode to configure the EEPROM.

C.1 Workstation Configurations

Your workstation may be configured with one of several combinations of system console, type of operating system, and internal interface settings. If these configurations are matched, the correct displays appear and the requested operating system can be booted. If there is a mismatch, you have to enter Configuration Control Mode and change the EEPROM configuration. Table C-1 lists typical matched configurations. Table C-2 lists typical mismatched configurations and what to do to enable the system console and boot the requested operating system.

Table C-1. System Unit, System Console, and Operating System Matched Situations at Power-Up

| System Console | RS-232 Mode | Boot Mode | Op. System | Display Shown | What To Do |
|----------------|-------------|-----------|------------|---------------|------------------------------------|
| Monitor &Kbd. | Local | HP-UX | HP-UX | Power Up | Configure internal I/O, if needed. |
| Monitor &Kbd. | Remote | HP-UX | HP-UX | Power Up | Configure internal I/O, if needed. |

*Table C-2. System Unit, System Console, and Operating System
Mismatch Situations at Power-Up*

| System Console | RS-232 Mode | Boot Mode | Op. System | Display Shown | What To Do |
|-----------------------|--------------------|------------------|-------------------|----------------------|---|
| Monitor &Kbd. | Local | Undetermined | Any | Config. menu | Configure internal I/O, if needed. Change Boot Mode to Op. Sys. installed. |
| Monitor &Kbd. | Local | Domain | HP-UX | Blank Screen | Configure internal I/O, if needed. Change Boot Mode to HP-UX. |
| Monitor &Kbd. | Remote | Undetermined | Any | Remote at 9 | Change RS-232 to Local. Configure internal I/O, if needed. Change Boot Mode to Op. Sys. installed. |
| Monitor &Kbd. | Remote | Domain | HP-UX | Blank Screen | Change RS-232 to Local. Configure internal I/O, if needed. Change Boot Mode to HP-UX. Select operating system, if needed. |
| Terminal | Local | Undetermined | Any | Blank Screen | Change RS-232 to Remote. Configure internal I/O, if needed. Change Boot Mode to Op. Sys. installed. |
| Terminal | Local | Domain | HP-UX | Blank Screen | Change RS-232 to Remote. Configure internal I/O, if needed. Change Boot Mode to HP-UX. Select operating system, if needed. |

C.2 System Console and System Unit Configurations

Either a keyboard with a monitor or a terminal may be used as your workstation's system console. When a keyboard is connected to the system unit's HP-HIL connector, it may always be used for inputting keyboard commands. Depending on the system console used, one of several types of information is displayed at the first power-up.

C.2.1 Keyboard and Monitor as System Console

At the first power-up after installation, when the workstation uses a keyboard and monitor as the system console *and* there are no pre-installed operating systems, one of the following two situations happens:

- The following Configuration Control Main menu appears in the upper right-hand corner. You may continue configuring your system unit by referring to the "Using Configuration Control Mode" section later in this appendix..

```
Configuration Control
Keys Control Class
-----
 1 I/O Configuration
 2 Boot Mode Selection

A Abort without changes
-----
Type [key] RETURN ?
```

- The following message appears:

```
Remote Console at 9
After beeps, type L RETURN to use the local monitor as console.
```

If the above message appears, the system unit's internal RS-232 interface or another accessory DIO-II RS-232 interface has been set to Remote.

If the indicated select code is 9, that means that the system unit's internal RS-232 interface has been set to Remote. To temporarily use the HP-HIL/Video interfaces so that the keyboard and monitor may be used as the system console, listen for two beeps (about 5 seconds after the message appears). Then type the following command within 10 seconds of hearing the two beeps:

L < Return >

To permanently change the internal RS-232 to Local, you must enter I/O Configuration Mode and change the interface configuration to Local.

If the select code is not a 9, then an accessory DIO-II RS-232 interface has been set to Remote. You must remove the RS-232 accessory card and change its configuration switches to make a permanent change to the accessory card. Refer to the interface card's documentation. Then, power up the system unit.

The system unit resets and the Configure Mode Main menu should appear in the display's upper right-hand corner. Go on to the "Using Configuration Control Mode" later in this appendix to continue configuring your system unit.

C.2.2 Terminal as System Console

When your workstation uses a terminal as the system console and has no pre-installed operating systems, one of the following situations happen at the first power-up:

- The following Configuration Mode Main menu appears on the right-hand side. You may continue configuring your system unit by referring to the "Using Configuration Control Mode" later in this appendix.

```
Configuration Control
Keys Control Class
-----
 1 I/O Configuration
 2 Boot Mode Selection

A Abort without changes
-----
Type [key] RETURN ?
```

- If nothing appears on the display, the system unit's internal RS-232 interface has been set to Local mode. You must reconfigure your system unit's RS-232 interface to Remote mode. The next section explains how to do this.

Reconfiguring the RS-232 Interface to Remote Mode

Follow these steps (refer to Figure C-1) to temporarily reconfigure your system unit's RS-232 interface to Remote mode when you power-up the system unit and no display appears on your terminal:

1. Set Service/Normal switch to Service.

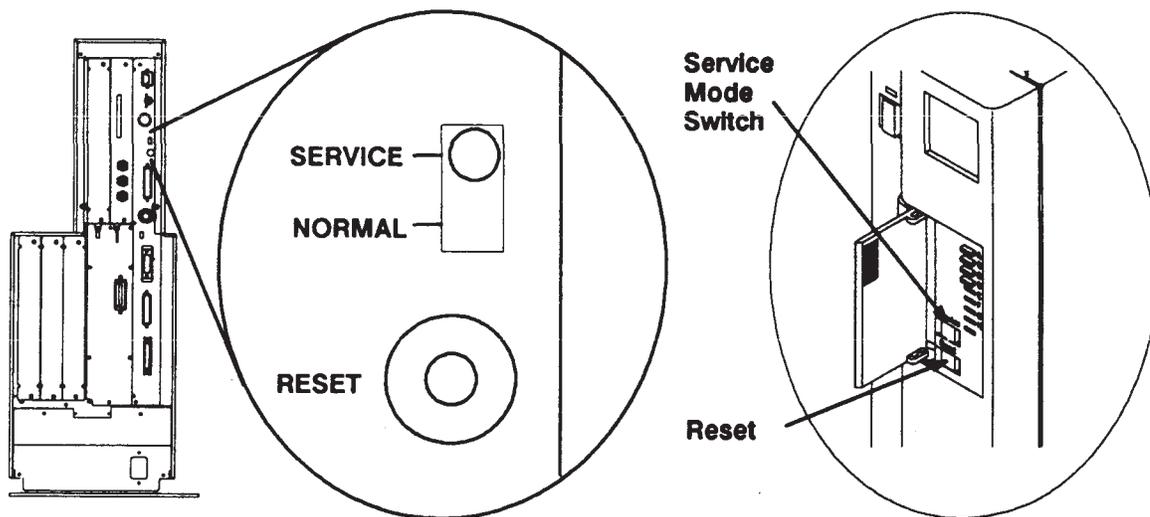


Figure C-1. System Unit Service/Normal Switch and Reset Button

2. Press the RESET button to reset the system unit.
3. To temporarily change the internal RS-232 interface to Remote so that the terminal may be used as the system console, listen for two beeps (about 5 seconds after the message appears). Then, type the following command:

R < Return >

The system unit resets and the Configuration Control Main menu appears in the terminal display's right-hand side. Go to the "Using Configuration Control Mode" section later in this appendix to continue configuring your system unit.

C.2.3 Terminal as System Console with Monitor

If your workstation uses a terminal as the system console and also has a monitor connected to the video board (but no keyboard connected to the HP-HIL connector), one of the following two situations happen:

- The following Configuration Control Main menu appears on the right-hand side. You may continue configuring your system unit by referring to the “Using Configuration Control Mode” section later in this appendix.

```
Configuration Control
Keys Control Class
-----
 1 I/O Configuration
 2 Boot Mode Selection

A Abort without changes
-----
Type [key] RETURN ?
```

- This power-up display appears on the monitor. Type the following command and the system unit resets:

R < Return >

The following Configuration Control Mode Main menu then appears. You may continue configuring your system unit by referring to the “Using Configuration Control Mode” section later in this appendix.

```
Copyright 1990,
Hewlett-Packard Company,
All Rights Reserved.

Series 400 Rev. 1, 5 Jun 90
md 12 rev 0.20, 1990/03/12.16:31:17
Bit-Mapped Video
MC68030 Processor
MC68882 Coprocessor
Configuration EEPROM
HP-HIL.Keyboard
  Type R RETURN for internal RS-232 console
HP-IB
DMA-CO
RAM 4194080 Bytes
HP98644 (RS-232) at 9
HP98265 (SCSI S 32) at 14
HP98643 (LAN) at 21, THIN, 080009AAAAAA
HP PARALLEL at 12

Configuration Mode
RESET to Power-up
```

```
Configuration Control
Keys Control Class
-----
 1 I/O Configuration
 2 Boot Mode Selection

A Abort without changes
-----
Type [key] Return ?
```

Note the line in the menu that reads:

Type R RETURN for internal RS-232 console

That means to type the command

R < Return >

To change the internal RS-232 interface to Remote so that you can use the terminal as the system console. Note that sometimes (depending on when you type the command) that some of the display does not appear.

C.3 Using Configuration Control Mode

Before you use Configuration Control Mode, ensure that your system console interface has been properly configured. Refer to the ‘System Console and System Unit Configurations’ section earlier in this appendix for that procedure.

New System Unit First Turn-On

Your system unit’s Boot Mode determines whether it runs Domain compatible or HP-UX compatible operating systems. New system units display their Boot Mode selection in following two ways:

- A special LED pattern appears a few seconds after the system unit gets powered up. The pattern appears after the power up display has completed on the left side of the screen and before the Configuration Control menu appears.
- The power-up display has a Configuration Control menu that may be accessed to find out what the Boot Mode selection is. You can change the selection if necessary.

Boot Mode LED Patterns

When you first power-up your system unit, the middle eight front panel LEDs all turn on, then off. After the left side of the power-up display appears, the fourth yellow LED down, (to the right if the LED display is horizontal), blinks at a high rate for about three seconds. During the time the fourth LED blinks, the top (or left,) two yellow LEDs light to indicate the current Boot Mode selection. Table C-3 lists these LED patterns.

Table C-3. Boot Mode Selection Top/Left Four Amber LED Patterns

| Undetermined | HP-UX | Domain |
|---|---|--|
|  |  |  |

Power-Up Display

The following Configuration Control Mode screen appears when you first turn a new system unit on. The Configuration Control menu is in the upper right-hand corner.

```
Copyright 1990,
Hewlett-Packard Company,
All Rights Reserved.
```

```
Series 400 Rev. 1, 5 Jun 90
md 12 rev 0.20, 1990/03/12.16:31:17
Bit-Mapped Video
MC68030 Processor
```

```
Configuration EEPROM
HP-HIL.Keyboard
RAM 4194080 Bytes
```

```
Configuration Control
```

```
Keys Control Class
```

- ```

1 I/O Configuration
2 Boot Mode Selection
```

```
A Abort without changes
```

```

Type [key] Return ?
```

```
Configuration Mode
RESET to Power-up
```

The next to the last line at the bottom identifies the system unit as being in the Configuration Mode.

Note the line on the left side that reads Configuration EEPROM. If the configuration information in the EEPROM could not be accessed or correctly applied, the line would read

```
Configuration EEPROM Failed
```

That means that one or more of the Configuration Control Classes has not worked correctly. You may have to replace the CPU board.

### C.3.1 Boot Mode Selection

With the Configuration Control Mode menu displayed, type the number key command

**2 < Return >**

and this Boot Mode Selection menu appears:

```
 Boot Mode Selection
Keys Mode Status

 1 Domain Compatible
 2 HP-UX Compatible
 3 Undefined P

 C Clear temporary
 E Execute
 A Abort without changes

Type [key] RETURN ?
```

The number keys are used to select one of the compatibility modes. Letter keys are the control keys for the menu. A C is used to clear any mode's temporary status that's indicated by a T in the status column. The E key is used to execute the menu and store the status information in the EEPROM. If the status is correct, you may type the A key to abort the Boot Mode Selection without changing it.

Below the menu, is the following prompt line:

```
Type [key] RETURN ?
```

Type the key, either letter or number. Then, press < Return > to complete the command.

Type the number key command to select the HP-UX Compatible Boot Mode:

**2 < Return >**

The following menu appears below the Boot Mode Selection menu:

```
 Boot Mode Selection
Keys Mode Status

 1 Domain Compatible
 2 HP-UX Compatible
 3 Undefined P

 C Clear temporary
 E Execute
 A Abort without changes

Type [key] RETURN ?
```

```
 2 HP-UX Compatible
Temporary or Permanent
Type T or P RETURN ?
```

Type **T** < **Return** > to temporarily select the boot mode. If you execute this selection, and then cycle power or reset the system unit, the system uses the permanently selected boot mode.

Type **P** < **Return** > to permanently select the boot mode selection. If you execute this selection, and then cycle power or reset the system unit, the system uses the permanently selected boot mode.

If you type P, the following menu appears:

```
 Boot Mode Selection
Keys Mode Status

 1 Domain Compatible
 2 HP-UX Compatible P
 3 Undefined

 C Clear temporary
 E Execute
 A Abort without changes

Type [key] RETURN ?
```

Type **E** < **Return** > to execute the menu selections.

Type **C** < **Return** > to clear any temporary selection.

After executing the Boot Mode Selection menu with HP-UX compatible mode selected, the system unit resets and the following power-up display appears:

```
Copyright 1990,
Hewlett-Packard Company,
All Rights Reserved.
```

```
Series 400, Rev. 1, 5 Jun 90
md 12 rev 0.20, 1990/03/12.16:31:17
Bit-Mapped Video
MC680n0 Processor
```

```
.
. .
. . .
```

```
System Search Mode
RESET to Power-up SPACE clears input
```

```
?
```

As soon as you see this display for HP-UX compatible mode, you have these options:

- Do nothing and the Boot ROM searches for an HP-UX compatible operating system. If one is found, it boots it. For system units that have pre-installed operating systems, this is the correct procedure.
- Type any key to stop the Boot ROM functions and place the system unit in an attended mode.

While in attended mode, you may do one of the following as soon as the keyboard line appears in the power-up display:

- Type any key to stop the Boot ROM process and put the system unit in attended mode. From attended mode, you may also do the next two options.
- Type **C** < **Return** > to enter Configuration Control Mode to change the Boot Mode Selection, Auto System Select, or I/O Configuration.
- Type **T** < **Return** > to enter test Mode and run the Boot ROM diagnostics.

If you are turning on a new system unit for the first time and need to change the internal interface configurations or change the Auto System Select Mode, you should type the command **C** < **Return** > to enter Configuration Control Mode. Then you may

select either the I/O Configuration or Auto System Select Mode. These modes are explained in the following sections.

---

## C.4 I/O Configuration Mode

These procedures are used for interfaces that are configured under Boot ROM control using keyboard inputs. If your system unit has interfaces with switches or jumpers to configure it, refer to their documentation for instructions.

### C.4.1 Entering I/O Configuration Mode

The following menu appears when you first enter the Configuration Mode:

```
Configuration Control
Keys Control Class

 1 I/O Configuration
 2 Auto System Selection
 3 Boot Mode Selection

 A Abort without changes

Type [key] RETURN ?
```

Type the following command:

**1 < Return >**

and a menu similar to the following appears:

```
Configurable Interfaces
Keys Interface Select Code

 1 LAN 21
 2 SCSI 14
 3 HP Parallel 12
 4 RS-232 9
 5 HP-IB

 N store New values
 D store Default values
 (then cycle SPU power)
 A Abort without changes

Type [key] RETURN ?
```

The order in which the interfaces appear and their respective number keys may be different than in the above example. Only interfaces that are configurable from Boot ROM control are listed. Interfaces in the system unit that have switches to set their configuration are not listed.

If the one of the following error messages appear in the display

```
Configure Mode Failed
```

```
Configuration EEPROM Failed
```

one or more of the following situations exists with the I/O Configuration Mode:

- All of the configurations have been set to default values.
- Some default and some changed values have been set.
- All the configurations have been set to their changed values. Some minor error occurred that shouldn't affect the system unit's configuration.

When an error message appears, check your system unit's Boot Mode Selection and I/O Configuration Mode selections and verify that they are correct for your application.

If an error message like the following appears in the mode line at the bottom, or the Configuration EEPROM Failed message appears at power-up, a hardware problem with the Boot ROM or its associated circuits probably exists.

```
Configure Mode Failed
```

```
RESET to Power-UP, SPACE to clear input
```

```
C?
```

Refer to the following table for possible error messages you may see when entering Configuration Mode.

*Table C-4. Configuration Mode Entry Error Messages*

| <b>Error Message</b>            | <b>Meaning and What To Do</b>                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| (No error message)              | If Configuration Mode does not start and no error message appears, a hardware failure probably occurred. Replace CPU board. |
| EEPROM Has Bad Information      | Configuration Mode started and main menu may appear, but something failed. Try again. Replace CPU board.                    |
| EEPROM Load Section Missing     | Could not load new configuration data. Hardware failure. Replace CPU board.                                                 |
| EEPROM Defaults Section Missing | Default configurations could not be found. Hardware failure. Replace CPU board.                                             |
| Too much data to save           | Too many interfaces for EEPROM to manage. Reconfigure system unit with fewer interfaces.                                    |

Only the interfaces' select codes are listed in the main Configurable Interfaces menu. HP-IB is fixed at select code 7 and cannot be changed. Most built-in interfaces have several configurable features. Interface default values are listed in the following table.

*Table C-5. Built-in Interface Default Configurations*

| <b>Interface</b> | <b>Configuration Function</b>      | <b>Default</b> | <b>Options</b> |
|------------------|------------------------------------|----------------|----------------|
| Optional HP-IB   | Select Code (cannot be changed)    | 7              | None           |
|                  | System Controller                  | Yes            | No             |
| RS-232           | Select Code                        | 9              | 0 to 31        |
|                  | Remote/Local                       |                |                |
|                  | Sys. Unit Shipped with Keyboard    | Local          | Remote         |
|                  | Sys. Unit Shipped without Keyboard | Remote         | Local          |
| SCSI             | Interrupt Level                    | 3              | 3 to 6         |
|                  | Modem Enable                       | Yes            | No             |
|                  | Select Code                        | 14             | 0 to 31        |
|                  | Interrupt Level                    | 3              | 3 to 6         |
|                  | Bus Address                        | 7              | 0 to 7         |
| Thin/AUI LAN     | Parity                             | Yes            | No             |
|                  | Select Code                        | 21             | 0 to 31        |
|                  | Interrupt Level                    | 5              | 3 to 6         |
| HP Parallel      | Select Code                        | 12             | 0 to 31        |
|                  | Interrupt Level                    | 3              | 3 to 6         |

If the default configurations will be used, you should exit the menu by typing the **A** command. If you want to change any of the configuration functions, refer to the appropriate configuring the built-in interfaces sections later in this appendix.

There are three columns of information:

- **Keys** - the keyboard number keys represent the interface you want to select to configure. Letter keys are for control functions.
- **Interface** - the built-in configurable interfaces. If an interface listed in your screen's left-hand side does not appear in the Main Configuration menu, that interface cannot be configured from I/O Configure Mode.
- **Select Code** - the listed interfaces select code. The standard-speed HP-IB interface is fixed at select code 7. When you get the power-up display in HP-UX compatible mode or enter I/O Configuration Mode, default select codes are listed. If you change an interface select code and save the new configuration, the new select code is listed the next time you turn on your system unit. You may also revert back to the default settings.

## C.4.2 Example Interface Menu

You may select one or more keyboard configurable interfaces in any order. For each interface, you can go to its Interface menu. The RS-232 Interface menu is shown in the following example. To select the RS-232 Interface, type the command key for the RS-232 interface:

[key] < **Return** >

The Configurable Interfaces menu gets replaced with this RS-232 menu:

```
 RS-232
Key Feature Value

 1 Select Code 9
 2 Interrupt Level 5
 3 Remote/Local L
 4 Modem Enable Y

X to exit menu

Type [key] RETURN ?
```

The three columns in the RS-232 menu are similar to the Configurable Interfaces menu:

- Key indicates the feature you want to select. To exit the interface menu, type **<X> <RETURN>**.
- Feature lists each configurable function for the selected interface,
- Value shows the current value (or mode) for each function.

Note that all Interface menus are not the same. Each has its own features available for configurations.

When you select an interface's function, the prompt line changes. An example is the RS-232's Select Code. After you have selected the RS-232 interface to configure, and you want to change its select code, type the following command:

### **1 < Return >**

The following output appears:

```
1 Select Code 9
 used select codes are :
12 14 15 21
Type 0.. 31 except used RETURN ?
```

Note the select code function line appears like it does in the main part of the RS-232 menu. The current select code appears at the right. Select codes already used in your system unit are not available and are listed in the third line.

At the bottom, you'll see the prompt line. This example means you would enter a select code between 0 and 31, except for select codes 12, 14, 15 and 21. If you want to use select code 23, you would enter the command:

### **23 < Return >**

Other features would be selected and changed the same way. After you have made all the changes to the RS-232 Interface that your system unit needs, exit the RS-232 menu by entering the command

### **X < Return >**

### C.4.3 Using the Control Functions

Your Configurable Interfaces menu has three control functions

N store New values  
D store Default values  
(then cycle SPU power)  
A Abort without changes

- **N** saves all listed interfaces reconfigured values in the EEPROM. You can turn OFF your system unit, then turn it back ON and the values you configured the interfaces to are used. Then the self-test runs.
- **D** exits the Configuration Mode and resets the factory default configurations. You must cycle system unit power to reconfigure the interfaces to these default values.
- **A** causes the Boot ROM to reset and run the self-test without saving any new interface configurations you may have made. The interfaces' existing configurations are used.

If the Boot ROM or EEPROM has problems after you enter N or D, the mode lines display one of the error messages shown in the following table.

*Table C-6. Configuration Mode Exit Error Messages*

| Command       | Error Message                   | Meaning and What To Do                                                                                    |
|---------------|---------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>N or D</b> | Too many configuration saves    | More than 64,000 saves were tried. Unlikely to occur.                                                     |
| <b>N or D</b> | Can not save new configuration  | Something prevented saving the new configuration. Hardware failure. Replace CPU board.                    |
| <b>N or D</b> | EEPROM can not save information | EEPROM may not save any or all of the new configuration information. Hardware failure. Replace CPU board. |
| <b>A</b>      | (No message should appear)      | No error messages should appear when you abort configuration mode and reset you system unit.              |

## C.4.4 HP-IB Configuration

When your display has the Configurable Interfaces menu and you enter the following command for the HP-IB interface:

[key] < **Return** >

this HP-IB menu takes its place:

```
 HP-IB
Key Feature Value

 1 Sys. Controller Y

X to exit menu

Type [key] RETURN ?
```

The '1' key now changes definition to mean that when it is typed, you want to change the built-in HP-IB interface's system controller function. System controller is the only function this interface has. A "Y" in the value column means that the built-in HP-IB is the system controller.

To change your built-in HP-IB interface's system controller function to 'no:'

1. Type the command **1** and the HP-IB menu prompt changes to:

```
 1 Sys. Controller Y
Type Y or N RETURN ?
```

2. Type the command **N** and the HP-IB menu changes to:

```
 HP-IB
Key Feature Value

 1 Sys. Controller N

X to exit menu

Type [key] RETURN ?
```

3. Return to the Configurable Interfaces menu by typing the command:

**X < Return >**

## C.4.5 RS-232 Configuration

From the Configurable Interfaces menu, type the command key for the RS-232 interface menu and the following RS-232 menu appears:

```
 RS-232
Key Feature Value

 1 Select Code 9
 2 Interrupt Level 3
 3 Remote/Local L
 4 Modem Enable Y

X to exit menu

Type [key] RETURN ?
```

Each feature is explained in the following subsections.

### RS-232 Select Code

From the RS-232 menu, type the command **1** and the prompt line changes to

```
1 Select Code 9
 used select codes are :
 12 14 15 21
Type 0.. 31 except used RETURN ?
```

The select code function line appears as it does in the main part of the RS-232 menu. The current select code appears at the right. Select codes already used in your system unit are not available and are listed in the third line.

The prompt line is at the bottom, you'll see the prompt line. Enter any select code between 0 and 31, except for select codes already used for other interfaces. If you want to use select code 20, you would enter the command **20**. Then the RS-232 menu changes to:

```
 RS-232
Key Feature Value

 1 Select Code 20
 2 Interrupt Level 3
 3 Remote/Local L
 4 Modem Enable Y

X to exit menu

Type [key] RETURN ?
```

### RS-232 Interrupt Level

Typing the command **2** from the RS-232 menu changes the prompt line to

```
2 Interrupt Level 3
Type 3, 4, 5 or 6 RETURN ?
```

You can change the interrupt level to one of three other levels. If you want to use level 4, you would type the command **4**. The RS-232 menu reappears with the new interrupt level shown. If you do not want to change the interrupt level, type **< Return >**.

### RS-232 Remote/Local Mode

Typing the command **3** from the RS-232 menu changes the prompt line to

```
3 Remote/Local L
Type L or R RETURN ?
```

Change the mode by typing the command **L** (local) if a keyboard and monitor will be used as the system console, or **R** (remote) if a terminal will be used as the system console. The RS-232 menu changes and the new mode is identified in the Value column.

### RS-232 Modem Enable Mode

Typing the command **4** from the RS-232 menu changes the prompt line to

```
4 Modem Enable Y
Type Y or N RETURN ?
```

Change the mode by typing the command **N** (no) or **Y** (yes) to disable or enable the modem. The RS-232 menu changes and the new mode is identified in the Value column.

After you have reviewed the RS-232 menu and made the necessary changes, return to the Interface menu by typing the command **X**.

## C.4.6 Small Computer Systems Interface Configuration

Enter the SCSI menu by typing the command key for the SCSI interface. The Configurable Interfaces menu changes to the SCSI menu:

```
 SCSI
Key Feature Value

 1 Select Code 14
 2 Interrupt Level 3
 3 Parity Y
 4 Bus Address 7

X to exit menu

Type [key] RETURN ?
```

### SCSI Select Code

From the SCSI menu, type the command **1** and the prompt line changes to

```
 1 Select Code 14
used select codes are :
 9 12 15 21
Type 0.. 31 except used RETURN ?
```

Note the select codes already used. Type the command for the select code you want to use. After you have entered the select code, the SCSI menu changes to show your change.

### SCSI Interrupt Level

From the SCSI menu, type the command **2** and the prompt line changes to

```
 2 Interrupt Level 3
Type 3, 4, 5, or 6 RETURN ?
```

Type the command for the interrupt level you want to use. After you have entered the new interrupt level, your SCSI menu changes to show your change.

### SCSI Parity Mode

From the SCSI menu, type the command **3** and the prompt line changes to

```
 3 Parity Y
Type Y or N RETURN ?
```

Type the command **Y** if you do want parity checking done by the system unit's SCSI interface. Type the command **N** if you do not want parity checking done. After you have made your choice, your SCSI menu changes to show your change.

### SCSI Bus Address

From the SCSI menu, type the command **4** and the prompt line changes to

```
3 Bus Address 7
Type 0.. 7 RETURN ?
```

Type the command for your new SCSI bus address. After you have made your choice, your SCSI menu changes to show your choice.

After all SCSI features have been changed as you need them, from the SCSI menu, type the command **X** to return to the Interface menu.

## C.4.7 Local Area Network Configuration

Enter the LAN menu by typing the command key for the LAN and this menu appears:

```
LAN
Key Feature Value

 1 Select Code 21
 2 Interrupt Level 5

X to eXit menu

Type [key] RETURN ?
```

### LAN Select Code

From the LAN menu, type the command **1** to change the prompt to

```
1 Select Code 21
 used select codes are :
10 14 15 23
Type 0.. 31 except used RETURN ?
```

You may change the LAN select code to any number except those already used. Just type the number for the select code you want, then type **< Return >**. The LAN menu will change to show the new select code. Then, exit the menu.

## LAN Interrupt Level

Enter the LAN menu's interrupt level by typing the command **2**. Then the prompt line changes to

```
2 Interrupt Level 5
Type 3, 4, 5 or 6 RETURN ?
```

Type the command to change the LAN interrupt level, then exit the LAN menu.

## C.4.8 HP Parallel Interface Configuration

Enter the HP Parallel Interface menu from the Interface menu by typing the command key for the HP Parallel Interface. The following menu appears:

```
HP PARALLEL
Key Feature Value

1 Select Code 23
2 Interrupt Level 3

X to exit menu

Type [key] RETURN ?
```

### HP Parallel Select Code

Type the command **1** to get this select code prompt:

```
1 Select Code 23
used select codes are :
10 14 15 21
Type 0.. 31 except used RETURN ?
```

You can type the command for any unused select code. The menu changes to reflect the new select code.

### HP Parallel Interrupt Level

Your HP Parallel interrupt level is accessed by typing the command **2**. Then, the prompt changes to

```
2 Interrupt Level 3
Type 3, 4, 5 or 6 RETURN
```

Type the command for the new select code. Then, exit the menu.

**NOTICE:** After you have made the required changes to your system unit's built-in interface configurations, you must use the Interface menu and make the changes permanent. Otherwise, if you turn the system unit off, then back on again, the original interface configurations will be in effect.

The following procedure explains how to configure internal interfaces.

---

### **Procedure C-1** *Configuring Internal Interfaces*

To configure internal interfaces, perform the following steps:

1. If you have already booted an operating system, log out and stop any user processes. Otherwise, go on to step 2.
2. Reset the system unit and get the power-up display, then when the keyboard is identified, type the command

**C < Return >**

3. From the Configuration Control menu, type this command to get the I/O Configuration menu:

**1 < Return >**

4. From the I/O Configuration menu, type the number command for the interface you want to configure:

*key* **< Return >**

5. Type the number command for the feature you want to change:

*key* **< Return >**

6. Type the number or letter key(s) command to change the feature:

*key(s)* **< Return >**

7. Exit the selected interface menu by typing **X < Return >**

8. Type the letter key command to store the new or default values, or abort and not make any changes:

*key* **< Return >**

9. When the Configuration Control menu appears and the system unit is turned on for the first time, you should type the following command to enter the Auto System Select Mode:

**2 < Return >**

10. If you have already selected an operating system, you should abort the menu without changing it by typing this command:

**A < Return >**

---

## C.5 Auto System Select Mode

After configuring the system unit's Boot Mode Selection for HP-UX and I/O Configuration, you should use the Auto System Select Mode to determine what operating system is automatically booted when you turn on your workstation.

From the following Configuration Control menu

```
Configuration Control
Keys Mode Class

1 I/O Configuration
2 Auto System Selection
3 Boot Mode Selection

A Abort without changes

Type [key] RETURN ?
```

type the command

**2 < Return >**

causes this Auto System Select menu to appear:

```
Auto System Select
Keys Option Status

1 Scan for System Y
2 Selected System N
3 Store Selected Sys. N

E Execute menu
A Abort without changes

Type [key] RETURN ?
```

The status column has letters indicating yes (Y) or no (N). When you type a number key command, you change the status for that option.

Each option is explained in the next three subsections.

### **C.5.1 Scan for System**

Mass storage devices are searched for operating systems determined by the priority shown below:

1. SCSI interface, select codes 0-31, bus address 7-5, unit 0.
2. HP-IB interface, select codes 0-31, bus address 0, unit 0.
3. SRM interface at select code 21.
4. LAN at select code 21.
5. SCSI interface, select codes 0-31, bus address 4-0, all units.
6. HP-IB interface, select code 0 - 31, bus address 1-7, all units.
7. SRM interface at select code other than 21.
8. LAN at select code other than 21.

The boot priority list is designed to make it easy to change and control which operating system is booted in the 'Search for System' mode. The guidelines used to establish the boot list are

- High priority addresses before low priority addresses.
- Local systems before remote systems (Local refers to dedicated devices and remote refers to shared devices, i.e. a server).

### C.5.3 Store Selected System

To set the Store Selected Sys. option to Y, type the command

**3 < Return >**

The following Auto System Select menu appears:

```
 Auto System Select
Keys Option Status

 1 Scan for System N
 2 Selected System Y
 3 Store Selected Sys. Y

E Execute menu
A Abort without changes

Type [key] RETURN ?
```

You may store either a selected operating system, or the operating system found when the Boot ROM searches for an operating system.

When you execute this menu, the system unit resets and the following power-up display appears:

```
Copyright 1990, :HP7958, 123, 4
Hewlett-Packard Company, 1H SYSTEM_HPUX
All Rights Reserved.

Series 400, Rev. 1, 5 Jun 90 :HP7959, 567, 8
md 12 rev 0.20, 1990/03/12.16:31:17 2H SYSTEM_HPUX
Bit-Mapped Video
MC68030 Processor
MC68882 Coprocessor
Configuration EEPROM
HP-HIL.Keyboard
HP-IB
DMA-CO
RAM 4194080 Bytes
HP98644 (RS-232) at 9
HP98265 (SCSI S 32) at 14
HP98643 (LAN) at 21 080009AAAAAA (T)
HP PARALLEL at 12
```

System Search Mode, will store selection  
RESET to Power-up SPACE clears input Select System Type RETURN ?

## C.5.2 Selected System

If you want to boot a specific operating system and more than one exists on your mass storage devices, set the `Selected System` status to yes (Y), then type the **E** (execute) command. The system unit resets and the power-up display changes to list mass storage devices with operating systems mounted on them. The display is similar to the following:

```
Copyright 1990, :HP7958, 1405, 0
Hewlett-Packard Company, 1H SYSTEM_HPUX
All Rights Reserved.

Series 400, Rev. 1, 5 Jun 90 :RODIME, 1404, 0
md 12 rev 0.20, 1990/03/12.16:31:17 2H SYSTEM_HPUX
Bit-Mapped Video
MC68030 Processor
MC68882 Coprocessor
Configuration EEPROM
HP-HIL.Keyboard
HP-IB
DMA-C0
RAM 4194080 Bytes
HP98644 (RS-232) at 9
HP98265 (SCSI S 32) at 14
HP98643 (LAN) at 21, THIN, 080009AAAAAA
HP PARALLEL at 12
```

```
System Search Mode, will store selection
RESET to Power-up SPACE clears input Select System Type RETURN ?
```

For example, if you wanted to select the HP-UX operating system on the Rodime Disk Drive, you would type the following command

**2H < Return >**

and the HP-UX operating system would then start booting. The HP UX operating system would then be stored and automatically booted the next time you turned on the system unit.

The path to the selected operating system is stored in the EEPROM when you execute the Auto System Select menu. If your workstation or system environment changes and the operating system you previously selected as the default has moved to another mass storage device, you must reconfigure the EEPROM. To reconfigure for the new path to the operating system you want, enter Configuration Control Mode, select Auto System Select and reselect the operating system.

The selected and stored operating system automatically boot each time the system unit is turned on. You may prevent that by entering Attended Mode when you turn the system unit on. At this time, you may temporarily select another operating system to boot.





# Appendix D

## Connecting Terminals to Domain/OS Systems

You can troubleshoot a Domain Compatible mode system that has display problems by connecting a terminal to the system SIO line. This appendix provides procedures to connect the standard field terminal or another node to the system's SIO line.

---

### **D.1**      **Using a Field Terminal**

The data terminal currently available for field use is a specially modified IXO model TC301. This device is battery powered with a 1-line, 16-character LCD display. The terminal communicates at 300 baud only, and is configured as a DCE device. It plugs into the system, and its attached cable needs no adapters. Use Procedure D-1 to activate the field terminal.

---

#### **Procedure D-1.** *Activating a Field Terminal*

1. Press the ON/OFF key. The terminal displays the message  
HI, IXO ACCESS CENTER?
2. Press the NO key. The terminal displays the message  
MANUAL, FULL
3. Press the PHONE key. The terminal displays the message  
LOGGING ON  
The terminal displays the online mode indicator.

4. You are now ready to connect the field terminal to the system and access the MD.

---

## D.2 Using a Workstation as a Terminal

If you need to use another workstation to emulate a terminal, type the following next to the “\$” shell prompt:

**\$emt < RETURN >**

When you receive the “emt > “ prompt, enter the following three command lines:

emt > **line1 < RETURN >**

emt > **raw**

emt > **tctl -line1 -default < RETURN >**

The workstation replies with the message

emt > EMT remote node .... F1 to exit

To enter Terminal mode (Remote mode), press the **F1** function key.

You are now ready to connect a cable from SIO line 1 on the EMT system to an SIO port on the system that you need to access. You need to use an RS-232 extension cable because the system’s SIO output is configured as a DTE. Use a null modem between the two systems. When you are finished using the node in the Remote mode, press the **F1** function key to exit emt.

**NOTICE:** The maximum SIO cable length must not exceed 15.24 m (50 ft).



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