applicationDEC 433MP

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Service Guide

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This document provides an overview of the features and capabilities of the applicationDEC 433MP system, and provides the basic information a service technician needs to diagnose and repair the system.

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Preface

About This Guide

This service guide is designed to help diagnose and repair the applicationDEC 433MP system.

Intended Audience

The procedures in this guide are for service technicians trained by Digital Equipment Corporation.

Manual Overview by Chapter

Chapter	Description
1	System Overview — provides a brief overview of the applicationDEC 433MP system hardware, several typical configurations, diagnostics, physical hardware, FRUs, and special diagnostics tools.
2	System Components — describes the main applicationDEC 433MP system parts.
3	Troubleshooting — describes a procedure for troubleshooting the application-DEC 433PM system.
4	Boot Sequence — describes the steps of the boot sequence.
5	Power-On Self-Test (POST) — describes this test, which verifies memory, non-volatile RAM, DMA controllers, floppy diskette drives, and the real-time clock.
6	ROM Resident Diagnostics (RRD) — describes firmware diagnostics that can be run whether the system has an operating system installed or not.
7	System Exerciser — describes a standalone, floppy diskette-based diagnostic that detects and isolates hardware problems to the FRU level.
8	Removal and Replacement — describes how to remove and replace system FRUs.

Chapter	Description
9	Other Diagnostics — describes additional diagnostics capabilities that are available for the applicationDEC 433MP.
A	RRD Numbered Tests – describes the 58 RRD tests.

Related Documents

Each applicationDEC 433MP system ships with a five-manual documentation set. The manuals in this set are listed in Table 1.

Table 1 applicationDEC 433MP Documentation Set

Manual	Part Number	Purpose
System Installation Guide	EK-PS100-IG	Installation of hardware components; meant to be used once at initial installation.
Software Installation Roadmap	EK-PS100-SR	Overview of SCO operating systems that are installable on the applicationDEC 433MP; should be read prior to installing the operating system; instructions for installation of the operating system are shipped with the SCO UNIX products.
Using the System	EK-PS100-RC	User information; shows how to operate the system hardware.
System Overview	EK-PS100-OV	User information; describes methods of adding users, storage space, processing power, and memory.
Technical Configuration and Option Installation Guide	EK-PS100-CG	System administrator information; describes how to configure the system hardware; provides installation and configuration information for option modules and optional media devices.

Table 2 lists related documentation.

Table 2 applicationDEC 433MP Related Digital Equipment Documentation

Manual	Part Number	Purpose
Terminal Multiplexer Intelligent I/O Subsystem Installation Guide	ER-PCTMC-IG	Installation of the terminal multiplexer host adapter, installation of the multiplexer software driver, installation of terminal concentrators, configuration of terminal and printer devices, description of using intelligent transparent printing, and explanation of the terminal multiplexer extension power kit.
VRC16 Color Multisync Monitor Installation and User Manual	ER-VRC16-IG	Installation and use of the VRC16 monitor.
PS1XG-AA High Resolution Graphics Adapter Installation and User's Manual	ER-PS1XG-IG	Installation of the VGA adapter, use of the bootable diskette utility for configuration of adapter and bus mouse, and description of DOS driver diskettes, description of all monitor modes supported.
ISA 16-Bit SCSI Host Adapter Installation and User's Manual	ER-PS1XR-IG	Installation of the ISA SCSI adapter, configuration of jumpers and terminator resistor packs.

Conventions

The following conventions are used in this manual:

Ctrl/X	A sequence such as Ctrl/X indicates that you must hold down the key labeled Ctrl while you simultaneously press another key.
[ ]	In format descriptions, brackets indicate that whatever is enclosed is optional; you can select none, one, or all of the choices.
boldface text	Boldface text is used to introduce a new term.
italic text	Italic text is used to represent the name of a command or variable, or to represent information that can vary in a system message (for example, Internal error *number*).

CHAPTER 1

1
System Overview

This chapter provides a brief overview of the applicationDEC 433MP system hardware, several typical configurations, diagnostics, physical hardware, Field Replaceable Units (FRUs), and special diagnostics tools.

1.1 Introduction

The applicationDEC 433MP is a versatile, expandable computer system based on the industry standard architecture of the Intel 80486 CPU, ISA/AT expansion slots for option modules with EISA readiness, and the Santa Cruz Operation (SCO) UNIX operating system. The 433MP system hardware is optimized for use with the multiprocessing extensions to SCO Unix, SCO MPX. These extensions provide symmetrical multiprocessing capabilities allowing the increased performance of multiple i486 processors.

The applicationDEC 433MP is an open system and may contain ISA modules, SCSI storage, and SCSI media devices from other vendors.

The system is readily expandable, making it easy to increase the number of processors and memory, increase the number of users, increase the storage capacity, and configure the system for alternate uses.

Hardware features are listed in Table 1–1.

Table 1–1 applicationDEC 433MP Hardware Features

Processors	Up to four Intel 80486 processors
System Memory	Up to 64 MB system memory
Media Devices	Support for 3.5-inch and 5.25-inch floppy, 320/525 MB QIC tape, and CD-ROM (Compact Disk — Read Only Memory)
Storage Devices	Up to six 209 MB internal disks, plus external expansion

(continued on next page)

Table 1–1 (Cont.) applicationDEC 433MP Hardware Features

Dual Bus Design	System processors and memory communicate over a dedicated high speed bus; I/O options use a separate bus
ISA I/O Bus	For installation of any industry-standard option module

1.2 System Hardware

The standard applicationDEC 433MP system includes one base processor and bridge module, 8 MB of system memory, one 3.5-inch diskette drive, and one 209 MB hard disk. All other media and storage devices are optional.

1.2.1 Processors

The applicationDEC 433MP is a symmetrical multiprocessing computer. Symmetrical multiprocessing is an architecture that divides system resources evenly across all of the CPUs in the system.

Processors are available on three types of modules:

- Base Processor: One 80486 processor.
- CPU/SIO: One 80486 processor and serial input/output logic for connection of terminal concentrators.
- CPU/SCSI: One 80486 processor and SCSI adapter logic.

All systems include one base processor module and a bridge module for communication with the Industry Standard Architecture (ISA) bus. Additional processor modules can be added.

The applicationDEC allows up to four Intel 80486 processor modules to be installed in the system. The base processor is standard in every system. Optional processor modules are the CPU/SIO processor module and the CPU/SCSI processor module.

1.2.2 System Memory

The applicationDEC standard system comes with 8 MB of 100 ns ECC memory. System memory is upgradeable in units of 4 MB to a maximum of 64 MB of memory. Five 1 MB SIMMs are installed for 4 MB of additional memory. The extra 1 MB SIMM is used for Error Correction Code. Single Inline Memory Modules (SIMMs) are used for easy upgrading of system memory.

Up to four memory modules can be installed. Each memory module can contain up to 16 MB of memory. This provides a total system memory of 64 MB.

1.2.3 Storage Devices

The standard applicationDEC 433MP system comes with one RZ24 209 MB hard disk drive. Additional mounting spaces within the system box allow up to five additional hard disk drives to be installed. This provides a total of 1.2 GB within the system. For additional storage, external storage expansion boxes are available. All storage devices are SCSI-compliant.

1.2.4 Media Devices

The applicationDEC supports the following media devices:

- RX23 3.5-inch diskette drive
- RX33 5.25-inch floppy diskette drive
- RRD42 CD-ROM drive
- TZK10 320/525 MB quarter-inch (QIC) tape drive

The RX23 3.5-inch 1.44 MB diskette drive reads and writes high density and double density diskettes. The RX33 5.25-inch 1.2 MB floppy diskette drive reads and writes high density and reads double density diskettes. The RRD42 CD-ROM is a High Sierra compatible drive.

Each applicationDEC 433MP comes standard with a single RX23 3.5-inch diskette drive.

1.2.5 Dual Bus Design

For increased system performance, the applicationDEC 433MP uses a dual bus design. This design provides a system bus for processor and memory interaction and a separate I/O bus for communications and option modules.

The system bus operates at 64 MB/s. This means that processor requests for system memory data are filled quickly, and processors spend as little time idle as possible.

The applicationDEC 433MP uses an ISA I/O bus to provide an open system environment for option modules. Up to seven ISA expansion modules can be installed in an applicationDEC 433MP system.

Each applicationDEC 433MP comes standard with two ISA modules already installed. These include a SCSI adapter for control of hard disks, and a serial/parallel module for communications. Five additional ISA slots are available for system expansion.

1.3 Typical System Configurations

An applicationDEC system may be configured for use in many different ways. Three typical configurations are:

- Multiuser Timesharing UNIX System or Single-user UNIX Workstation
- X Window System
- Network File Server

The multiuser timesharing configuration is the most typical configuration; users communicate with the system through dumb terminals over serial communications lines. SCO UNIX is used, and, with MPX multiprocessor extensions, the applicationDEC 433MP system is an efficient timesharing system. Figure 1–1 illustrates a typical configuration of the applicationDEC in the multiuser timesharing configuration. Figure 1–2 shows the configuration of a single-user workstation.

When running SCO Open Desktop, the applicationDEC 433MP can serve as an X Window System. In this configuration, other systems running X server software can access applications on the host system. Open Desktop provides full X Window System support. The SCO Server Upgrade provides X-server support software for other systems to be connected to the network.

In a network file server configuration, other systems connected to the network share a filesystem which resides on the applicationDEC 433MP. The software support for this configuration is industry-standard SCO Network File System (NFS) on SCO UNIX and Open Desktop. Other systems on the network running NFS can access remote files on the applicationDEC 433MP as if they were local files.

Figure 1–1 applicationDEC 433MP Multiuser Timesharing Configuration

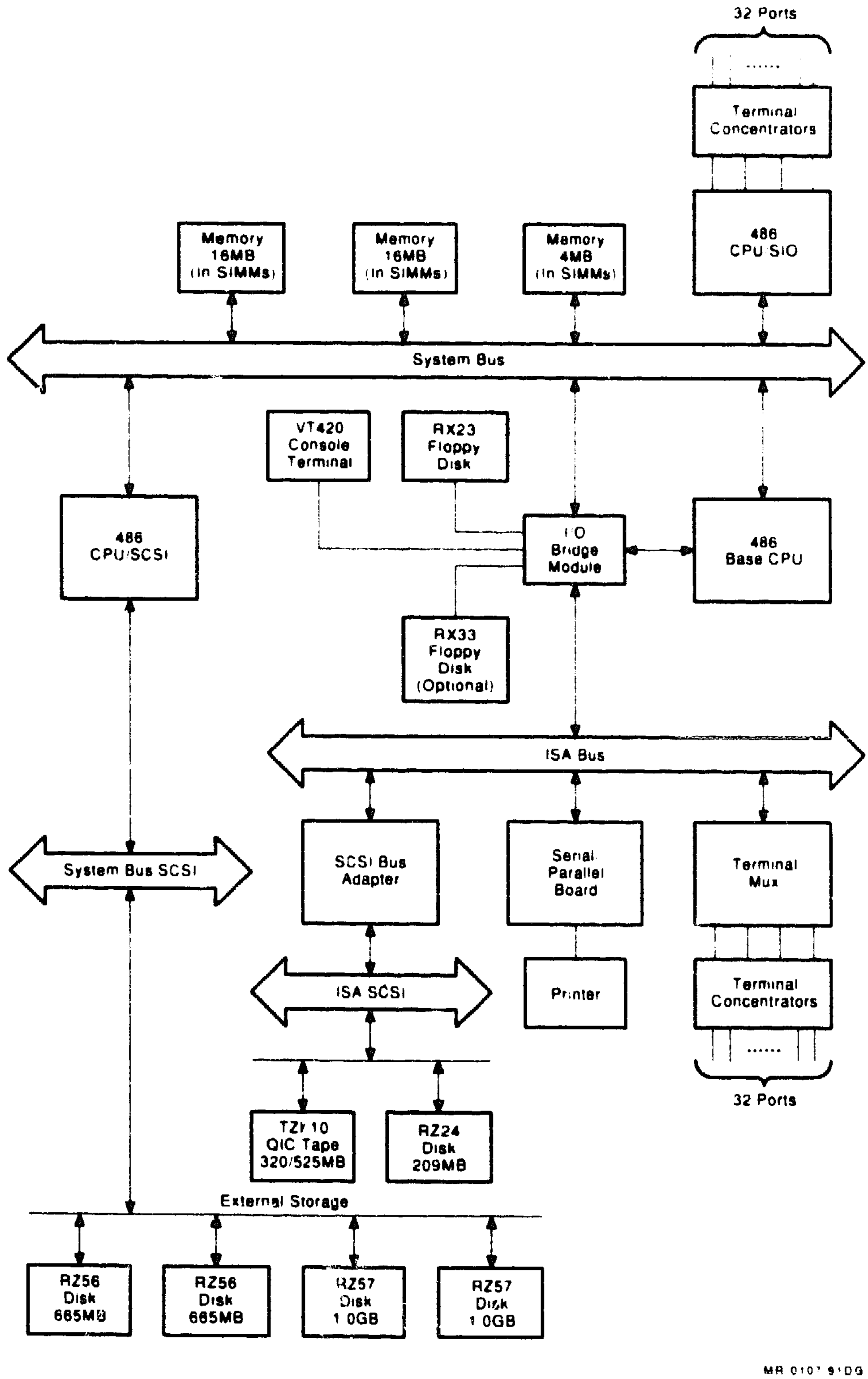
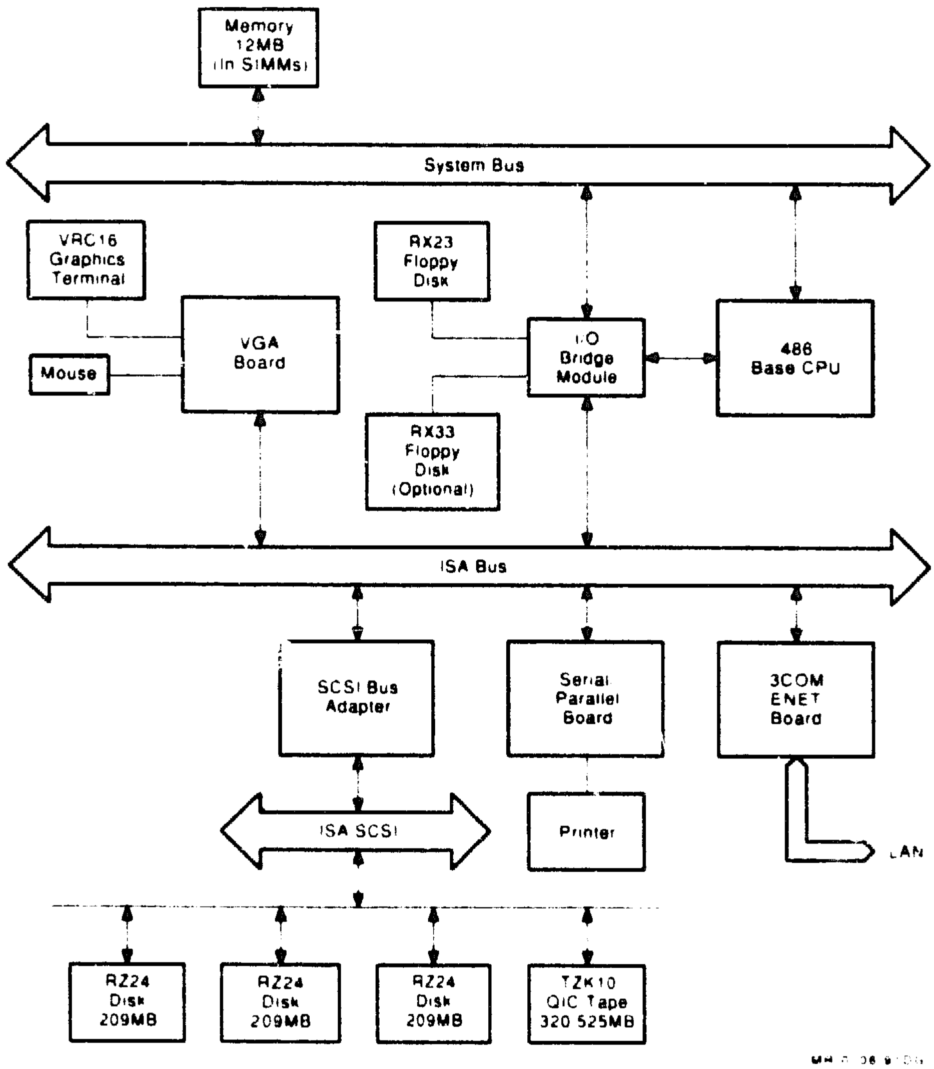


Figure 1–2 applicationDEC 433MP Single-User Workstation



1.4 Diagnostics Overview

Three diagnostic programs are included with the applicationDEC 433MP:

- Basic Input/Output System (BIOS) Power-On Self-Test (POST)
- ROM Resident Diagnostic (RRD)
- System Exerciser

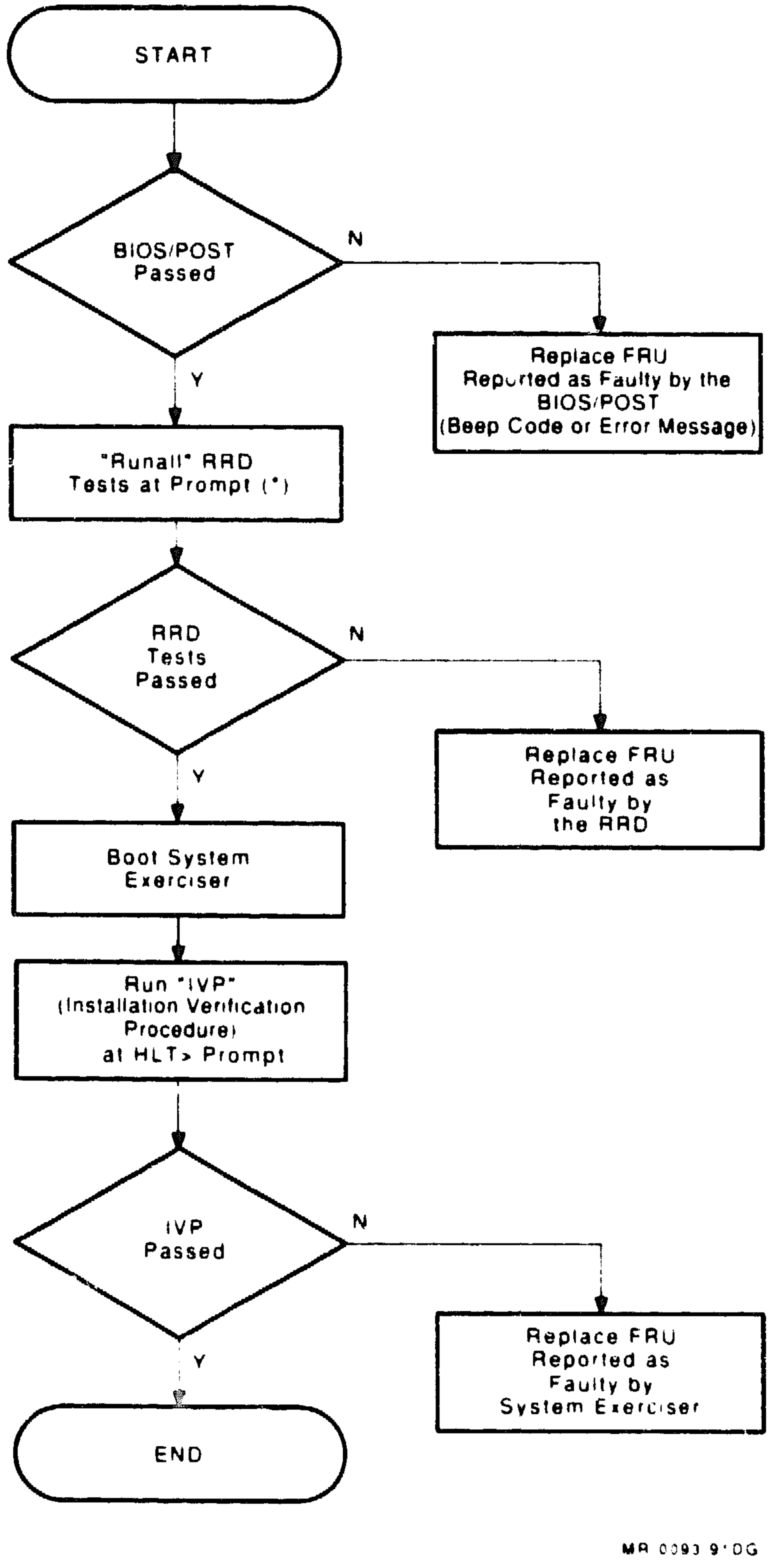
At system power-up, the BIOS power-on self-test (POST) determines if the system hardware is operational. The hardware check includes memory, non-volatile RAM, DMA controllers, floppy drives, and the real-time clock. Finally, the BIOS calls the RRD to set up the ISA extensions. See Chapter 5 for information about the BIOS power-on self-test.

The ROM Resident Diagnostic (RRD) consists of numbered tests that check memory, bus cycles, and multiprocessor capability. These tests can be run individually or as a "runall" package to verify all system bus CPUs. The RRD tests isolate the system problem to a single module. See Chapter 7 for information about the RRD tests and commands.

Like the RRD, the System Exerciser tests the CPUs and memory. However, it also checks storage devices, performs all tests concurrently rather than serially, and can isolate a system problem to a single module or device (such as an individual SIMM module on one of four memory modules). See Section 7.1 for overview information about the System Exerciser.

The sequence in which diagnostics are to be run, the basic diagnostic strategy, is shown in Figure 1–3.

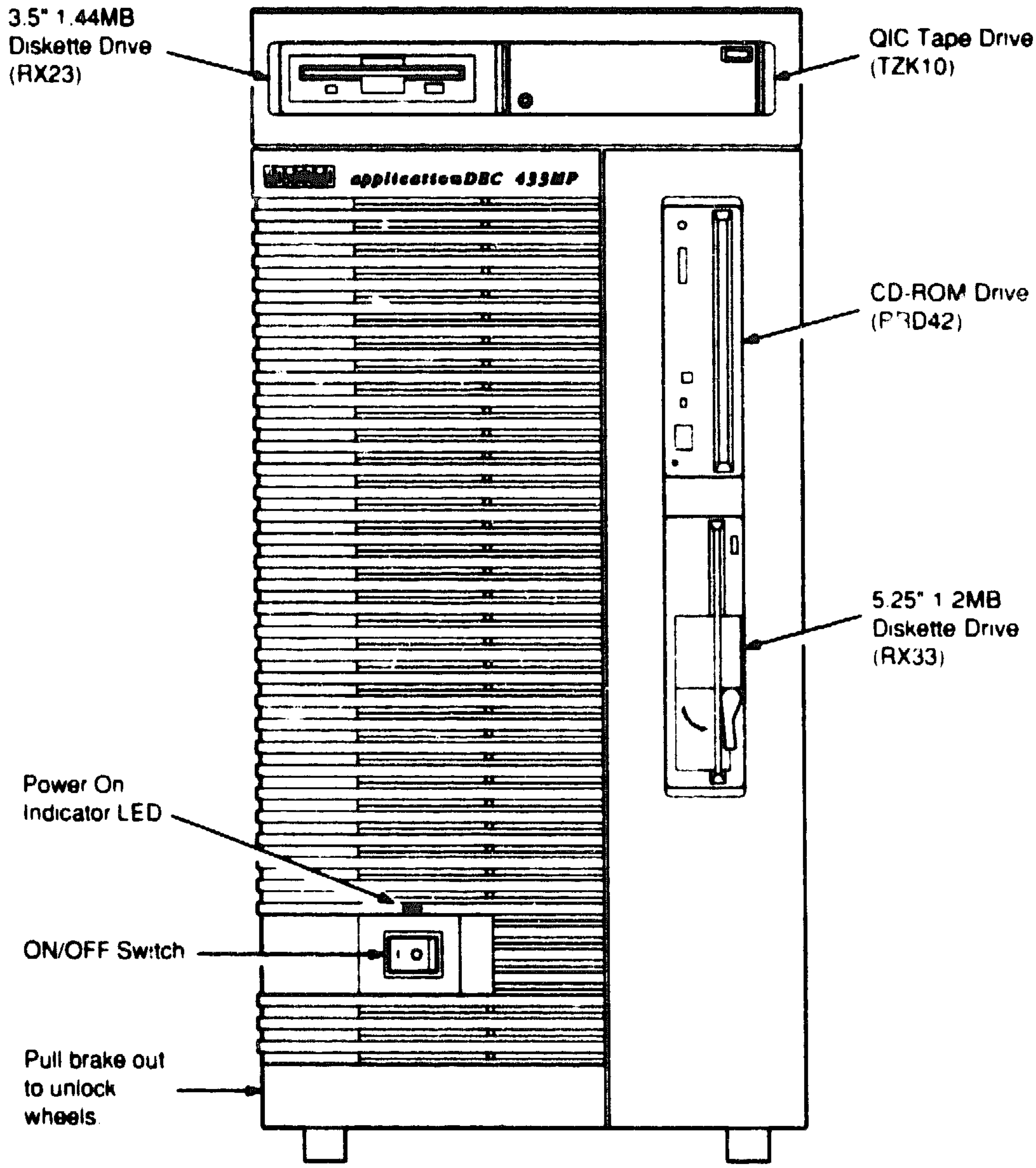
Figure 1–3 Diagnostic Strategy



1.5 Physical Description

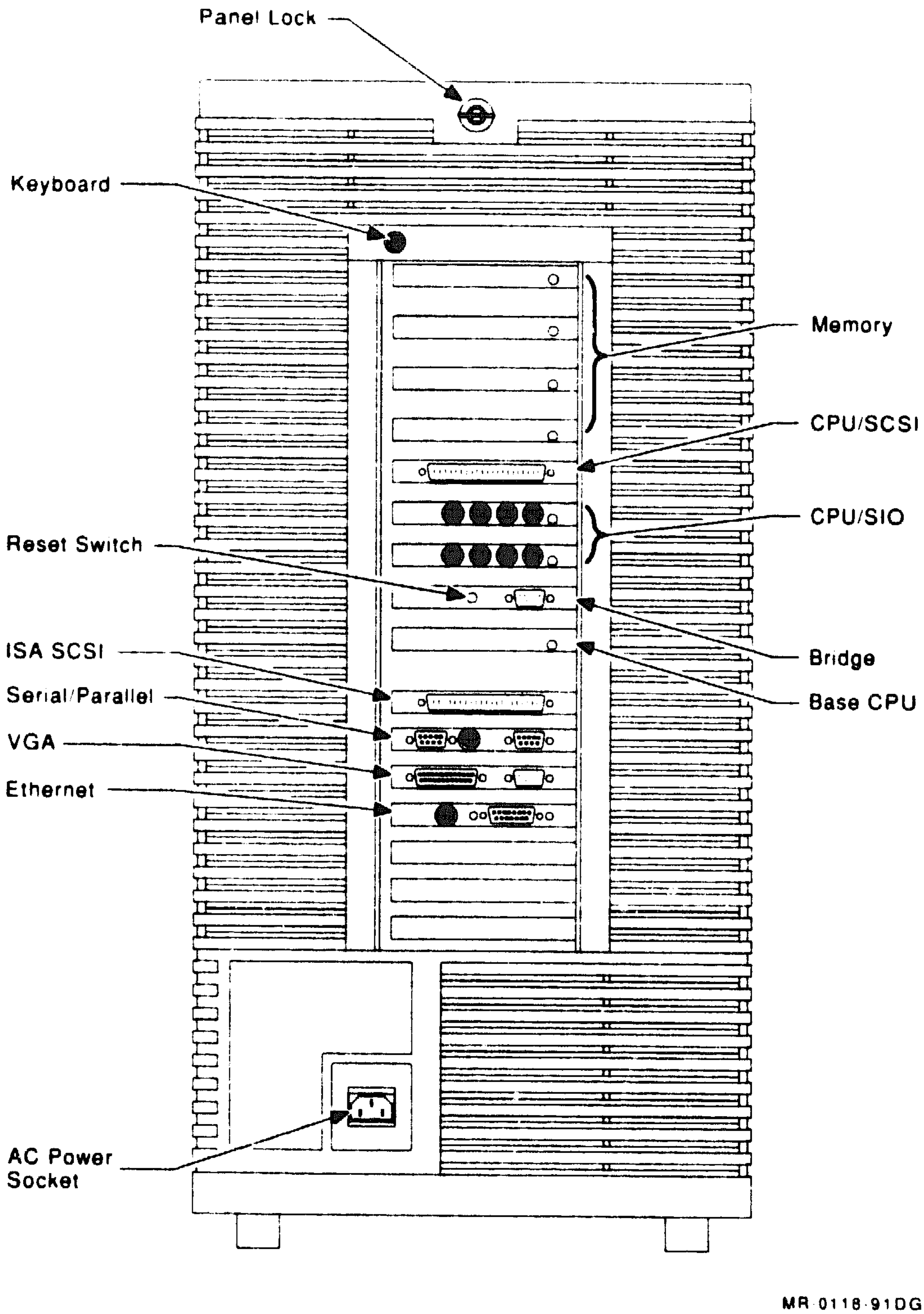
Figures 1–4 and 1–5 illustrate the front and back panels of the applicationDEC 433MP system.

Figure 1–4 applicationDEC 433MP Front Panel



TA-0771-AC

Figure 1–5 applicationDEC 433MP Back Panel



Figures 1–6 and 1–7 show the locations of the major components in the applicationDEC 433MP system box. Module allocation in the card cage is detailed in Section 2.3.

Figure 1–6 applicationDEC 433MP Internal Components, Right Side

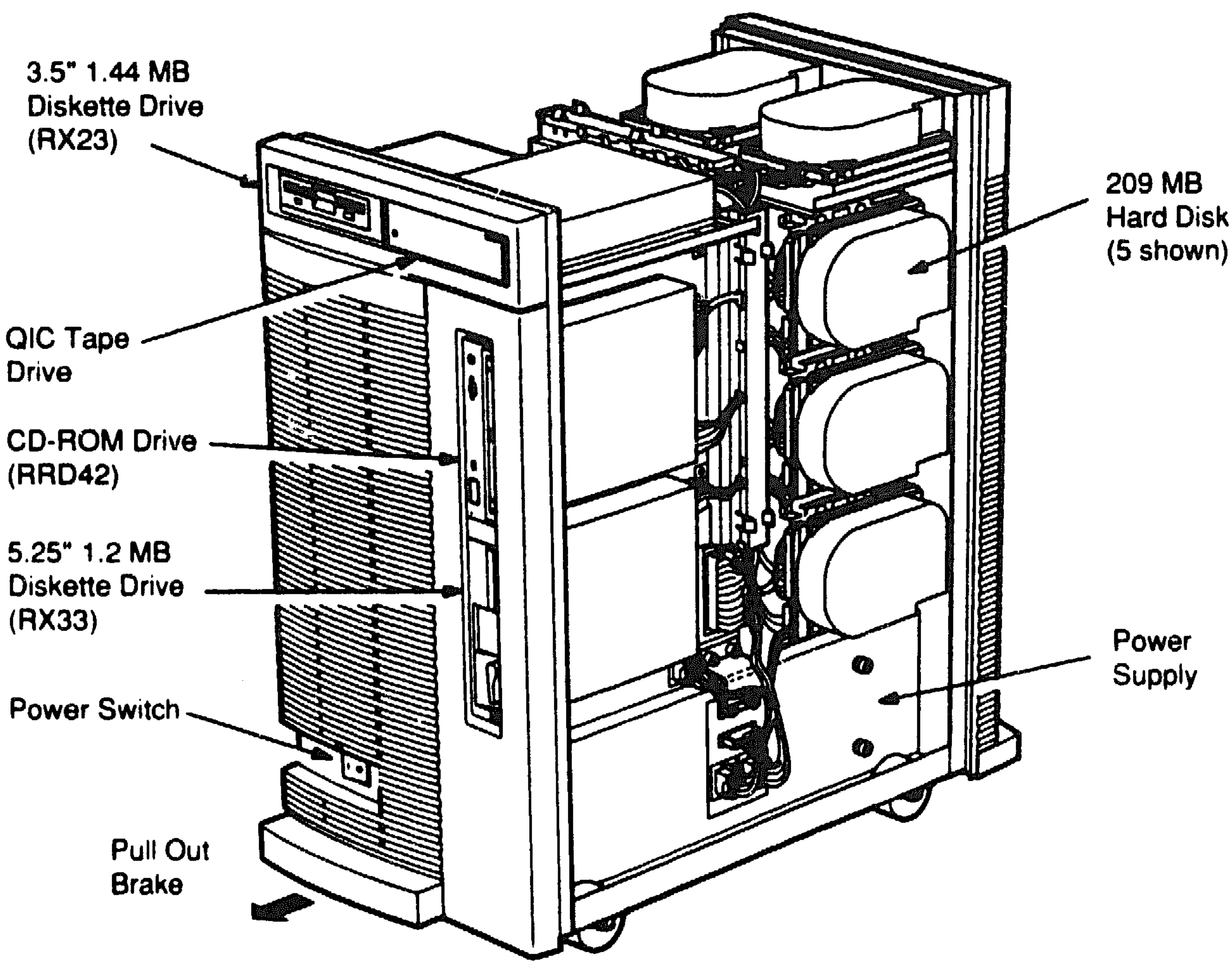
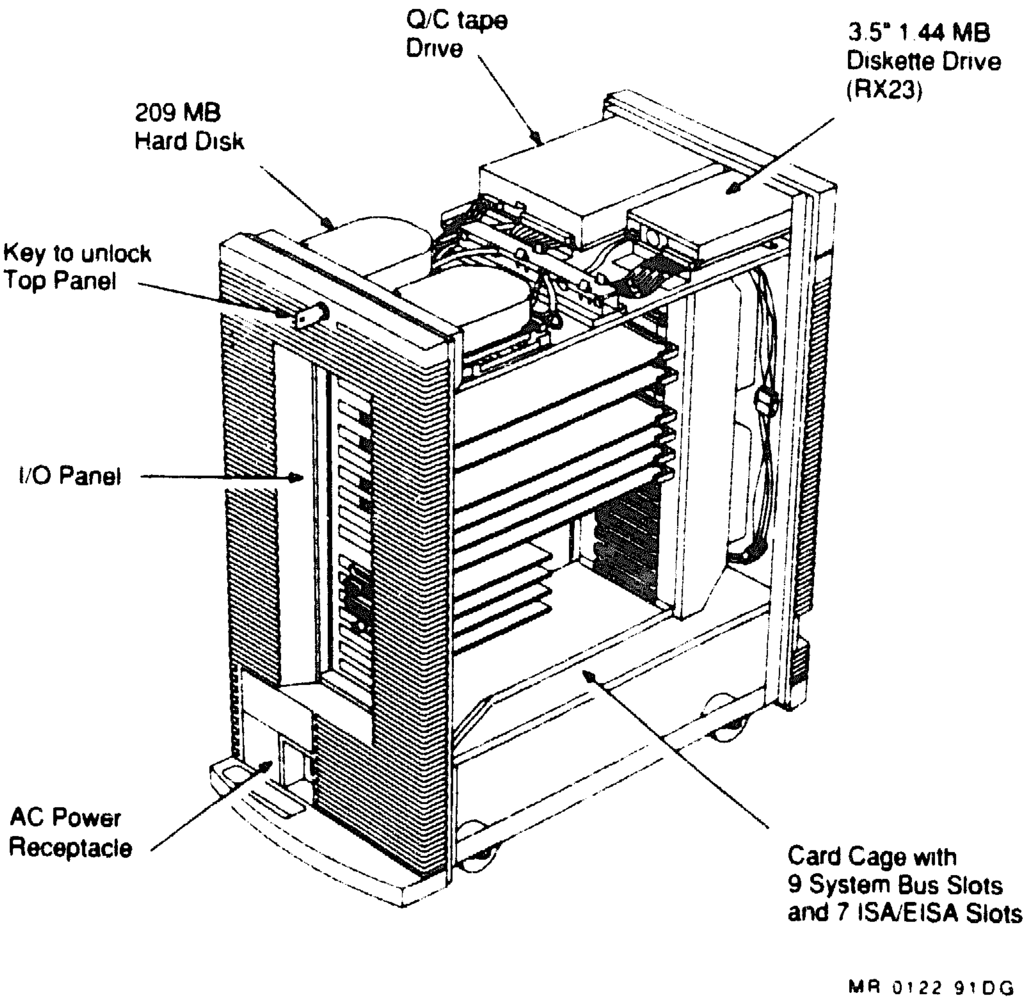


Figure 1–7 applicationDEC 433MP Internal Components, Left Side



1.6 FRU Parts List

Table 1–2 lists the applicationDEC 433MP Field Replaceable Units (FRUs).

Table 1–2 applicationDEC 433MP Field Replaceable Units

Part Number	FRU	Order Number
	Base System Major Components	
54-19551-01	Base processor module	
54-19547-01	Bridge module	
54-19553-01	Memory module	
54-19557-AA	1 MB SIMM	
54-19555-01	16-slot backplane	
30-35157-01	Serial/parallel board	
00-H7828-AA	Power supply	
54-19549-01	CPU/SIO module	
54-20845-01	CPU/SCSI module	
	Option Modules	
54-19549-01	CPU/SIO module	
54-20845-01	CPU/SCSI module	
30-34571-02	ISA/SCSI adapter board	PS1XR-AA
29-28310-01	Multiplexer board	
29-29053-01	PS1XG VGA board	PS1XG-AA
	Storage Devices	
	CD-ROM	RRD42-AA
30-34261-01	QIC tape drive, 320/525 MB	TZK10-AA
29-28144-02	RZ24 209 MB SCSI drive, spinup PCBA	RZ24-SF
29-28145-01	RZ24 head disk assembly	RZ24-SF
30-30000-01	RX23 3.5-inch floppy disk drive	RX23-AA
30-24962-01	RX33 5.25-inch floppy disk drive	RX33-AA

(continued on next page)

Table 1–2 (Cont.) applicationDEC 433MP Field Replaceable Units

Part Number	FRU	Order Number
	Power Cords	
17-00083-39	US	BN26J-1K
17-00209-15	UK/Ireland	BN26B-2E
17-00199-21	Central Europe	BN19W-2E
17-00210-13	Switzerland	BN24T-2E
17-00198-14	Australia/New Zealand	BN24R-2E
17-00310-08	Denmark	BN19K-2E
17-00364-18	Italy	BN19Z-2E
17-00456-16	India	BN22Z-2E
17-00457-16	Israel	BN22P-2E
	Accessories	
29-28309-01	Terminal concentrator, 8-channel	PC4XD-DB
29-28312-01	Terminal multiplexer software	
12-33529-01	Connector/adapter, 8-pos male to 6-pos female	H8577-A
17-00811-02	Cable assembly, 06 cond oval, 26 AWG	BC16E-10
17-02867-01	Cable assembly, 25 round, shield 25MD	BC13F-08
17-02874-01	Cable assembly, molded 8 pos	BC13K-10
17-02797-01	Cable assembly, 25-pos male D-sub to 8-pos	BC13G-04
17-02798-01	Cable assembly, 25-pos fem D-sub to 8-pos	BC13H-04
12-33190-01	Connector, adapter 25-pos	H8751-K
30-35472-02	PS1XS Mouse, 3 button	PS1XS-AA
29-29054-01	3.5-inch driver/diagnostic diskettes (3) for PS1XG-AA graphics adapter	
30-34761-01	VRC16 16-inch color monitor (no power cord)	VRC16-D3
30-34761-02	VRC16 16-inch color monitor	VRC16-D4
30-34761-03	VRC16 video cable	BC13L-10
29-29049-01	VRC16 tilt and swivel base	

(continued on next page)

Table 1–2 (Cont.) applicationDEC 433MP Field Replaceable Units

Part Number	FRU	Order Number
	Miscellaneous Parts	
00-H8571-J	Adapter for MMJ connector	
11-17373-00	Green LED assembly	
12-30552-01	SCSI terminator, 50 position	
12-23609-11	4.5-inch system fan	
12-33816-01	Terminator	
12-34838-01	6V lithium battery	
12-32905-3A	Low-profile jumper, 8 position, 2 x 04	
12-17119-01	Plastic key	
12-31734-01	RZ24 mounting grommets	
17-02866-01	SCSI cable assembly, 50 cond. 1.2 ft	
17-02866-02	SCSI round cable, 50 position	
17-02963-01	SCSI cable	
17-02983-01	50-pin flat cable, 1.2 ft	
17-02985-01	34-pin RX33 cable, 2.7 ft	
21-33453-02	80486 microprocessor, 33 MHz	
36-35153-01	Configuration label	
70-26625-01	Speaker assembly	
70-26605-01	Power wire assembly	
70-26613-01	Front panel assembly	
70-26614-01	Rear panel assembly	
70-26615-01	Top cover assembly	
70-26616-01	Side panel assembly	
70-26617-01	Module cover assembly	
70-26618-01	Brake assembly	
70-26623-01	Contact plate cover assembly	
74-41424-01	RX23 mounting bracket	
74-41425-01	RX33 mounting bracket	
74-41422-01	RRD42 mounting bracket	
74-41423-01	RZ24 mounting bracket	
74-41434-01	Fan spacer	
74-41445-01	Card guide	
74-41861-01	Duct cover, backplane	
74-42113-01	Power supply lock	
74-42132-01	Holder, SCSI terminator	

(continued on next page)

Table 1–2 (Cont.) applicationDEC 433MP Field Replaceable Units

Part Number	FRU	Order Number
	PC Keyboard	
	USA	PC4XL-BB
	Belgium	PC6XL-AB
	Denmark	PC6XL-AD
	UK/Ireland	PC6XL-AE
	Finland/Sweden	PC6XL-AF
	Germany	PC6XL-AG
	Italy	PC6XL-AI
	Switzerland (French/German)	PC6XL-AL
	Norway	PC6XL-AN
	France	PC6XL-AP
	Spain	PC6XL-AS
	Israel	PC6XL-AT
	Portugual	PC6XL-AV

1.7 Special Tools

Table 1–3 lists the special tools required to service the applicationDEC 433MP.

Table 1–3 applicationDEC 433MP Special Tools

Number	Tool
30-23507-03	CD-ROM test disk
AK-PGV7A-CA	System exerciser diagnostics floppy diskette
29-29054-01	3.5-inch driver/diagnostic diskettes (3)
FD-10164-00	Loopback, serial port 9-pin

CHAPTER 2

2

System Components

2.1 Overview

This chapter describes the following applicationDEC 433MP system parts:

- Backplane
- Base Module
- Bridge Module
- Memory Modules and SIMMs
- CPU/SIO Module
- CPU/SCSI Module
- Serial/Parallel Adapter
- Video Graphics Adapter (VGA)
- Terminal Multiplexer Host Adapter
- 209 MB Disk Drive RZ24
- 320/525 MB Quarter-Inch Tape Drive TZK10
- CD-ROM Drive RRD42
- 3.5-inch 1.44 MB Diskette Drive RX23
- 5.25-inch 1.2 MB Floppy Disk Drive RX33

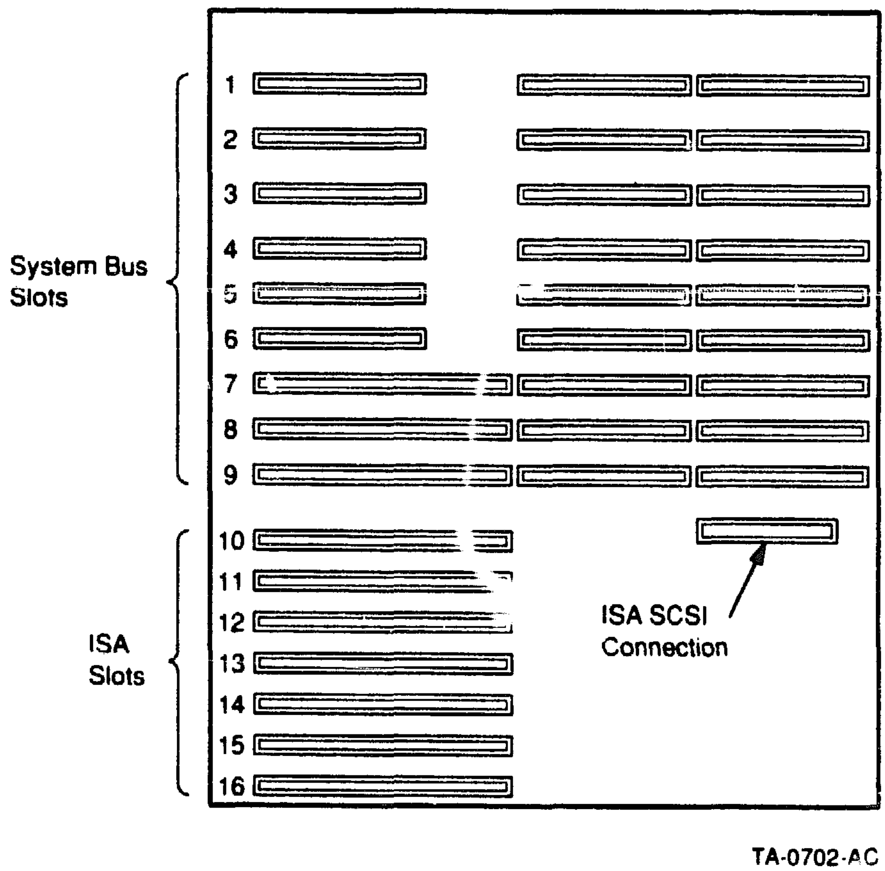
2.2 Industry-Standard Options

The applicationDEC 433MP is an open system. ISA modules and storage or media devices from other vendors may be used in the system.

2.3 Backplane

The applicationDEC 433MP backplane contains two separate buses. The system bus provides a high-speed private interconnect for CPU and memory interactions. The ISA bus provides an open bus for installation of industry standard I/O and other optional modules. Figure 2–1 shows the system bus and ISA bus slots.

Figure 2–1 Backplane



The top nine slots (slots 1—9) in the backplane are system bus slots, for Digital Equipment Corporation system bus modules only. The bottom seven slots (slots 10—16) are ISA slots, which may contain any industry standard ISA option module. Table 2–1 lists configuration possibilities for each backplane slot. Module restrictions are listed in Table 2–2.

Table 2–1 applicationDEC 433MP Backplane Slot Configuration Guidelines

Slot	Bus	Use
1	System bus	Memory
2	System bus	Memory
3	System bus	Memory
4	System bus	Memory
5	System bus	CPU/SIO, or CPU/SCSI [1]
6	System bus	CPU/SIO, or CPU/SCSI [2]
7	System bus	CPU/SIO
8	System bus	Bridge module
9	System bus	Base CPU
10	ISA	ISA SCSI Controller
11	ISA	Serial Parallel Adapter
12	ISA	ISA Option [3]
13	ISA	ISA Option [3]
14	ISA	ISA Option [3]
15	ISA	ISA Option [3]
16	ISA	ISA Option [3]

[1]A CPU/SCSI in slot 5 can be used to control internal or external devices.

[2]A CPU/SCSI in slot 6 can be used to control external devices only.

[3]Digital ISA options include a terminal multiplexer VGA adapter. These may be installed in any ISA slot.

There are no restrictions on ISA backplane slots for ISA boards. However, the ISA SCSI adapter should always be installed in slot 10 to simplify internal cabling.

Table 2–2 Module Restrictions

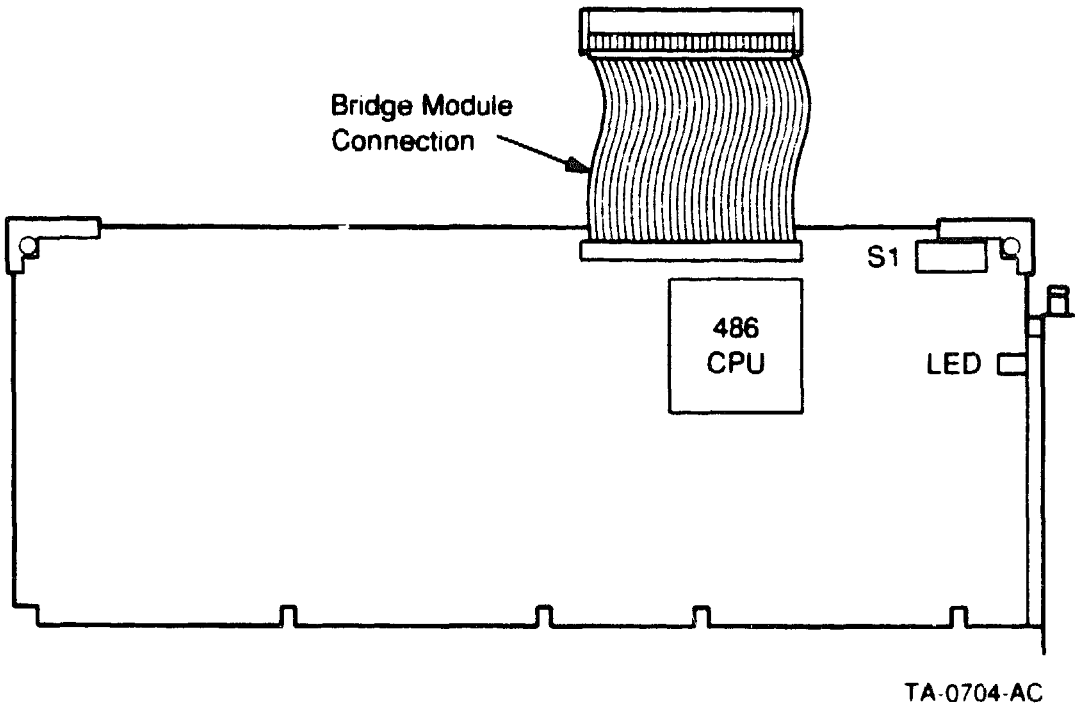
Module	Slot
Base	9
Bridge	8
CPU/SIO	4, 5, 6
CPU/SCSI	5, for internal and/or external devices 6, for external devices only
Memory	1, 2, 3, 4

2.4 Base Module

The applicationDEC 433MP base processor module includes an Intel 80486 processing chip for system and user code execution. It also contains logic for communication with the bridge module through a ribbon cable. Only one base processor can be installed.

The base CPU module is shown in Figure 2-2.

Figure 2-2 Base CPU Module



Features of the base CPU module include:

- Intel 80486 processor
- Memory allocation switch S1: allocates sections of memory for use by ISA modules
- Cable for connection to bridge module
- LED: indicates power and processor activity

The Intel 80486 processor on the base processor module provides execution of both system and user code. The base processor module is standard with every applicationDEC 433MP system and is the only processor in single processor versions of the system. Although the applicationDEC 433MP is designed for multiprocessor expansion, the system is fully functional with only the base processor installed. In a single processor configuration, the SCO MPX software extensions are not required.

Expansion CPUs such as the CPU/SIO and CPU/SCSI cannot be used as single processors. Both of these modules require that the base processor module be already installed.

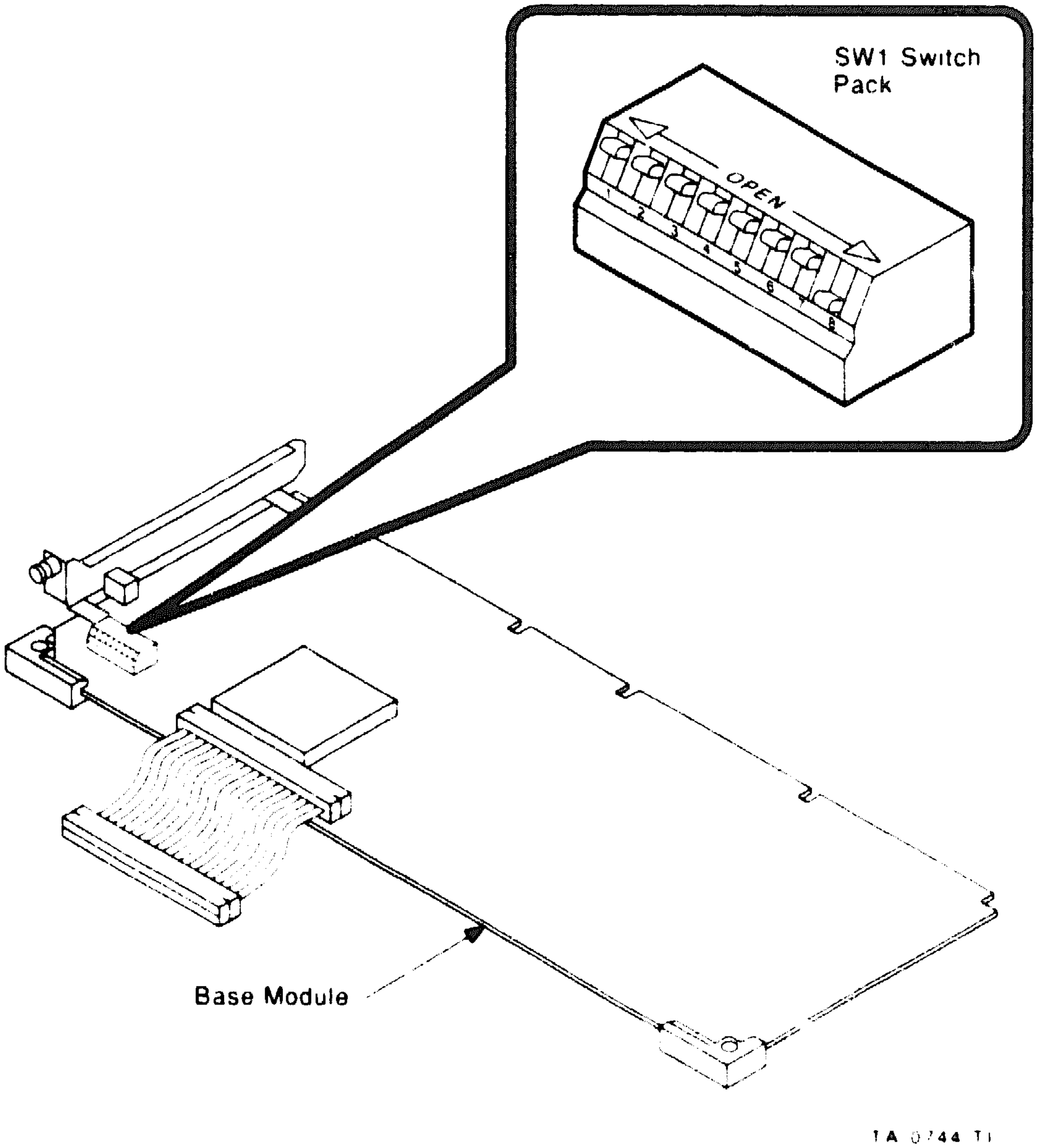
2.4.1 Memory Switches

Figure 2–3 shows switchpack 1 (SW1) on the base module.

This switch controls how memory locations between 8 MB and 15 MB are allocated. Each switch controls 1 MB of memory, as shown in Table 2–3. If the switch is set ON, that 1 MB of memory is allocated to the ISA bus. ISA options can then use this space to read and write data. If the switch is set OFF, that 1 MB of memory is allocated to the system bus space.

Memory allocated to the ISA I/O space by these switches is not cached by system processors. This is necessary because ISA options change data in this space without activating cache coherency flags. The only method to ensure that ISA I/O data is always valid is to block it from being cached. These switches, when set, prevent any processor from caching memory in this space.

Figure 2–3 SW1 Switchpack; Memory Allocation Switches



For maximum performance, memory should only be allocated for I/O options if necessary. If a memory space is not needed by an ISA option currently installed, the memory space should be allocated to the system bus.

Table 2–3 Base Processor Switchpack 1

Switch	Memory Range	On	Off (Open)
S1	8 MB— 9 MB	ISA	System bus
S2	9 MB—10 MB	ISA	System bus
S3	10 MB—11 MB	ISA	System bus
S4	11 MB—12 MB	ISA	System bus
S5	12 MB—13 MB	ISA	System bus
S6	13 MB—14 MB	ISA	System bus
S7	14 MB—15 MB	ISA	System bus
S8	VGA BIOS Cache	Always set ON, switch down	Not applicable (Do not set open.)

2.4.2 Setting Memory Switches

Only one ISA option requires that memory space be designated as ISA space — the terminal multiplexer host adapter.

If you have one or two terminal multiplexers installed, the memory switches must be set as shown in Table 2–4. The switch settings depend on the amount of system memory installed. The settings are the same whether one or two terminal multiplexers are installed.

Table 2–4 Memory Switch Settings

Terminal Multiplexers	8 MB	12 MB	16 MB or more
First at E10000 Second at E20000	1—7 set (down)	5—7 set (down)	7 only[1] set (down)

[1]When switch 7 is set in a system with more than 16 MB, change setup option 8 (ISA extended memory size) to 13312

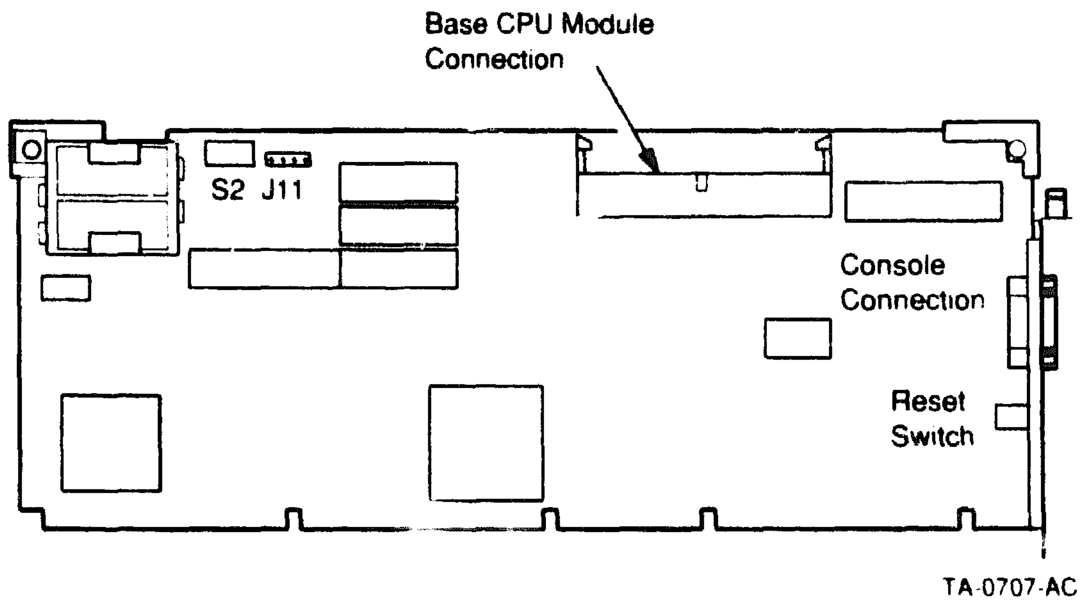
2.5 Bridge Module

The bridge module, shown in Figure 2–4, is a standard feature of all applicationDEC 433MP systems. The bridge module provides the data link between the ISA bus and the system bus. The bridge module also contains a connector for the console terminal. Additional logic on the board provides control for the diskette drives. Other features of the bridge module include:

- Reset switch (S1)
- Clock for system time
- On-board battery for CMOS ROM setup data retention in the event of power loss
- Jumpers for selection of default boot diskette drive (J11)
- Jumpers for designation of console port as COM1: or COM2: (S2)
- Connector for cabling to base processor module

Only one bridge module may be installed.

Figure 2–4 Bridge Module Layout



2.5.1 Console Connector

The console connector can have COM1: or COM2: as its address. This selection is made with jumpers on the bridge module.

The console connector is a 9-pin D subminiature connector. This connector allows for direct connection of some terminals. If the terminal you are using requires MMJ connectors (modified modular jacks, used by some Digital terminals), use the converter (part number H8571-J) provided with the applicationDEC 433MP system. Connect the converter directly to the bridge module console connection and connect the MMJ cable to the converter.

2.5.2 Reset Switch

The reset switch provides an external means of resetting the system in the event of a software failure or the system becoming hung. The reset switch restores all system components to their initial power-up states.

If the operating system is installed, pressing the reset switch causes the system to reboot.

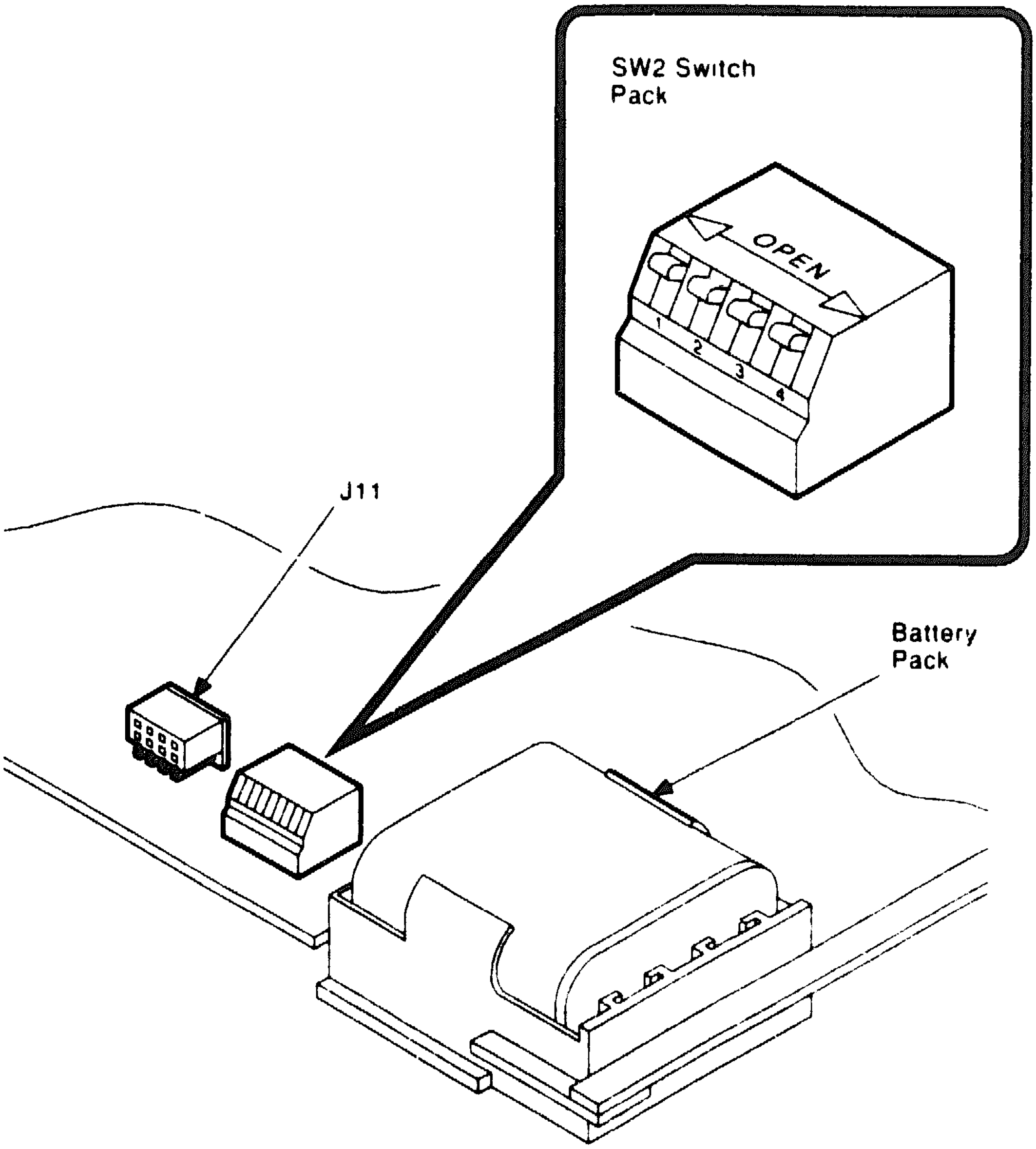
2.5.3 Bridge Module Jumper Settings

Jumpers and switches on the bridge module control two features:

- Designation of the boot diskette drive (controlled by jumper pack J11)
- Designation of the console connector as COM1: or COM2: (controlled by switch 2)

Figure 2–5 shows jumper pack J11 and switchpack 2 (SW2).

Figure 2–5 Bridge Module J11 and SW2 Locations



Jumper pack J11 controls whether the 3.5-inch or 5.25-inch diskette drive is designated as the boot drive (Drive A). The boot diskette drive is the drive from which the system attempts to boot when it goes through its power-on sequence.

NOTE:

If there is a diskette in the boot diskette drive when the system is powered up, the system attempts to boot from the diskette drive. If the diskette is not a bootable diskette, the system hangs. You must ensure that nonbootable diskettes are not in the boot drive when the system is powered up or reset.

To designate the 3.5-inch diskette drive as the boot drive, place the four-pin jumper on the upper pin pairs in J11. To designate the 5.25-inch diskette drive as the boot drive, place the four-pin jumper on the lower pin pairs.

The factory configuration is for the 3.5-inch diskette drive to be the boot drive.

Switch 2 on SW2 controls the address of the serial connector on the bridge module. When switch 2 is up (open), COM1: is the address of the serial connector. When switch 2 is down (closed), COM2: is the address. The default is COM1.

The other switches on SW2 must always be up (open).

2.6 Memory Modules and SIMMs

The applicationDEC 433MP system accommodates a maximum of 64 MB of system memory. Each memory module provides 16 MB of memory; four memory modules may be installed.

Single Inline Memory Modules (SIMMs) are used for memory capacity. The SIMMs contain 1 MB of memory each and are inserted in slots on the memory module. Memory must be added in increments of 4 MB. SIMMs are available in packages of five SIMM modules each; four are used for memory and one is used for error checking. There are 20 slots for SIMMs on the memory module, allowing 16 MB of total memory per memory module.

Each applicationDEC 433MP has at least one memory module with at least 8 MB of memory. Additional memory modules, part number PS1XM-AA, are sold without any SIMMs installed. SIMMs are available in packages of 4 MB (5 SIMMs), part number PS1XM-BA, or in packages of 100 MB, (25 sets of 4 MB SIMMs), part number PS1XM-BB.

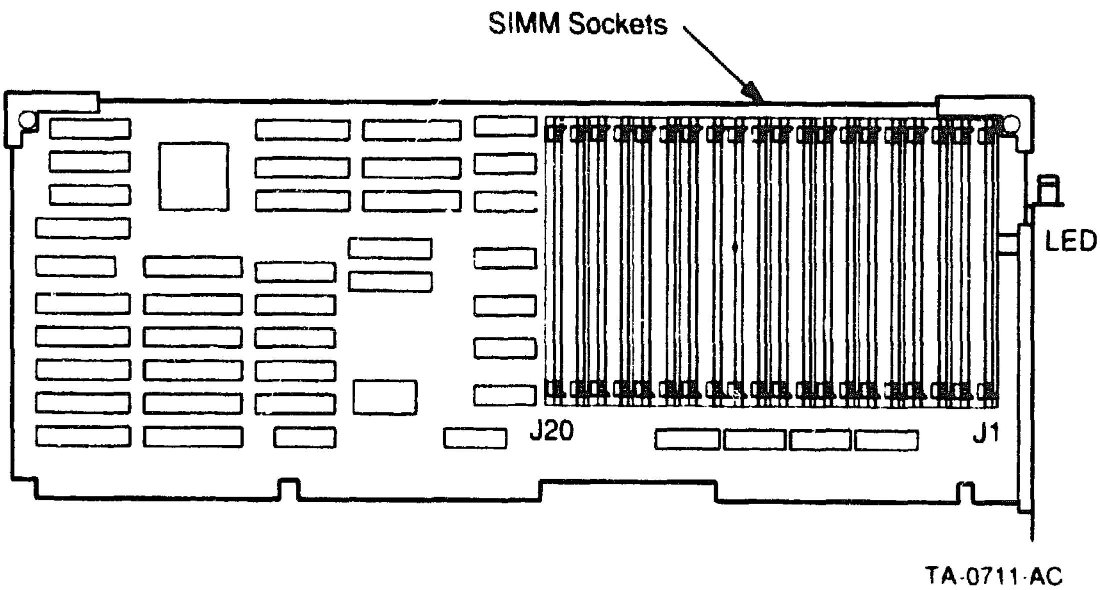
SCO MPX includes an Error Correction Code (ECC) Daemon program which uses the fifth SIMM for error detection and correction.

2.6.1 Features

The memory module, shown in Figure 2–6, has the following features:

- SIMM sockets for increasing memory
- LED to indicate that an ECC error has been detected.

Figure 2–6 Memory Module



2.6.2 Software Support

Additional memory cards are recognized by the system. No additional software installation is required.

2.6.3 ECC Daemon

The ECC Daemon is a software feature of the SCO MPX extensions. This program executes in the background at a frequency you select. Each time the program runs, it scans all memory locations and runs Error Correction Code, or ECC. This code makes use of the fifth SIMM in every package of four SIMMs to perform cross-check computations on every bit in memory. The ECC software detects and corrects single-bit errors. When one bit in the array is set incorrectly, the ECC software reverses the state of the incorrect bit.

When a single-bit error is detected, the memory module's LED illuminates.

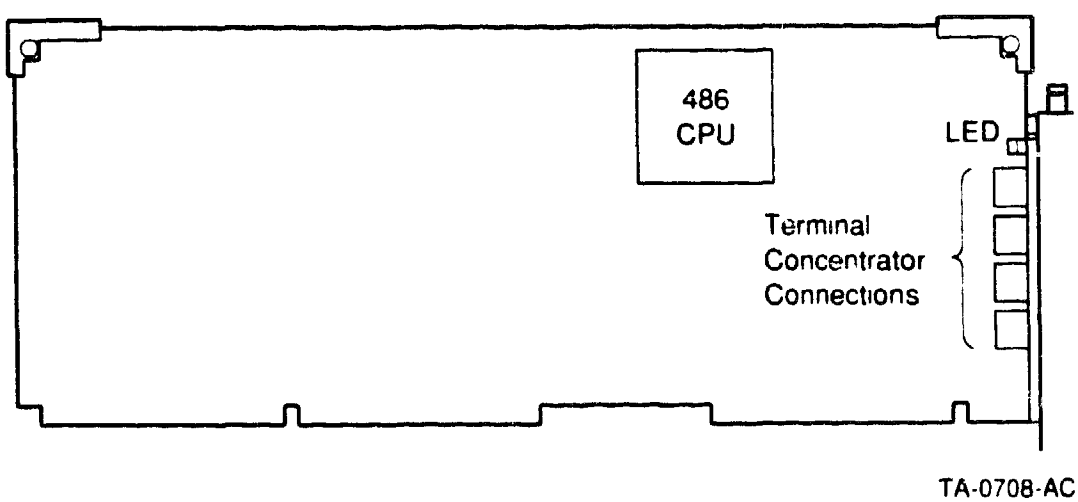
A double-bit error occurs when the ECC daemon discovers that at least two bits in the array are incorrectly set. It is not possible to correct a double bit error and the ECC daemon issues a *panic* error message and shuts down the system.

The ECC daemon software logs all error messages to the system console and to the file */usr/adm/messages*.

2.7 CPU/SIO Module

The CPU/SIO module, shown in Figure 2–7, provides symmetrical multiprocessing capability for the applicationDEC 433MP system. The CPU/SIO board contains a complete terminal multiplexer logic for support of up to 32 terminals.

Figure 2–7 CPU/SIO Module



Features of the CPU/SIO module include:

- Intel 80486 CPU for additional processing power
- Four terminal concentrator ports for connection of terminal concentrators (for a maximum of 32 terminal lines)
- LED to indicate CPU activity

The Intel 80486 processor provides additional processing power for symmetrical multiprocessing. The SCO MPX multiprocessor extensions provide support for the CPU/SIO processor. One license and copy of MPX must be installed for each CPU/SIO installed on your system. For details on how to install the MPX extensions, refer to the *SCO MPX Release Notes and Installation Guide*.

At the I/O distribution panel, four mini-DIN connectors are available for connection of up to four terminal concentrators.

Terminal concentrators (part number PC4XD-DB) that connect to ports on the CPU/SIO module are not included with the CPU/SIO option. Each CPU/SIO accommodates up to four terminal concentrators. Up to eight terminals can be connected to each of the terminal concentrators. This provides 32 serial lines for each CPU/SIO module.

Each terminal multiplexer port on the CPU/SIO module is identified by a letter A-D. The port names are used to identify the **tty** device under SCO UNIX. The device naming convention used by SCO MPX allows you to define a device as a terminal, printer, modem, or intelligent transparent printer. Refer to the *SCO / UNIX MPX Release and Installation Notes* for information on how to define the terminal devices used on the CPU/SIO.

2.8 CPU/SCSI Module

The CPU/SCSI module, shown in Figure 2–8, has the following features:

- Intel 80486 processor
- SCSI adapter logic
- External SCSI connector

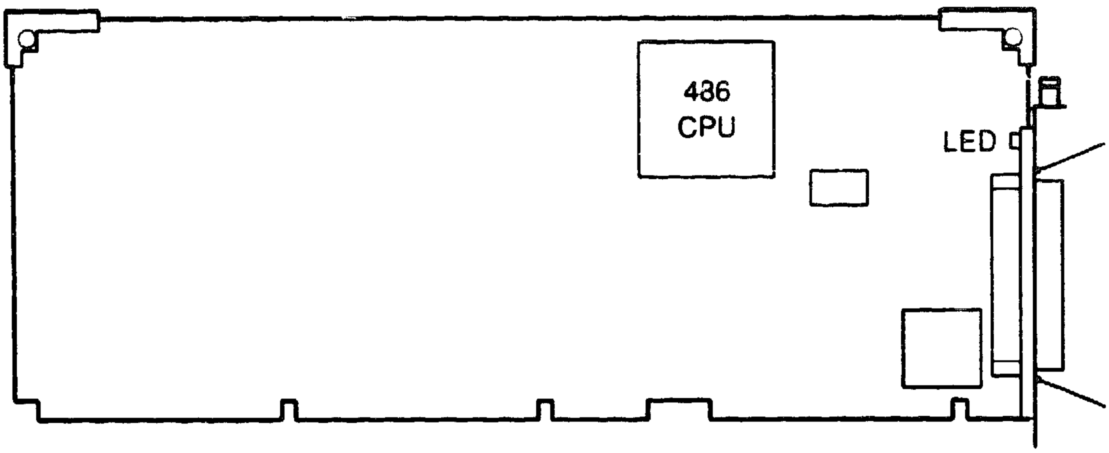
The Intel 80486 processor provides additional processing power for symmetrical multiprocessing. The SCO MPX multiprocessor extensions provide support for the CPU/SCSI module's processor. You must install one license and copy of MPX for each CPU/SCSI installed on your system.

The SCSI adapter provides higher performance SCSI transactions than the ISA-based SCSI adapter. Since the CPU/SCSI resides on the system bus, SCSI transactions can occur without data transfer through the slower ISA bus.

The CPU/SCSI adapter always uses SCSI ID 7 as its address.

The external SCSI connector can provide a complete external SCSI bus, or extend the internal SCSI bus to external devices.

Figure 2–8 CPU/SCSI Module



Devices on the SCSI bus controlled by the CPU/SCSI module are defined using the *mkdev corollary* command. Refer to the *SCO MPX Release Notes and Installation Guide* for details.

2.9 ISA Bus 16-Bit SCSI Host Adapter

The ISA bus 16-bit SCSI host adapter is a factory-installed ISA bus SC I adapter. It is functionally equivalent to an Adaptec 1540B SCSI adapter and is fully supported by the SCO UNIX drivers for an Adaptec 1540B.

The ISA SCSI adapter supports up to seven SCSI devices, of which four can be hard disks.

See Section 2.8 for additional information on the SCSI bus schemes available in the applicationDEC 433MP system.

2.9.1 Configuration Jumpers

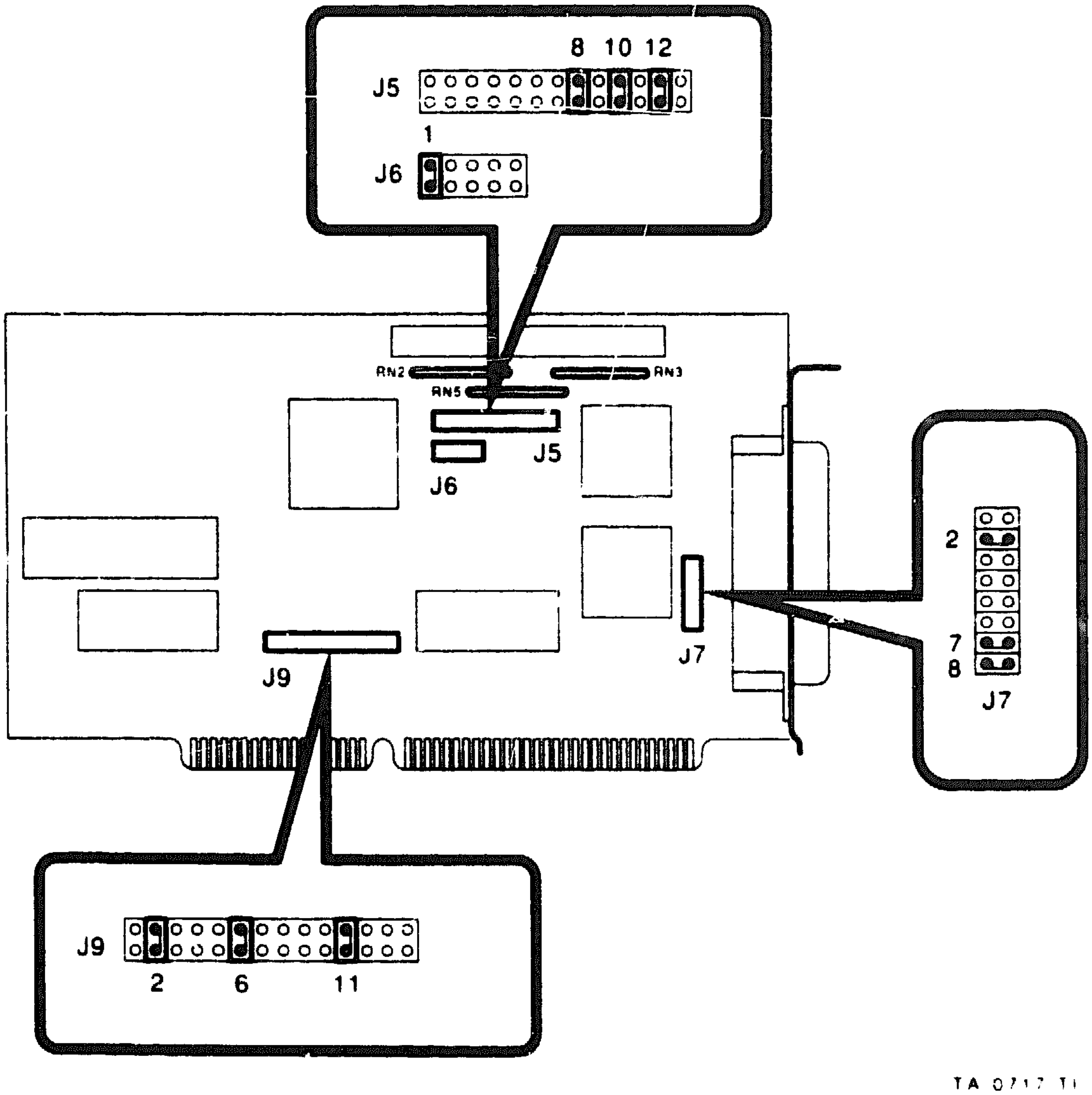
Table 2–5 shows the configurable features of an ISA SCSI adapter.

Table 2–5 ISA SCSI Adapter Configurable Features and Defaults

Feature	Default Setting
Address	330H
IRQ and Interrupt Channel	IRQ11
Synchronous Negotiation	Disabled
SCSI Parity	Enabled
SCSI Address	ID7
DMA Channel	Channel 5
DMA Request/Acknowledge Levels	5
DMA Transfer Speed	5.7 MB/s
BIOS	Enabled
BIOS Address	C8000
BIOS Wait States	Zero Wait States

Figure 2–9 shows the ISA SCSI adapter and the location of jumpers J5, J6, J7, and J9. All of the selectable features are chosen using these jumpers. The factory default jumper configurations are shown.

Figure 2–9 ISA SCSI Adapter Module



Figures 2–10 through 2–13 show the different jumper configurations.

Figure 2–10 SCSI Adapter: Factory Configuration J5

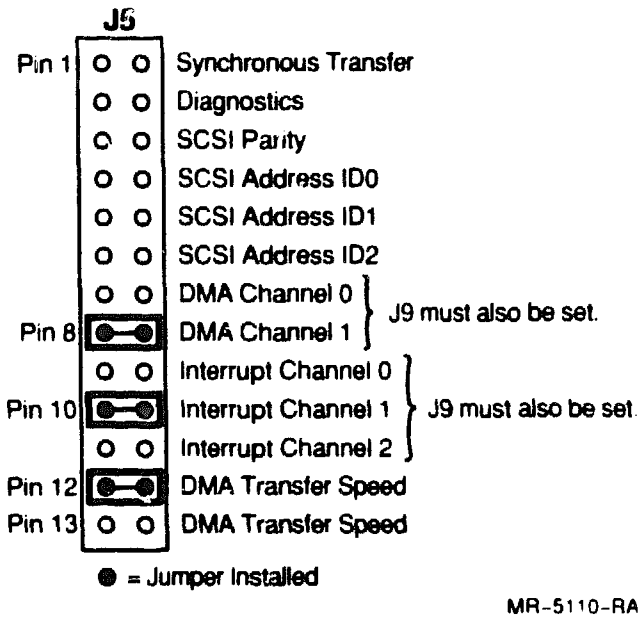


Figure 2–11 SCSI Adapter: Factory Configuration J6

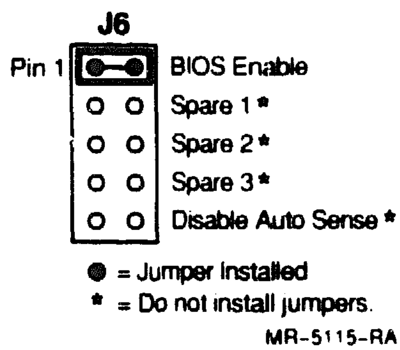


Figure 2–12 SCSI Adapter: Factory Configuration J7

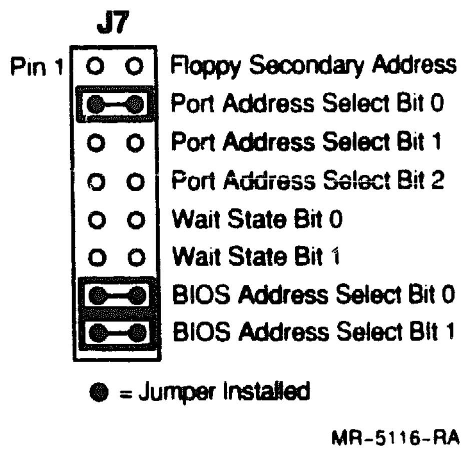
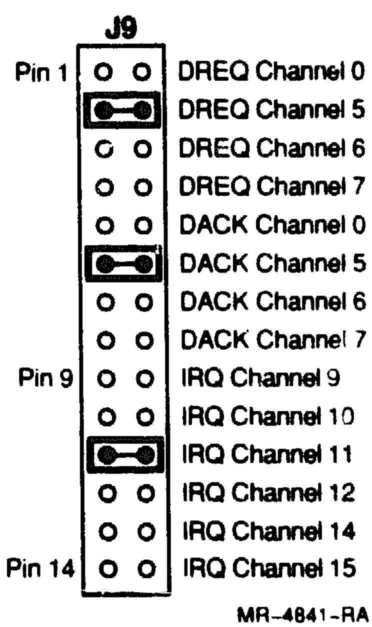


Figure 2–13 SCSI Adapter: Factory Configuration J9



Descriptions of the selectable features follow.

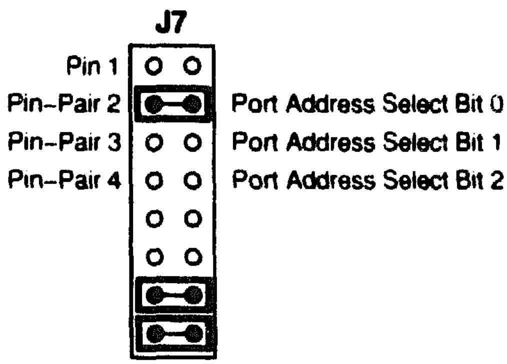
2.9.2 ISA Address

The ISA port address of the SCSI adapter can be set to one of the following addresses:

- 330 (default)
- 334
- 234
- 230
- 134
- 130

Pin pairs 2, 3, and 4 on jumper pack J7 control which address is selected, as shown in Figure 2–14.

Figure 2–14 ISA Address Jumper Settings



ISA Port Address			
Bit 2 A9 4	Bit 1 A8 3	Bit 0 A2 2	Select Bit 1 Address Pin–Pair
○	○	○	334H
○	○	●	330H*
○	●	○	234H
○	●	●	230H
●	○	○	134H
●	○	●	130H
●	●	○	Not Used
●	●	●	Not Used

● = Jumper Installed
* = Default

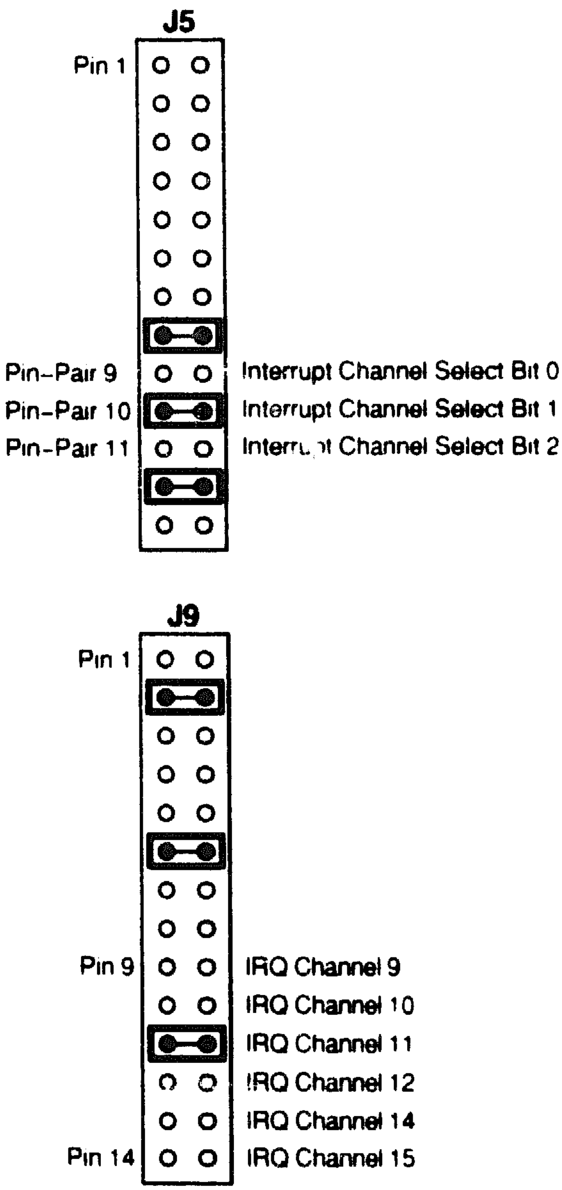
MR-5117-RA

2.9.3 IRQ and Interrupt Channel

The IRQ and interrupt channel must be set to identical values. The IRQ and interrupt channel can be set to 9, 10, 11, 12, 14, or 15.

Pin pairs 9, 10, and 11 on jumper pack J5 control the interrupt channel assigned to the SCSI adapter. Pin pairs 9 through 14 on jumper pack J9 control the IRQ channel. Both jumper packs must be set to the same value. Figure 2-15 shows how values are selected in these jumper packs.

Figure 2-15 IRQ and Interrupt Channel Jumper Settings



J5 Interrupt Channels

Pin-Pair 9	Pin-Pair 10	Pin-Pair 11	Interrupt Channel
○	○	○	9
●	○	○	10
○	●	○	11*
●	●	○	12
○	○	●	14
●	○	●	15

● = Jumper installed
* = Default

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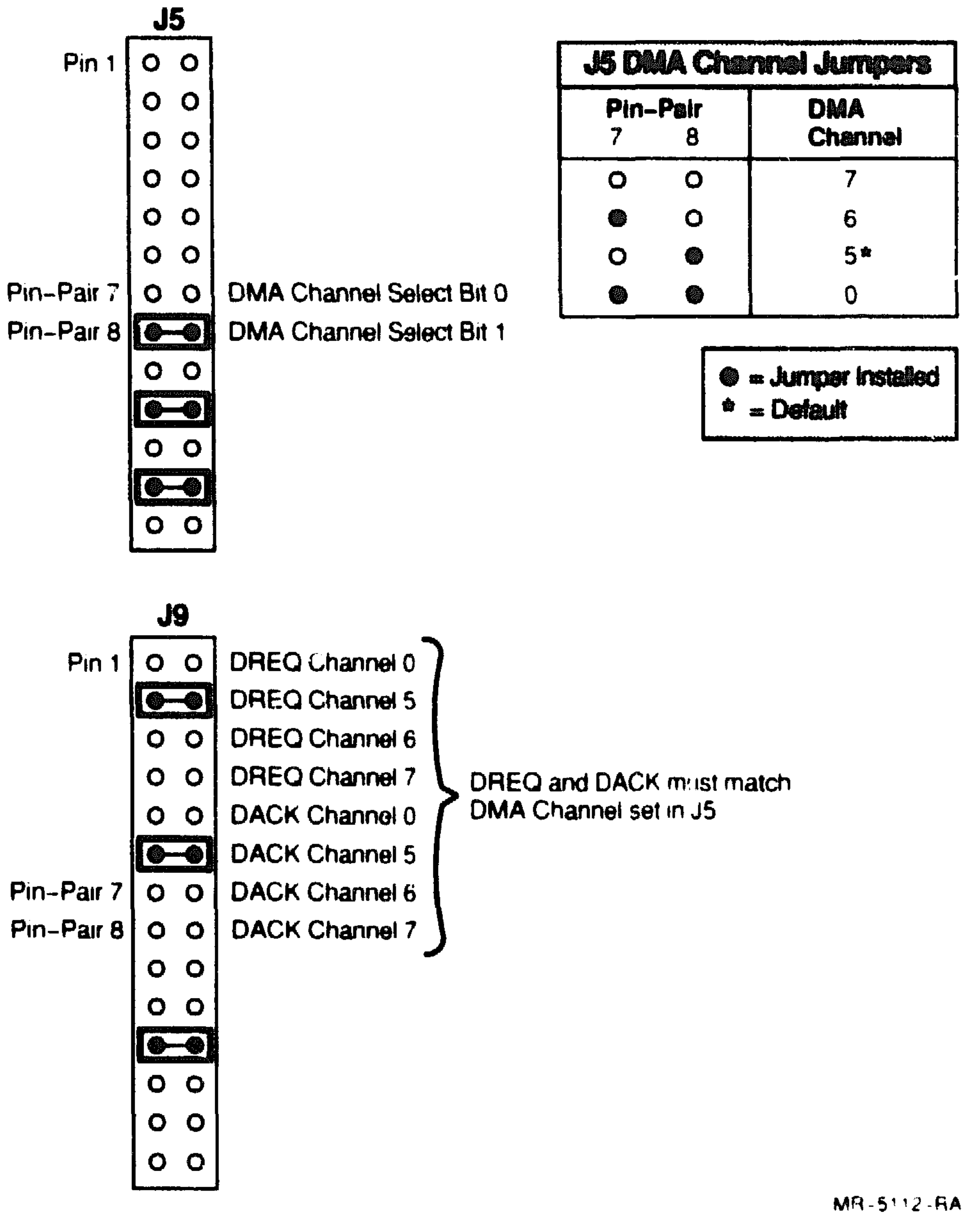
2.9.4 DMA Channel

The DMA channel can be set to 0, 5, 6, or 7. The default setting is DMA channel 5. The DREQ and DACK channels must be set to match the DMA channel selected.

Figure 2–16 DMA Channel Jumper Settings



J5 DMA Channel Jumpers

Pin-Pair 7	Pin-Pair 8	DMA Channel
○	○	7
●	○	6
○	●	5*
●	●	0

● = Jumper Installed
* = Default

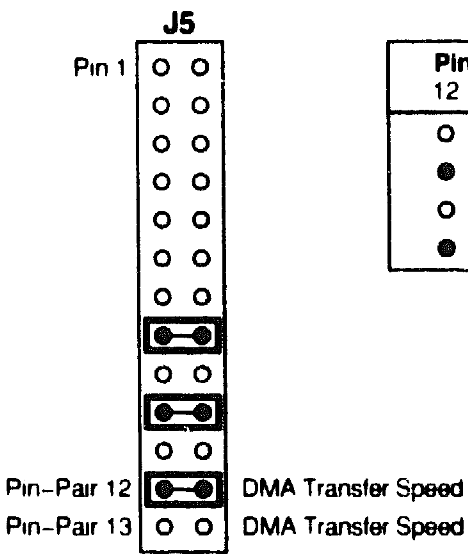
Pins 7 and 8 on J5 and pins 1 through 8 on J9 control the DMA channel and DREQ and DACK channel settings. Figure 2–16 shows how the DMA channel is specified.

2.9.5 DMA Transfer Rate

The DMA transfer rate can be set to 5.0, 5.7, 6.7, or 8.0 MB/s. The default setting is 5.7 MB/s.

Pins 12 and 13 control the setting of the DMA transfer rate, as shown in Figure 2–17.

Figure 2–17 DMA Transfer Rate Jumper Settings



Pin–Pair 12	Pin–Pair 13	DMA Speed
○	○	5.0 MB/s
●	○	5.7 MB/s*
○	●	6.7 MB/s
●	●	8.0 MB/s

● = Jumper Installed
* = Default

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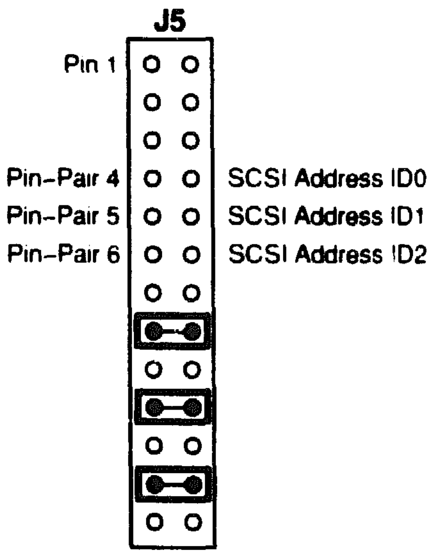
2.9.6 SCSI ID Address

The SCSI ID address of the adapter can be set between 0 and 7. The default setting is 7.

Pins 4, 5, and 6 control the SCSI ID address, as shown in Figure 2–18.

Figure 2–18 SCSI Address Jumper Settings



Pin-Pair 4	Pin-Pair 5	Pin-Pair 6	SCSI Address
○	○	○	7*
●	○	○	6
○	●	○	5
●	●	○	4
○	○	●	3
●	○	●	2
○	●	●	1
●	●	●	0
0	1	2	SCSI Address Bit Number

Jumper installed sets a zero in the SCSI Address.

● = Jumper Installed
* = Default

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2.9.7 SCSI Parity

SCSI parity checking can be enabled or disabled. The default is parity checking enabled. Pin 3 of jumper pack J5 controls this setting. If the pin is installed, parity checking is disabled. If the pin is removed, parity checking is enabled.

2.9.8 SCSI Synchronous Transfer

SCSI synchronous negotiation transfers can be enabled or disabled. The default is disabled synchronous transfers. This means that the adapter supports synchronous transfers if initiated by another device.

2.9.9 BIOS Memory, Enable, and Wait State Selections

The BIOS PROM can be enabled with a jumper on pin 1 on jumper pack 6 (J6). This jumper must always be installed, as shown in Figure 2–11.

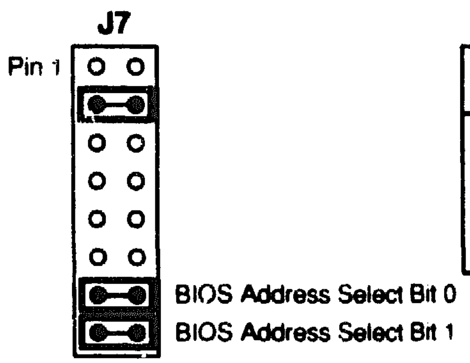
The starting address of memory space for the on-board BIOS can be set to the following values:

- DC000
- CC000
- D3000
- C8000

The default setting is C8000.

Pins 7 and 8 on jumper pack J7 control the BIOS memory address space, as shown in Figure 2–19.

Figure 2–19 BIOS Memory Jumper Settings



BIOS SEL 0	BIOS SEL 1	Address
-	-	DC000
●	-	CC000
-	●	DB000
●	●	C8000*

● = Jumper Installed
– = Jumper Not Installed
* = Default

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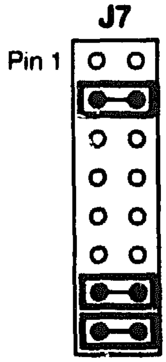
BIOS wait states can be set to values of 0, 100, 200, or 300 ns. The default setting is 0. Pins 5 and 6 on jumper pack J7 control the BIOS wait state selection, as shown in Figure 2–20.

Figure 2–20 BIOS Wait States Jumper Settings



WS 0	WS 1	Delay (ns)
-	-	0 (IOCHRDY Not Driven)*
●	-	100
-	●	200
●	●	300

● = Jumper Installed
– = Jumper Not Installed
* = Default

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2.9.10 Terminator Resistor Packs

Each end of a SCSI bus must be terminated. Terminator resistor packs are used on a module to terminate the SCSI bus when only one end of the SCSI bus terminates with a cable terminator. The terminator resistor packs are RN2, RN3, and RN5, as shown in Figure 2–9.

Factory-installed ISA SCSI adapters have terminator resistor packs removed. The internal end of the SCSI bus is terminated with a cable terminator. The external end of the SCSI bus is terminated with a 50-pin SCSI terminator (part number H8574-A).

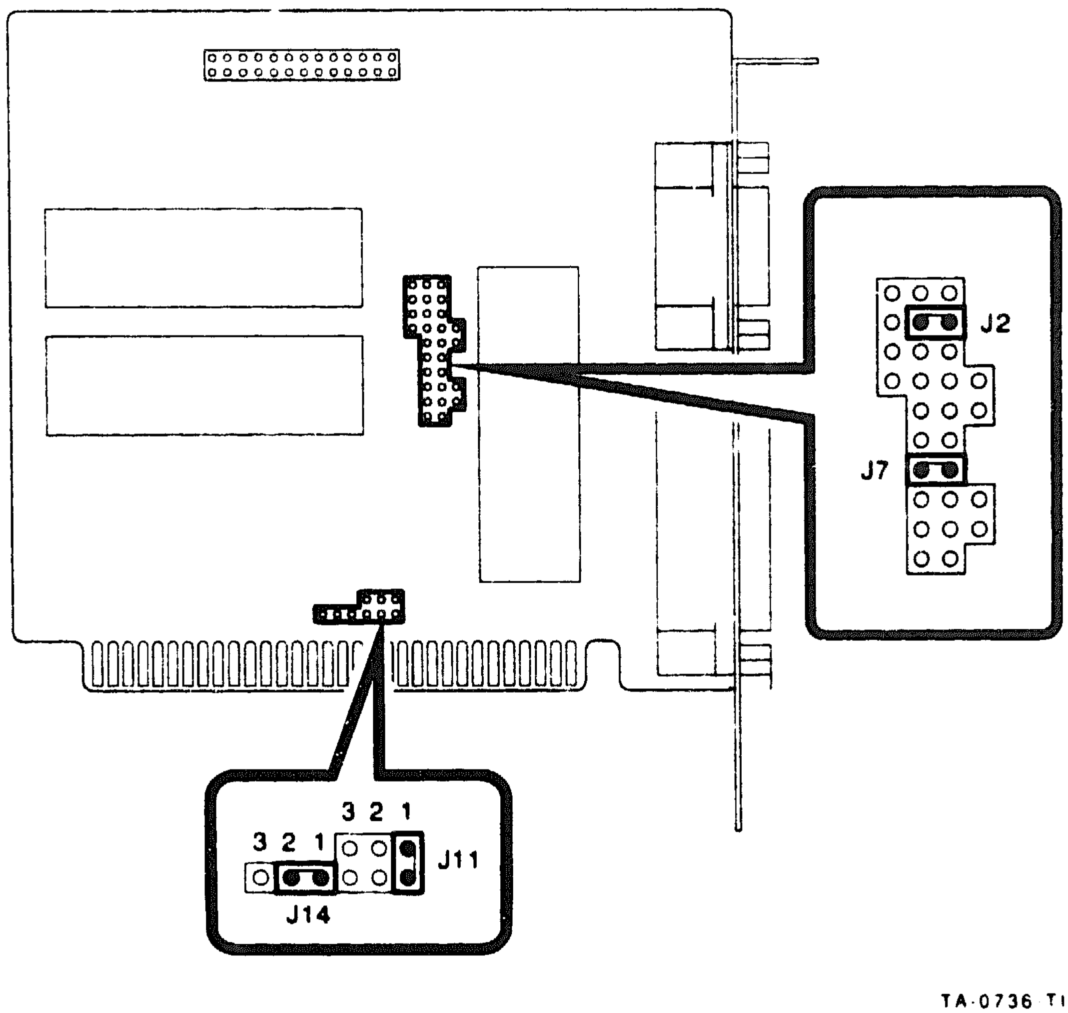
When installing a PS1XR-AA ISA SCSI adapter option, the terminator resistor packs are present on the board and should be left in place. The resistor packs serve to terminate the internal end of the SCSI bus. The external end is terminated with the 50-pin SCSI terminator.

2.10 Serial/Parallel Adapter

The serial/parallel adapter, shown in Figure 2–21, is a factory-installed ISA module that provides one serial port and one parallel port.

The serial port is factory-configured to have COM2: as its address. The parallel port is factory-configured to have LPT1: as its address.

Figure 2-21 Serial/Parallel Module



2.10.1 Serial Port Address

The serial port address is controlled by jumpers, as shown in Figure 2-22. The address can be set to COM2:, COM3:, or COM4. The default setting is COM2.

The IRQ line for the serial port can be set to IRQ2, IRQ3, IRQ4, or IRQ5. The default setting is IRQ3.

Figure 2–22 Serial Port Jumpers

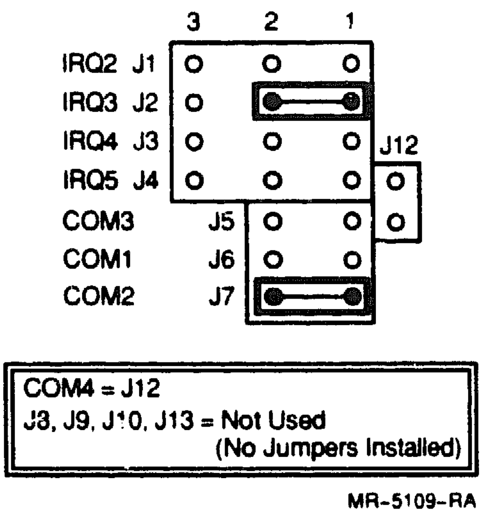


Table 2–6 lists the addresses possible for the serial port.

Table 2–6 Serial Port Addresses

Address Name	Address	Jumper Installed
COM1	3F8-3FF	J6
COM2:	2F8-2FF	J7
COM3:	3E8-3EF	J5
COM4:	2E8-2EF	J12
Disabled	N/A	None

Table 2–7 lists the IRQ settings possible for the serial port.

Table 2–7 Serial Port IRQ Settings

IRQ Setting	Jumper Installed
IRQ2	J1 Pins 1-2
IRQ3	J2 Pins 1-2
IRQ4	J3 Pins 1-2
IRQ5	J4 Pins 1-2

Pin pairs 2-3 in J1 through J4 should be left open (no jumper installed).

2.10.2 Parallel Port Address

The parallel port address is controlled by jumpers, as shown in Figure 2–23. The address can be set to LPT1:, LPT2:, or LPT3. The default setting is LPT1.

The IRQ line for the parallel port can be set to IRQ5 or IRQ7. The default setting is IRQ7.

Figure 2–23 Parallel Port Jumpers

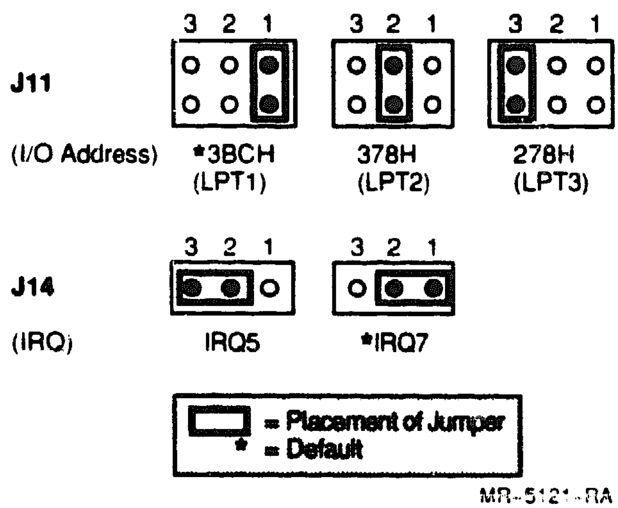


Table 2–8 lists the addresses available for the parallel port.

Table 2–8 Parallel Port Addresses

Address Name	Address	Jumper Installed
LPT1:	3BC	J11 — Pin 1
LPT2:	378	J11 — Pin 2
LPT3:	278	J11 — Pin 3

Table 2–9 lists the IRQ settings available for the parallel port.

Table 2–9 Parallel Port IRQ Settings

IRQ	Jumper Installed
IRQ5	J14 Pins 2-3
IRQ7	J14 Pins 1-2

2.10.3 Signal Pinouts

Figure 2–24 shows the signals presented on the serial port connector.

Figure 2–24 Serial Port Pinout

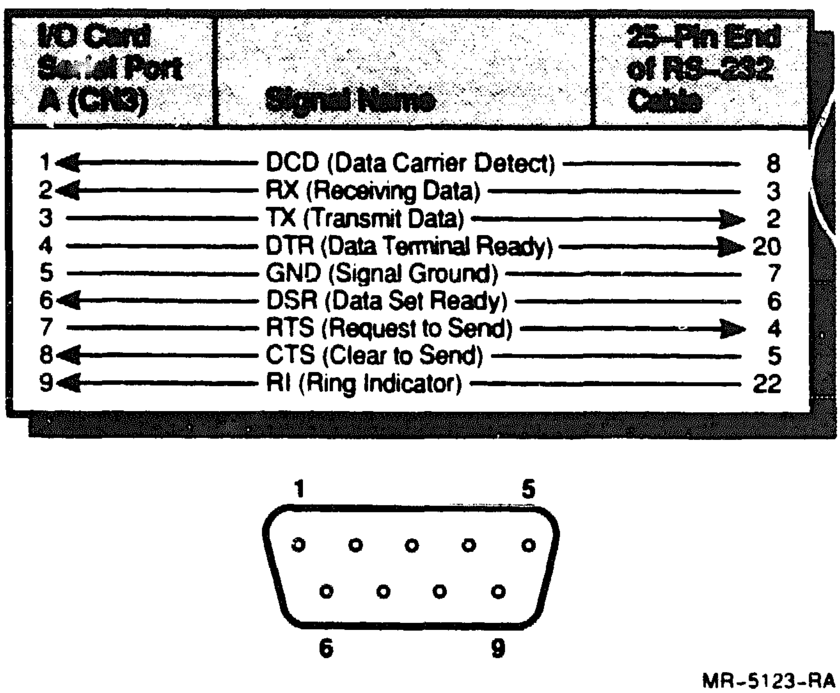
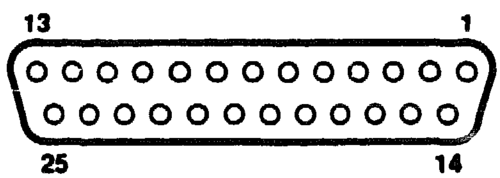


Figure 2–25 shows the signals presented on the parallel port connector.

Figure 2–25 Parallel Port Pinout

Pin	Signal	In/Out
1	-STROBE	Out
2	Data Bit 0	Out
3	Data Bit 1	Out
4	Data Bit 2	Out
5	Data Bit 3	Out
6	Data Bit 4	Out
7	Data Bit 5	Out
8	Data Bit 6	Out
9	Data Bit 7	Out
10	-ACK	In
11	BUSY	In
12	PE	In
13	SLCT	In
14	-AUTO FEED XT	Out
15	-ERROR	In
16	-INIT	In
17	-SLCT IN	Out
18-25	GND	-



MR-5124-RA

2.11 Video Graphics Adapter (VGA)

The Video Graphics Adapter, VGA (part number PS1XG-AA), provides graphics capabilities for graphics monitors. One graphics monitor can be connected to each VGA card. This high resolution graphics adapter includes the following features:

- High resolution (up to 1024 x 768 and Super VGA 800 x 600 on multisync monitors)
- High 72 Hz refresh rate
- Compatibility with VGA, EGA, CGA, MDA, and Hercules graphics modes
- Bus mouse support

The VGA adapter contains automatic monitor detection circuitry, which allows it to configure itself for the attached monitor. If the adapter is unable to determine the monitor type and resolution, utility software is provided with the adapter to configure it for the monitor attached. (See Chapter 9.)

The Digital Equipment VRC16 Color Multisync monitor is recommended for use with the applicationDEC 433MP. However, the VGA adapter supports many monitors from various vendors. For more information, see the *VGA High Resolution Graphics Adapter User and Installation Guide* (part number ER-PS1XG-IG).

2.11.1 Bootable Utility Diskette

The VGA adapter is shipped with a bootable utility diskette, which you can use to configure the adapter for your monitor (if the VGA adapter is unable to automatically detect the monitor). The utility diskette contains a program called VGASETUP, which allows you to configure the VGA adapter and specify an IRQ level and address for the bus mouse. In addition, the diskette contains a diagnostic test program that verifies proper operation of the VGA adapter.

2.11.2 Preinstallation Configuration

There are no jumpers or switches on the VGA module. All address and IRQ selections are either software configurable or fixed.

2.11.3 ISA Address and IRQ Selection

The VGA address port and memory port are not selectable. The VGA address is configured for 3B0-3DF. The memory port is configured for A0000-BFFFF.

An IRQ line must be selected for the bus mouse. This IRQ line must be unique and not conflict with any IRQ already assigned to an option in the ISA bus. The IRQ line is set with the utility software and can be any IRQ from 2 to 5, or disabled. The factory configuration is for the mouse IRQ to be disabled. You must use the bootable utility diskette supplied with the VGA adapter to configure the mouse for an IRQ setting and a primary or secondary address.

Select IRQ 5 for the bus mouse.

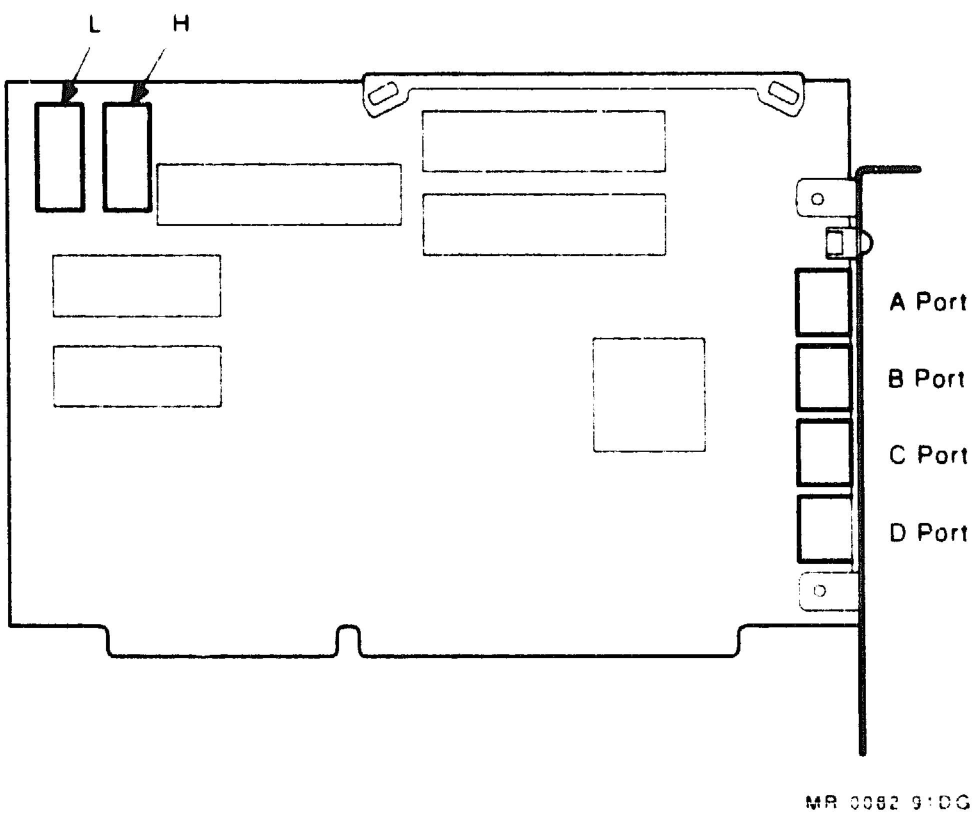
The bus mouse address is selectable between the primary address (23C — 23F) and the secondary address (238 — 23B). The bus mouse should be configured for the primary address in an applicationDEC 433MP system.

2.12 Terminal Multiplexer Host Adapter

The terminal multiplexer host adapter, shown in Figure 2–26, is an ISA bus option module that allows connection of up to 32 serial terminals. Each terminal multiplexer adapter has four connectors for installation of a terminal concentrator. Each terminal concentrator allows up to eight terminals to be connected.

The terminal concentrator can be used with the terminal multiplexer option, or with the CPU/SIO option. See Chapter 9 for information on terminal multiplexer diagnostics.

Figure 2–26 Terminal Multiplexer Host Adapter

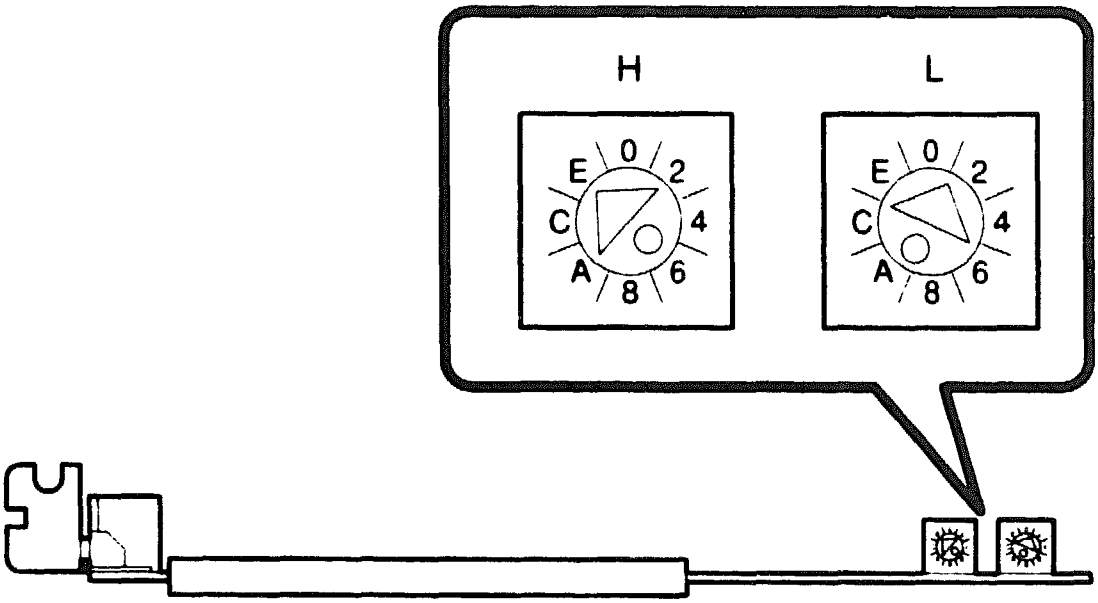


Before installing the terminal multiplexer, set its memory address as shown in Table 2–10. Figure 2–27 shows the rotary switches (H and L) that set the address. Make sure these switches are set correctly.

Table 2–10 Terminal Multiplexer Memory Address Settings

Terminal Multiplexer	Memory Address	H Switch	L Switch
First installed	E10000-E1FFFF	E	1
Second installed	E20000-E2FFFF	E	2

Figure 2–27 Terminal Multiplexer Rotary Switch Settings



Set the base processor memory switches (on SW1) as shown in Table 2–4.

Then install the terminal multiplexer host adapter in the system according to Section 8.18.

You must select an IRQ line for the terminal multiplexer. During installation of the software driver, you will be asked to specify the IRQ line. Select the line as shown in Table 2–11.

Table 2–11 Terminal Multiplexer IRQ Settings

Terminal Multiplexer	IRQ
First installed	12
Second installed	15

2.13 209 MB Disk Drive RZ24

The RZ24 disk drive is a SCSI hard disk drive with 209 MB storage capacity. One disk drive is standard with every applicationDEC 433MP system. Up to four hard disk drives can be installed on the ISA SCSI bus. If a dual SCSI bus scheme is used, up to six hard disks can be installed in the chassis.

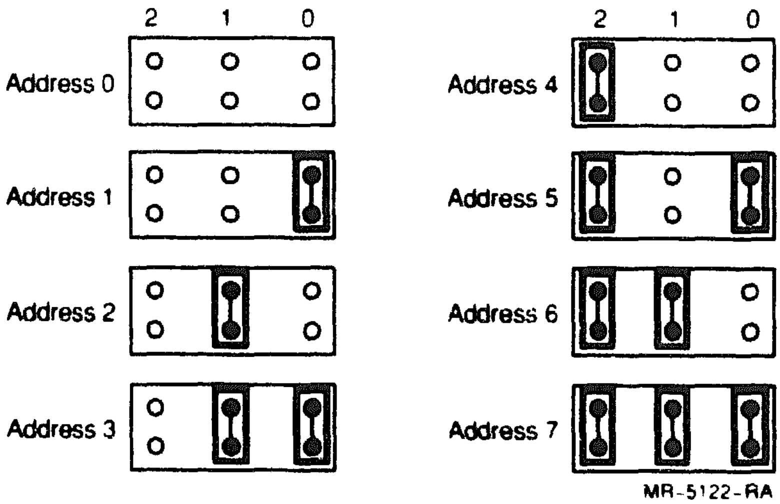
Before installing the RZ24, check that the SCSI address is set correctly for the device bracket into which you plan to install the drive.

2.13.1 Setting SCSI Address

The SCSI architecture allows eight addressable devices (addresses 0 — 7) to be connected to the SCSI bus. The SCSI adapter, which controls SCSI bus requests and data transfers, uses address 7. Each storage device connected to a SCSI bus must have a unique address between 0 and 6.

The SCSI storage device address is set with jumpers, as shown in Figure 2–28. The three address jumpers represent binary numbers 0 to 7. When a jumper is installed, it represents a 1 in that address position. If no jumpers are installed, the address is 0. If a jumper is installed on the middle jumper pins, the address is 2.

Figure 2–28 SCSI Address Jumpers



The factory-installed devices are configured as shown in Figure 2–29. The address scheme is designed to avoid changing SCSI addresses when upgrading a system to include the second CPU/SCSI bus. If you use these addresses, you do not need to change the SCSI addresses of any existing devices.

The SCSI address jumpers are located on the bottom of the RZ24 as shown in Figure 2–30. The settings are shown in Table 2–12.

2.13.2 Software Support

Each hard disk drive must be defined as a device. For hard drives attached to the ISA SCSI bus, use the *mkdev hd* command. Refer to the *SCO UNIX System Administrator's Guide* for information on how to define each hard disk drive.

For hard drives attached to the system bus SCSI (using the CPU/SCSI adapter), use the *mkdev corollary* command. Refer to the *SCO MPX Release and Installation Notes* for information on this command.

Figure 2–29 Recommended SCSI Addresses

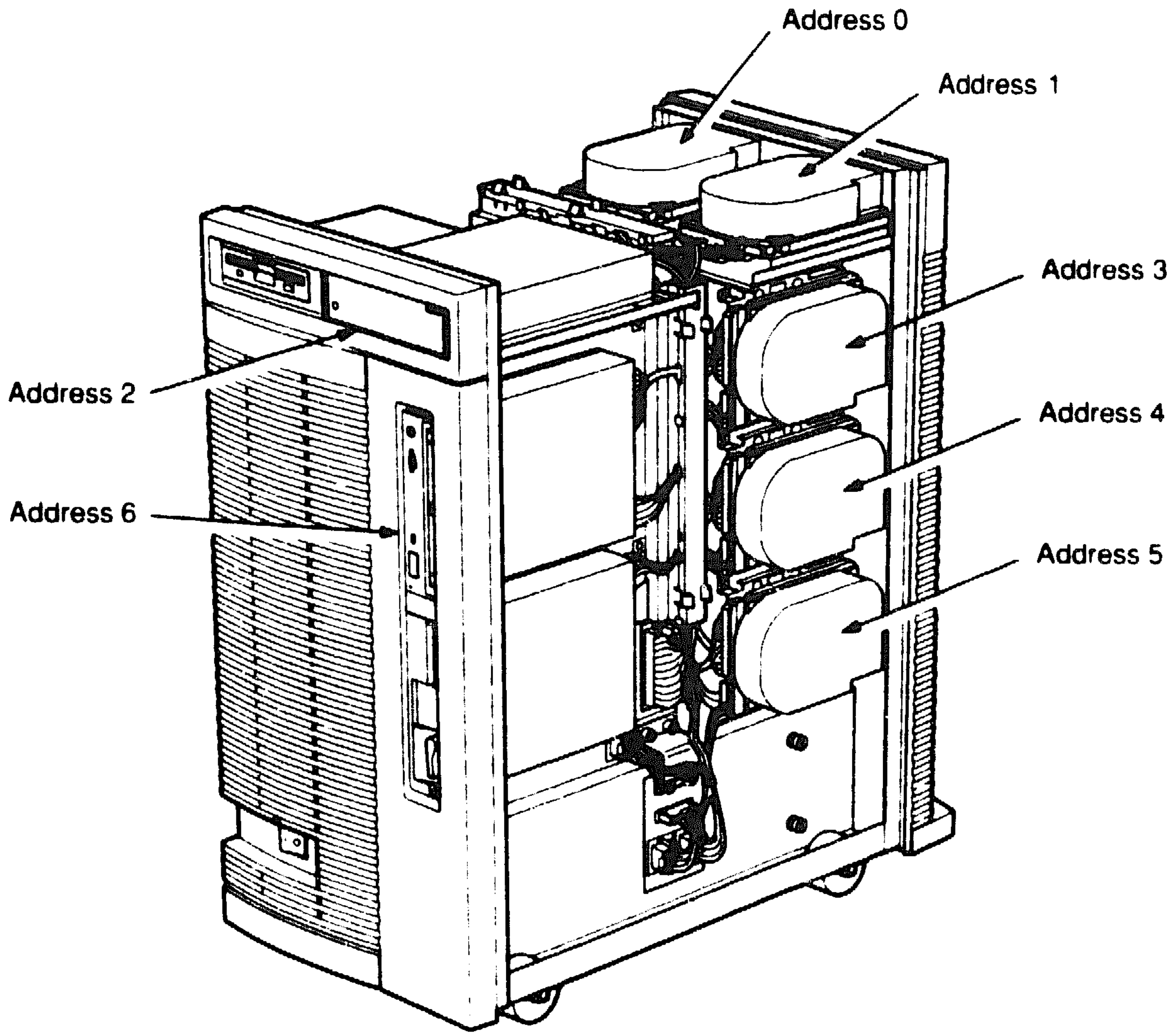


Figure 2–30 RZ24 Disk Drive SCSI Jumpers

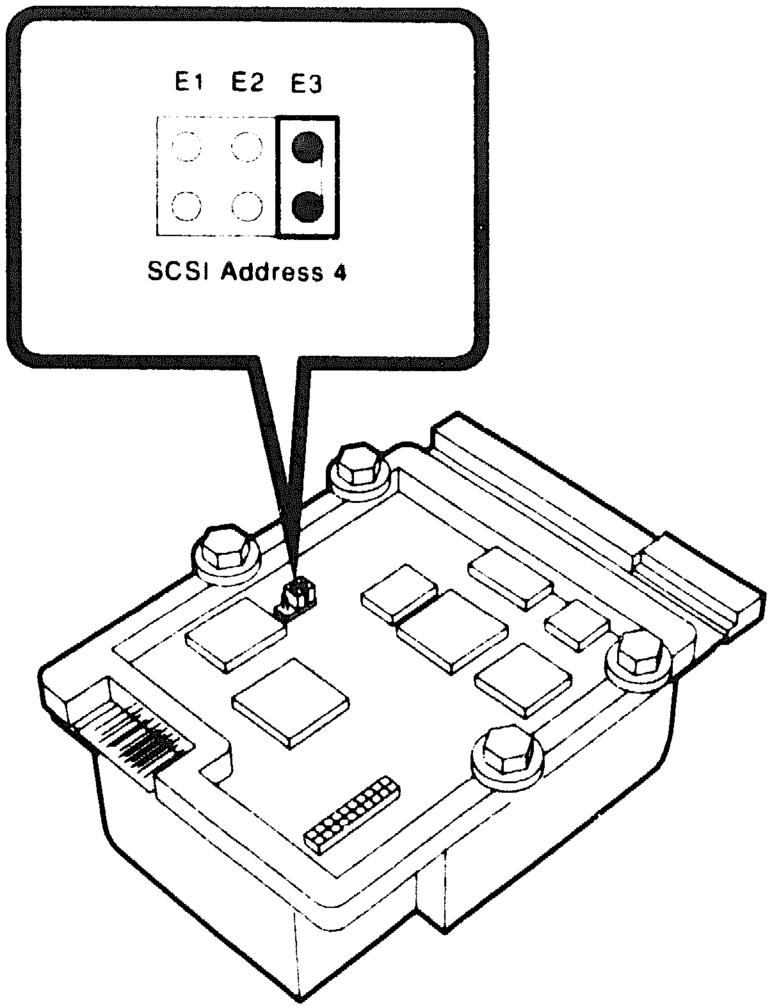


Table 2–12 SCSI Addresses and SCSI Address Jumpers

Address	E3	E2	E1
0	Out	Out	Out
1	Out	Out	In
2	Out	In	Out
3	Out	In	In
4	In	Out	Out
5	In	Out	In
6	In	In	Out
7	In	In	In

2.14 320/525 MB Quarter-Inch Tape Drive TZK10

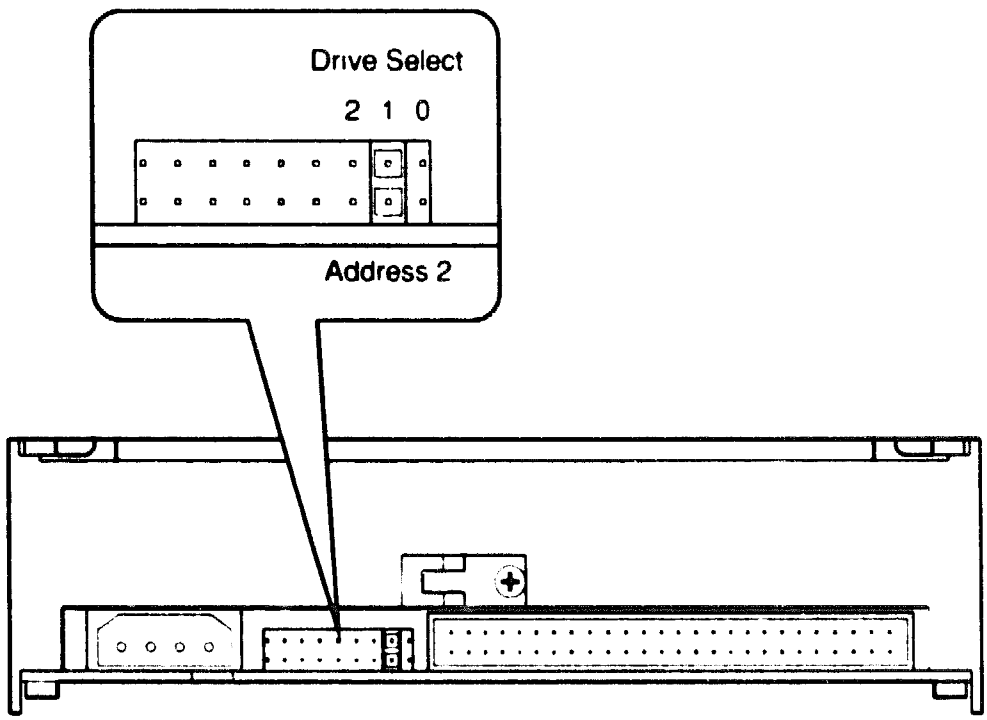
The TZK10 cartridge tape provides the following features:

- Ability to read and write in formats from 120 MB to 525 MB
- Standard quarter-inch tape cartridge size

2.14.1 Preinstallation Configuration

Check that the address of the QIC tape is set to 2. Jumpers on the back of the QIC tape unit are used to set the SCSI ID address. See Figure 2–31.

Figure 2–31 QIC Tape SCSI Address Jumpers



2.14.2 Cleaning and Maintenance

The TZK10 tape drive heads need to be cleaned after every eight hours of use to ensure maximum longevity of the heads. This eight hour figure is a guideline and should be adjusted if the environment is particularly dirty.

The Digital Tape Cleaning Cartridge (order number TZK1X-HA) is recommended for cleaning the tape heads.

2.14.3 Retensioning Tapes

Tapes must be retensioned prior to use. To retension a tape, use the SCO UNIX command:

```
$ tape -s reten
```

2.14.4 Software Support

Use the *mkdev tape* command to configure the QIC tape drive. Refer to the *SCO UNIX Administrator's Guide* for further information on defining the device to the operating system.

SCO UNIX and SCO ODT come preconfigured with cassette and SCSI-tape support. To declare the SCSI-tape as the default tape, use the *mkdev tape* command.

There can be different devices defined in your system for the tape drive. For example, the **/dev/rct0** device rewinds tapes after use. The **/dev/ct0** device accesses the same tape drive, but does not rewind the tape after use.

2.15 CD-ROM Drive RRD42

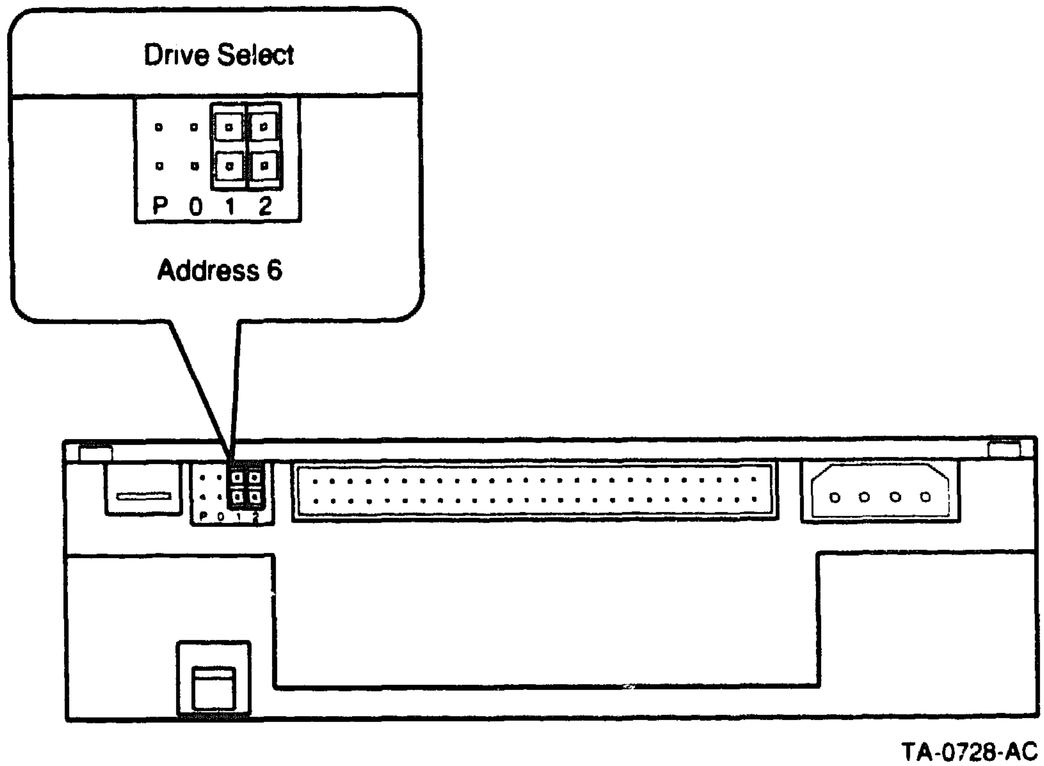
The RRD42 CD-ROM provides the ability to read High Sierra and ISO-9660 format diskettes.

2.15.1 CD-ROM SCSI Address Setting

Check that the SCSI address of the CD-ROM is set to address 6. Jumpers on the back of the CD-ROM unit are used to set the SCSI ID address.

Figure 2–32 shows the location of the SCSI address jumpers for the CD-ROM.

Figure 2–32 CD-ROM SCSI Jumpers



2.15.2 Software Support

The CD-ROM is defined to the operating system using the *mkdev cdrom* command. The *mkdev high-sierra* command defines the CD-ROM's filesystem.

2.16 3.5-inch 1.44 MB Diskette Drive RX23

The RX23 is a 3.5-inch 1.44 MB diskette drive. The controller for this drive is on the bridge module. An internal cable from the backplane connector to the RX23 provides control and data signals for the drive.

The RX23 is factory configured as the boot media (Drive A) for the applicationDEC 433MP system. To set the 5.25-inch diskette drive as the boot media, you must change a jumper on the bridge module. See Section 2.5.3 for more information.

The RX23 has a formatted capacity of 1.44 MBs. It has 135 tracks per inch (TPI) and can read and write industry compatible 3.5-inch, high density, diskette media. It is compatible with the field formatted industry-standard, 18-sector format on 700 Oersted type media.

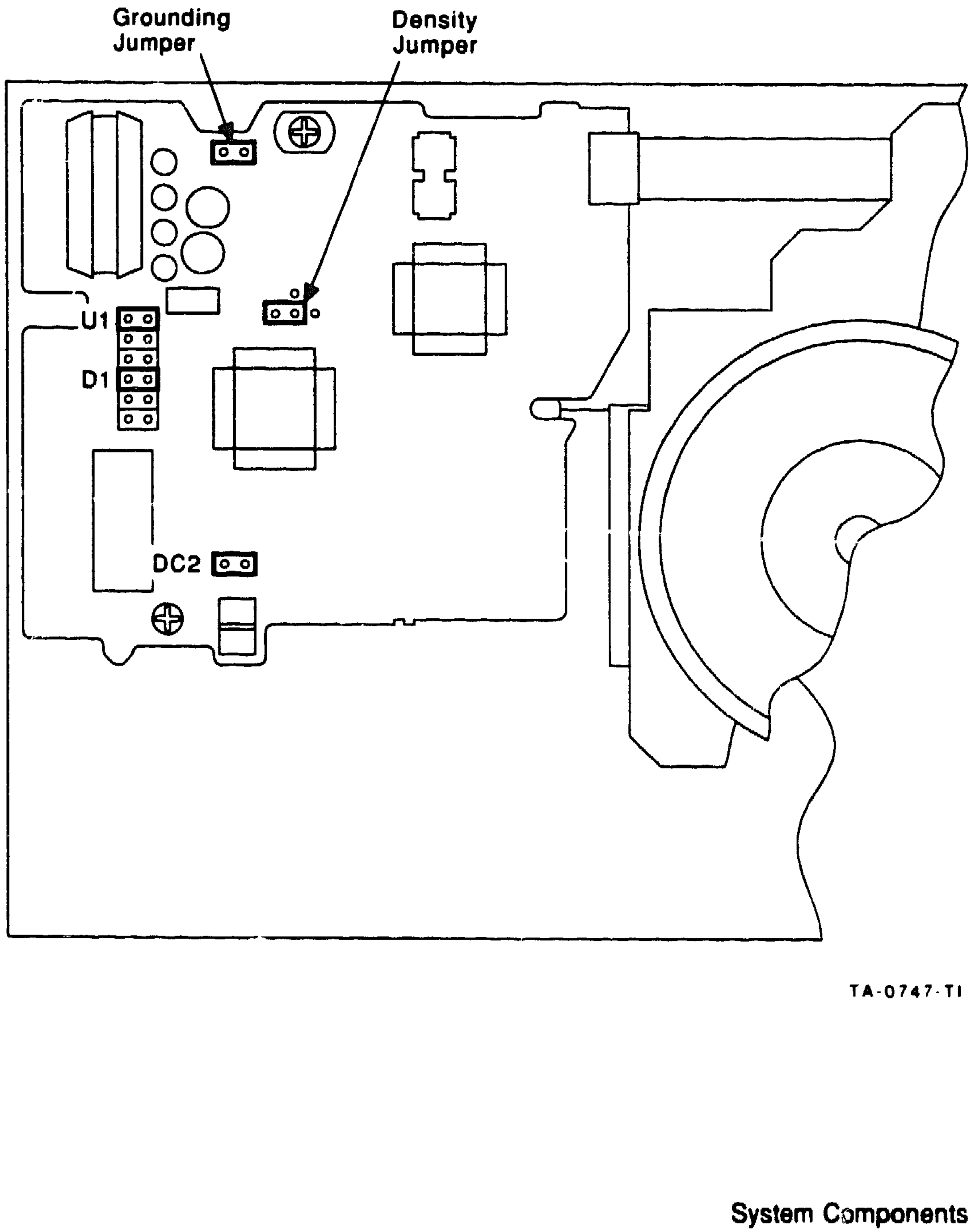
The media for the RX23 diskette drive is a 3.5-inch diskette. This diskette can be either 1 or 2 MBs. The existence of a 2 MB detect slot on the diskette determines the byte capacity of the diskette. If no detect slot exists, the byte capacity is 1 MB. If a detect slot exists, the byte capacity is 2 MBs. A microswitch on the front of the drive detects whether there is a detect slot.

The RX23 is automatically recognized by the operating system. The RX23 is factory configured as the boot media for the applicationDEC 433MP system. To specify the optional RX33 5.25-inch 1.2 MB floppy diskette drive as the boot drive, you must change a jumper setting on the bridge module. See Figure 2–33.

2.17 5.25-inch 1.2 MB Floppy Disk Drive RX33

The 5.25-inch 1.2 MB floppy disk drive (model number RX33-AS) is an optional drive for the applicationDEC 433MP system. The controller for this drive is on the bridge module. Internal cabling from the backplane provides connection to the RX33.

Figure 2–33 RX33 Diskette Drive Jumper Locations



CHAPTER 3

3 Troubleshooting the System

This chapter describes a procedure for troubleshooting the applicationDEC 433MP system.

3.1 Electrostatic Protection

Observe standard antistatic precautions and guidelines when handling static sensitive materials during the troubleshooting process.

3.2 Preliminary Checks

Before troubleshooting any system problem, refer to the *Site Maintenance Guide* to determine the system's service history. If options have been installed or reconfigured recently, make sure that:

- System modules are in the correct slots
- Modules are seated firmly in the backplane slots
- Cables are connected properly and firmly
- Jumpers and switches are set correctly
- Configuration information displayed by the setup utility matches the physical configuration of the system

3.3 Basic Troubleshooting Procedure

Figure 3–1 shows the recommended basic troubleshooting procedure for a system.

Figure 3–1 System Troubleshooting Procedure

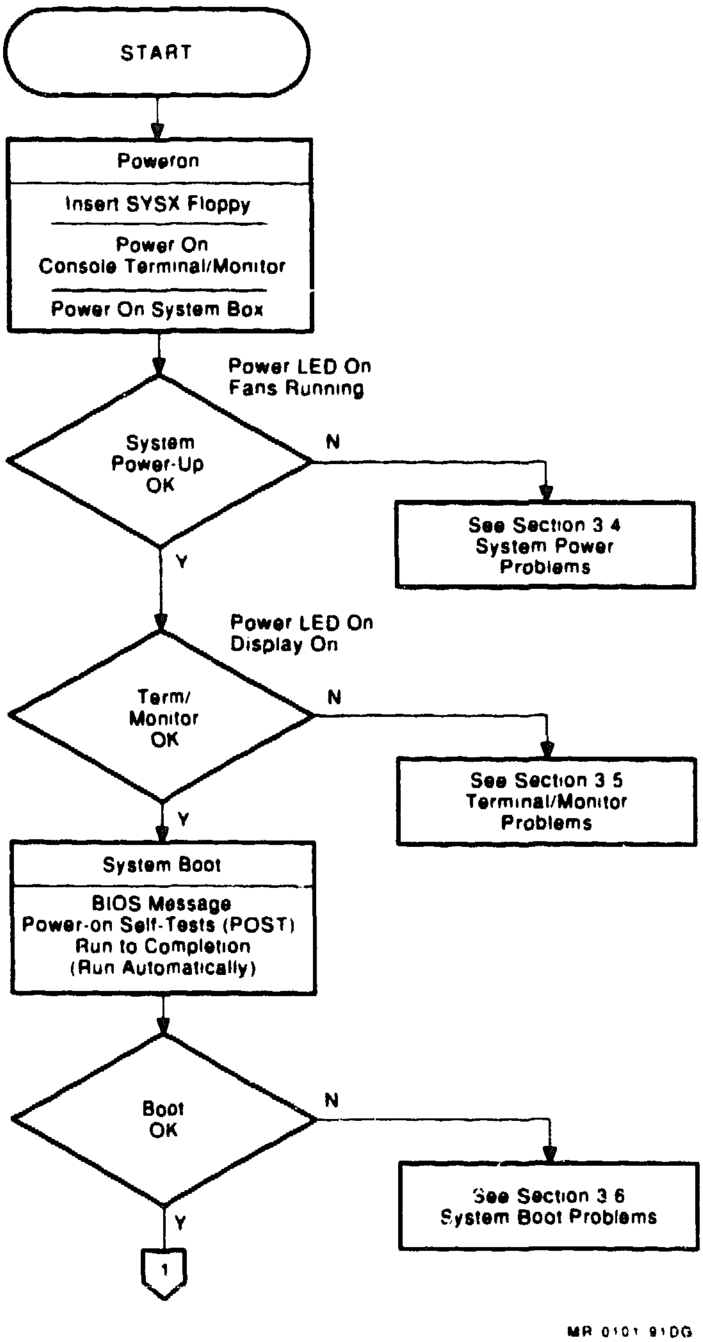


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Figure 3–1 (Cont.) System Troubleshooting Procedure

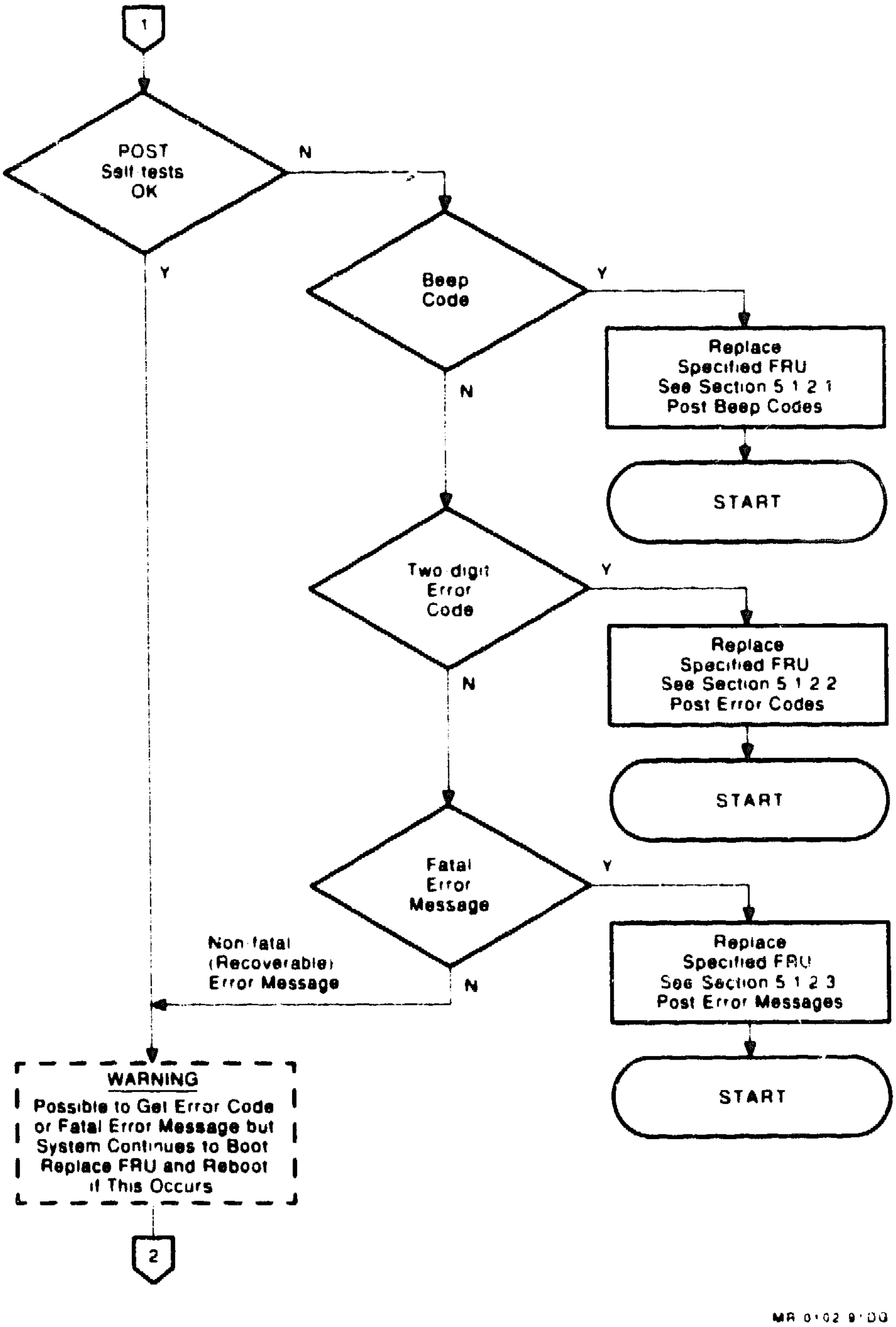

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Figure 3–1 (Cont.) System Troubleshooting Procedure

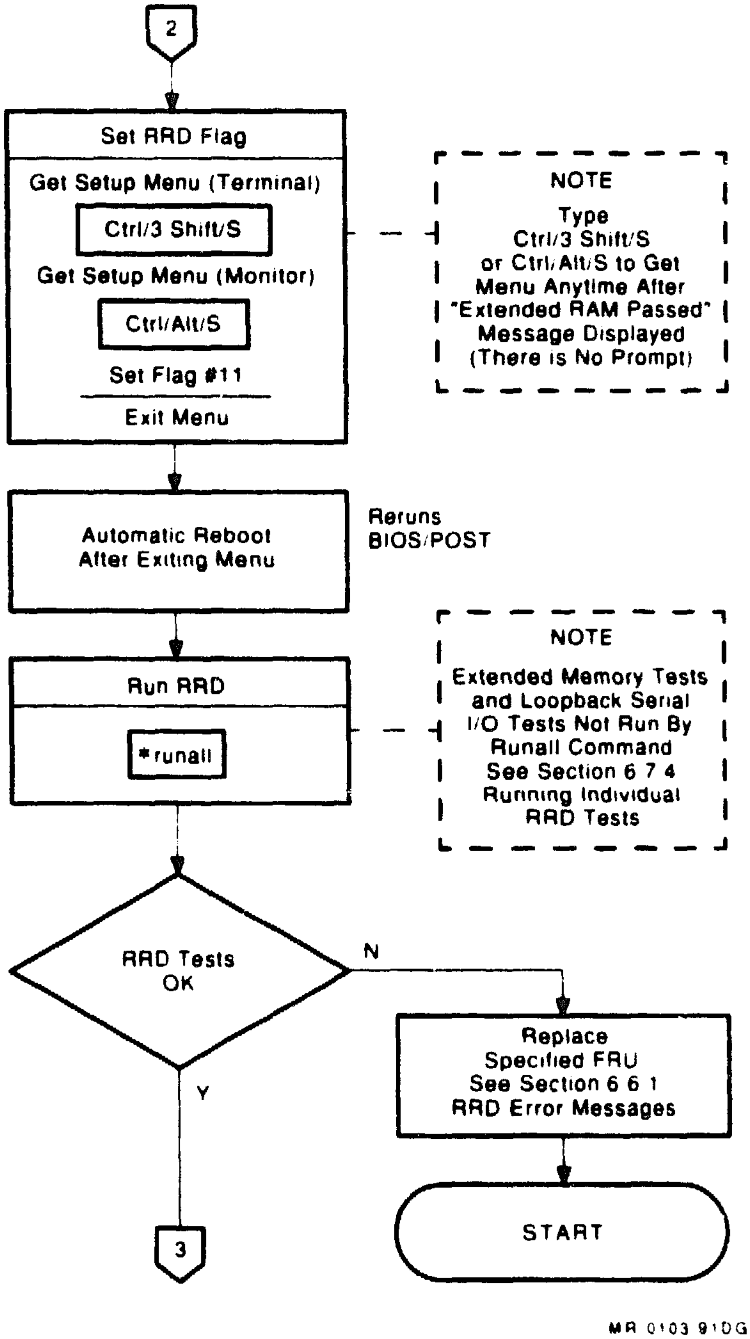

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Figure 3–1 (Cont.) System Troubleshooting Procedure

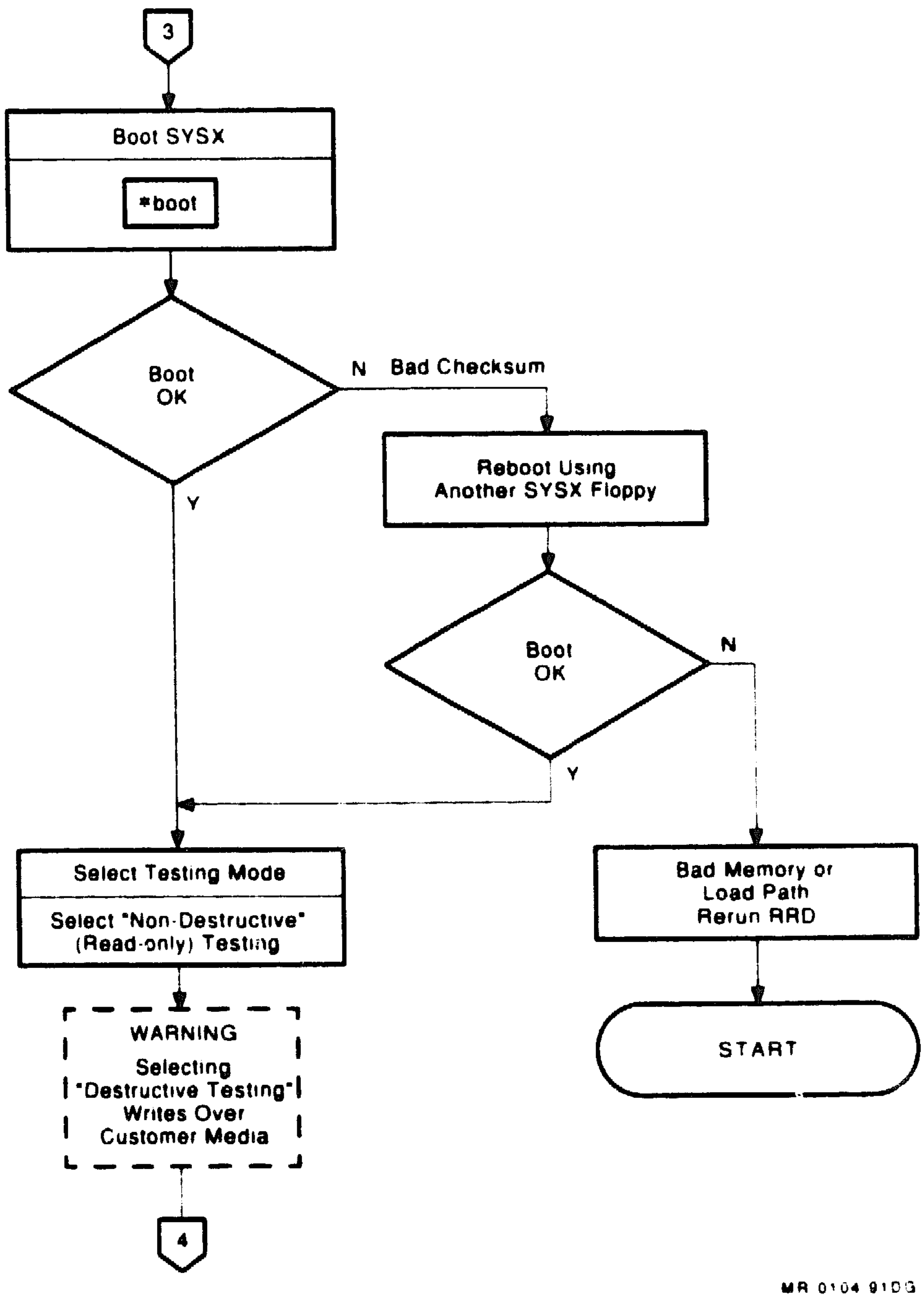

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Figure 3–1 (Cont.) System Troubleshooting Procedure

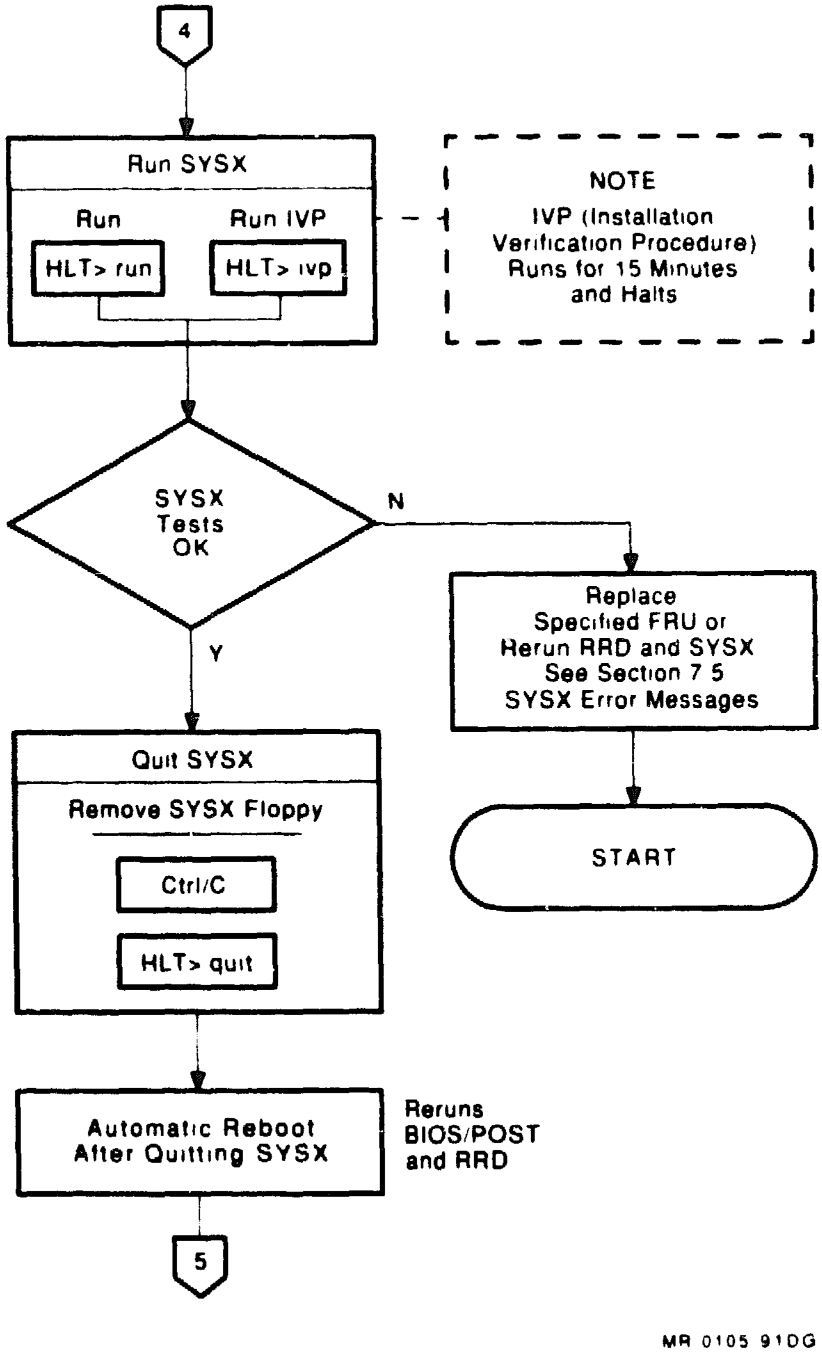

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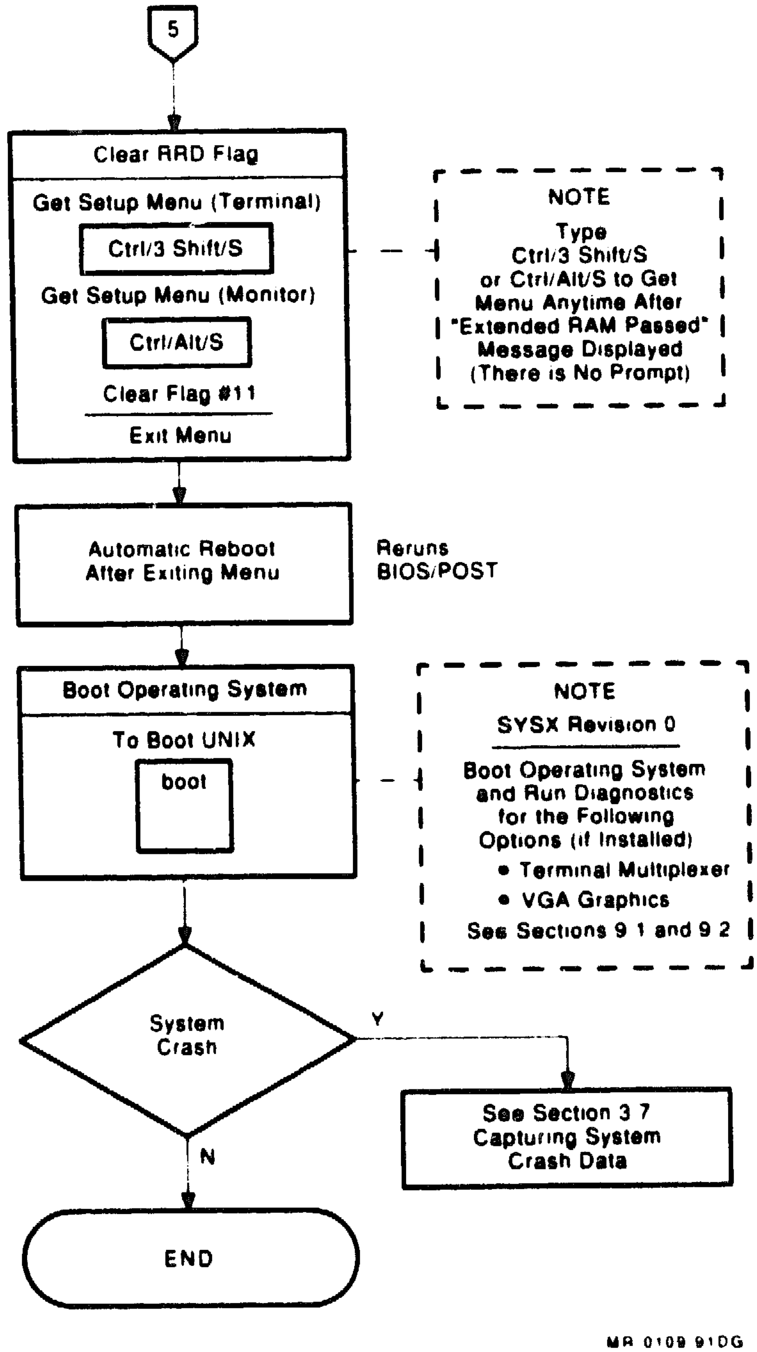
Figure 3–1 (Cont.) System Troubleshooting Procedure



The steps are as follows:

1. Insert the System Exerciser (SYSX) floppy disk in the drive. Next, power-up the console terminal/monitor and then the system box. (If the SYSX disk is not inserted now, the system will later attempt to boot the operating system rather than SYSX.) If you experience system power problems, see Section 3.4. If you experience terminal/monitor power or display problems, see Section 3.5.

Note

The VT420 console terminal may hang during the normal power-up sequence when used with SCO UNIX. If this occurs, terminal setup parameters may not be set correctly. Refer to Section 3.8.

2. Following a successful powerup, the system should boot automatically. The BIOS message should be displayed and the BIOS Power-On Self-Test (POST) should run to completion. If there are system boot problems (system hung in an undefined state), see Section 3.6.
3. Check that no fatal errors were found by the BIOS POST. Errors are indicated in three ways:

Beep code	Indicates a fatal error was detected before the console terminal/monitor was initialized. Specifies a faulty FRU. See Section 5.3.1.
Two-digit error code	Indicates a fatal error was detected after the console terminal was initialized. Specifies a faulty FRU. See Section 5.3.2.
Error message (textual)	Indicates either a fatal or nonfatal (recoverable) error was detected. If a fatal error, specifies a faulty FRU. See Section 5.3.3.

   Return to step 1 after replacing a FRU.
4. Call the setup menu and enable the ROM Resident Diagnostics (RRD) by setting the RRD flag (flag #11). The setup menu is called by typing Ctrl/3 then Shift/S when the system has a terminal connected. When a graphics monitor is connected, type Ctrl/Alt/S. See Section 6.2 for instructions on using the setup menu.
5. Run RRD by typing *runall* at the asterisk (*) prompt. If these diagnostics detect an error, see Section 6.6 to determine the failing FRU. Return to step 1 after replacing the FRU.
6. Call the setup menu again (see step 4) and disable the RRD by clearing the RRD flag (flag #11).

7. Boot the System Exerciser (SYSX) by typing *boot* at the asterisk (*) prompt. If a bad checksum message is displayed, reboot using the same floppy or (if that fails) another SYSX floppy. If SYSX will not boot after the repeated attempts, return to step 1 and rerun RRD. The problem is probably a memory failure (run RRD extended memory tests) or a bad floppy drive or drive cable.
8. After SYSX is booted, you must select the testing mode. Select "nondestructive" (read-only) testing for each drive by pressing Enter at each prompt.

Caution

Customer media will be overwritten causing data to be lost if "destructive" testing is selected.

9. Run SYSX by typing *run* or *ivp* at the HLT> prompt. The *run* command causes SYSX tests to run continuously. The *ivp* command performs a 15 minute installation verification procedure. If SYSX detects an error, see System Exerciser Error Flags in Section 7.5 to determine the failing FRU. Return to step 1 after replacing the FRU.

Note

Return to step 1 and rerun RRD and SYSX if an error report is generated but a failing FRU is not specified. A possibility is that the failing FRU is the processor module reporting the error.

10. Boot the operating system

Note

If the SYSX program run in step 5 was revision 0, boot the applicable operating system and run the Terminal Multiplexer diagnostics (see Section 9.1) and VGA Graphics diagnostics (see Section 9.2) if these options are installed.

11. If a system crash occurs after booting the operating system and when running system software, see Section 3.7 for procedures on capturing crash dump data.

3.4 System Power Problems

Figure 3–2 shows the steps to be taken if a system fails to power up properly.

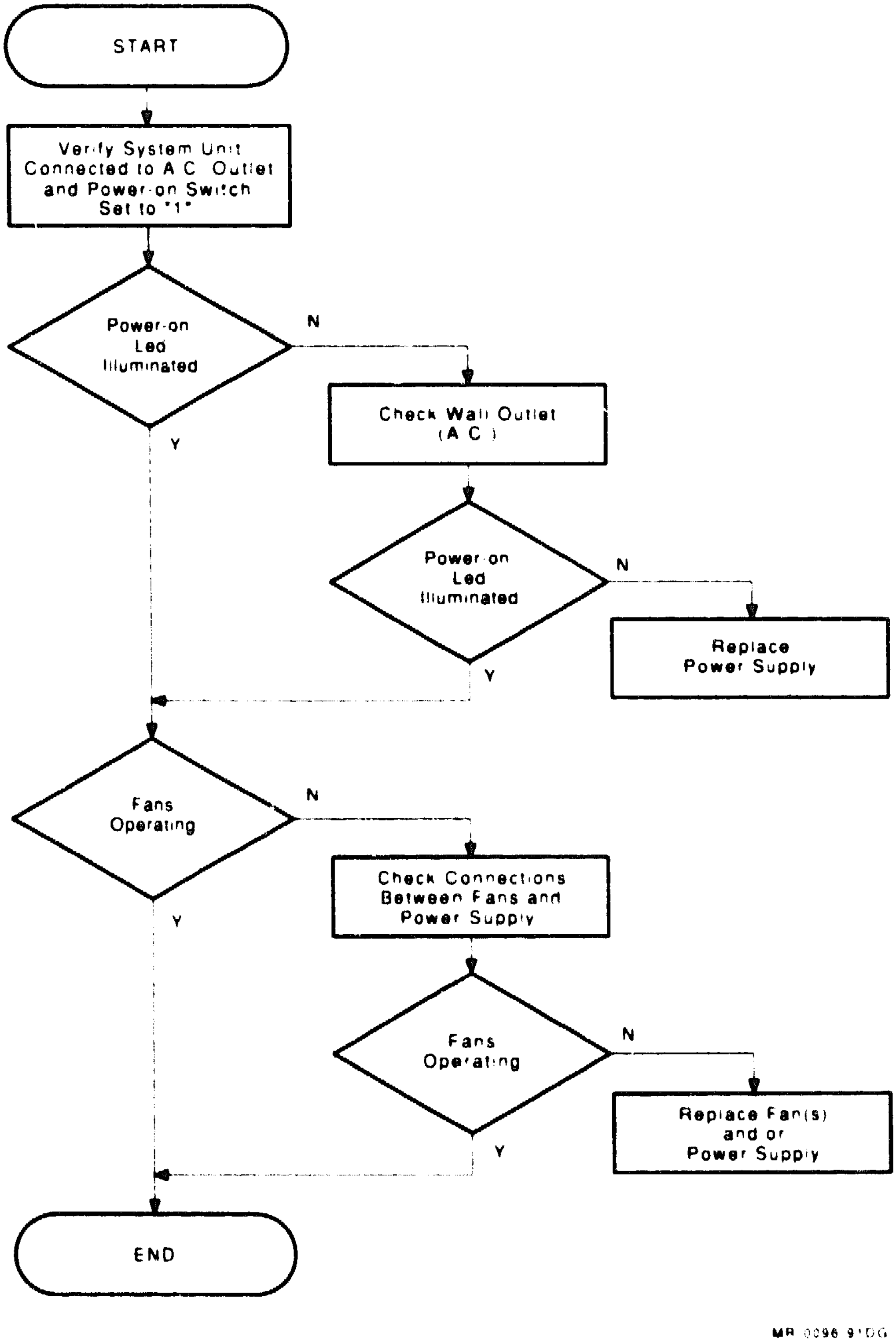
The steps are as follows:

1. Verify that the system box power cord is connected to the wall outlet, and that the power-on switch is set to 1.
2. If the power-on LED is not illuminated, check that power is applied to the wall outlet.
3. If power is applied to the wall outlet and the power-on LED is still not illuminated, remove the system box covers and replace the power supply. See Section 8.24.
4. If the power-on LED is illuminated and a system box fan is not turning, remove the system box covers and check the connections between the the fan and power supply. If connected properly, replace the fan (see Section 8.25). If that does not correct the problem, replace the power supply (see Section 8.24).

Note

If the fan is not turning in the power supply, replace the power supply.

Figure 3–2 Troubleshooting System Power Problems



3.5 Console Terminal/Monitor Problems

Figure 3–3 shows the steps to troubleshoot terminal/monitor problems.

Figure 3–3 Troubleshooting Terminal/Monitor Problems

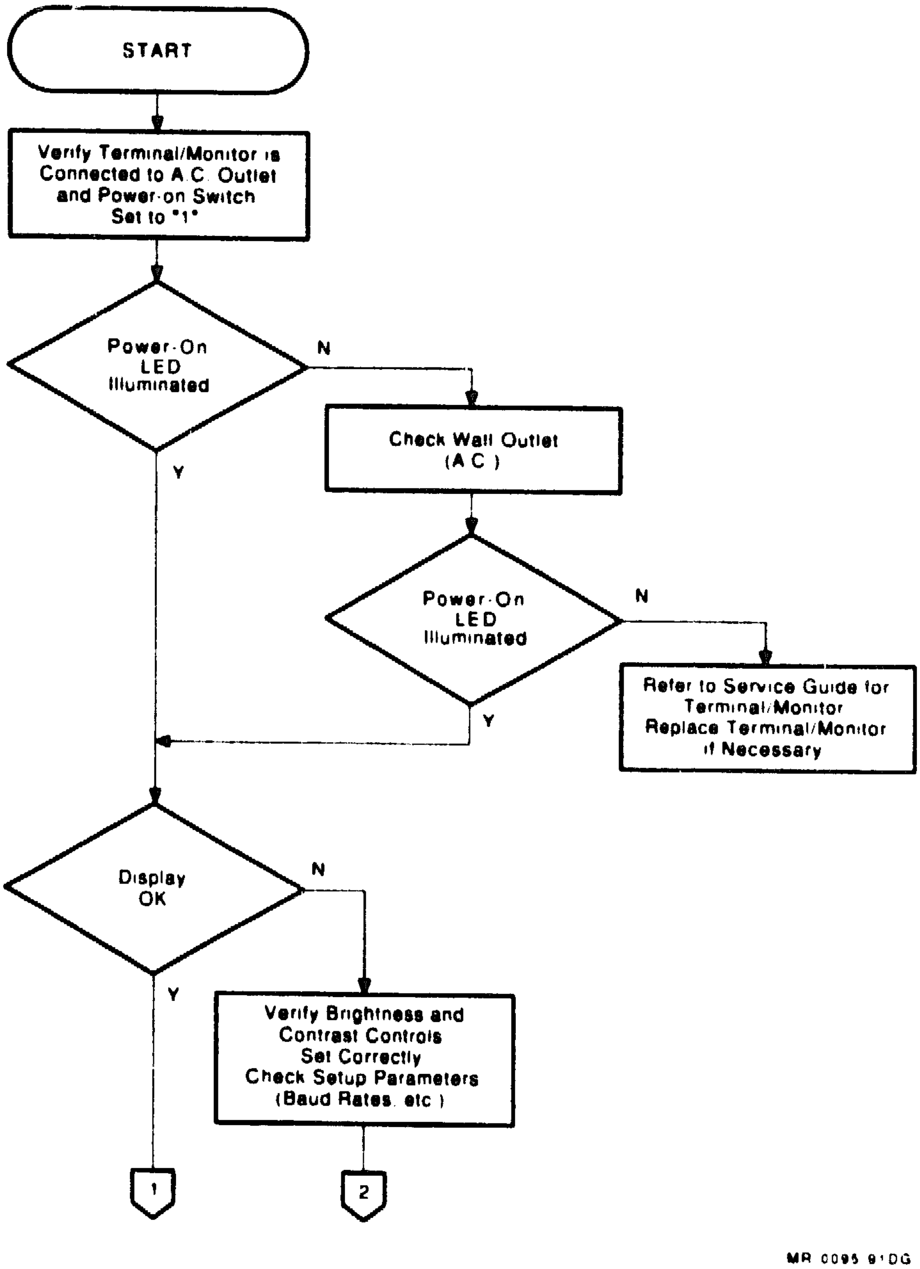


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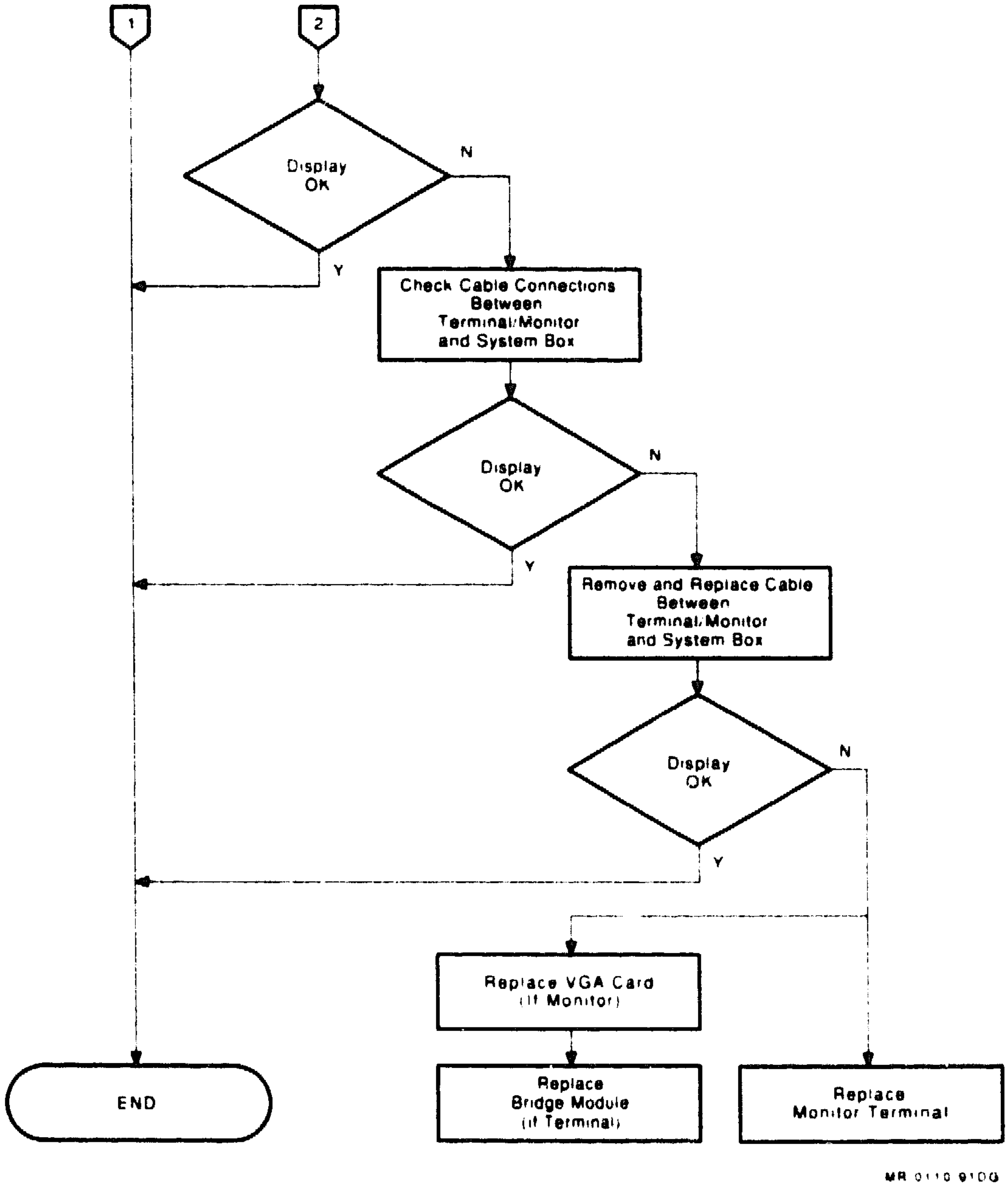
Figure 3–3 (Cont.) Troubleshooting Terminal/Monitor Problems



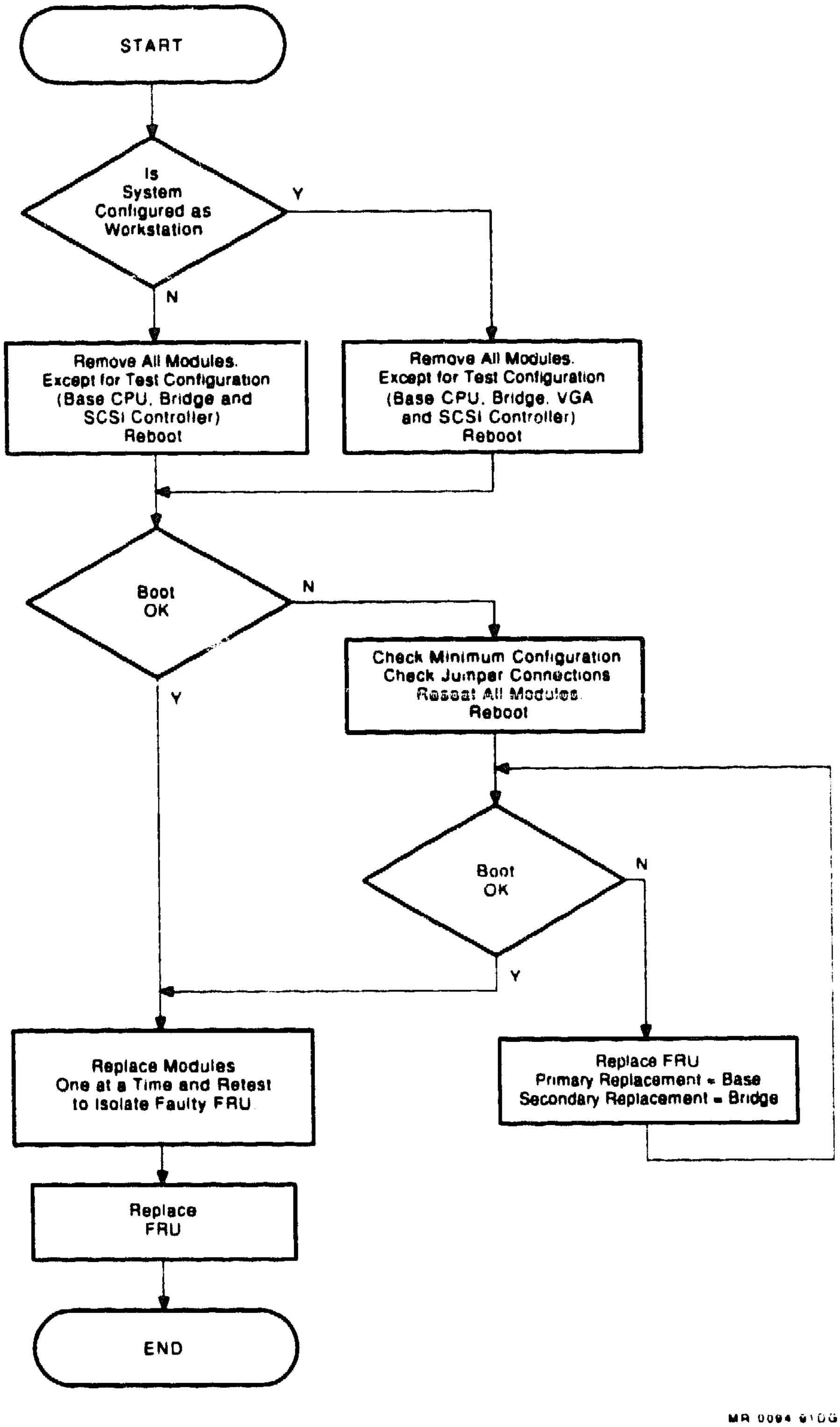
The steps are as follows:

1. Verify that the terminal/monitor power cord is connected to the wall outlet and that the power-on switch is set to 1.
2. If the power-on LED is not illuminated, check that power is applied to the wall outlet.
3. If power is applied to the wall outlet and the power-on LED is still not illuminated, refer to the *Service Guide* for the terminal/monitor. Replace the terminal/monitor if necessary.
4. If the power-on LED is illuminated and there are display problems, verify that the terminal/monitor brightness and contrast controls are set correctly. Also check that baud rate settings and other terminal/monitor setup parameters are correct. Refer to the terminal/monitor *Service Guide*.
5. If there are still display problems, check the cable between the terminal/monitor and the system box. If connections appear correct, remove and replace the cable. Finally, if the problem remains, replace the bridge module or VGA module in the system box, or the terminal/monitor itself. (Replace the bridge module if a terminal is installed; replace the VGA module if a monitor is installed.)

3.6 System Boot Problems

Figure 3–4 shows the steps to take if the system fails to boot immediately after powerup; that is, if BIOS or POST fail to execute or complete and the system is left in an undefined state.

Figure 3–4 Troubleshooting System Boot Problems



The procedure calls for removing all modules except for a basic test configuration, ensuring that the test configuration works, and then rebooting, adding a module after each successful reboot. This is continued until a failure occurs, in which case, the last module added is the failing FRU. The steps are as follows:

1. Power down the system and remove the left side panel and the card cage cover.
2. Unplug all modules from the card cage backplane except the following:

   Base CPU module
   Bridge module
   ISA SCSI controller module
   VGA module (when graphics monitor connected to system)

3. Power up the system. If the system still does not boot, power down and check jumper and cable connections and also module seating. Now, power up again. If the system still does not boot, replace the modules in the basic test configuration one at a time, checking to see if the system boots after each replacement. The first module replaced should be the base CPU. The second should be the bridge module.
4. When the basic test configuration boots successfully, add the modules removed in step 2 one at a time, but now check to see if the boot *fails* after the module is inserted. Continue this procedure and replace any FRU causing a failure until all previously removed modules or their replacements are inserted in the backplane and the system boots successfully.

3.7 Capturing System Crash Data (SCO UNIX)

When the SCO UNIX operating system crashes, it usually displays a *panic*: kernel error message on the system console. The *panic* message gives some information about the error. After displaying the message, the system writes the system image to the swap device and stops.

In order to save the crash dump image file, the image must be saved from the swap device to another device before rebooting the system. Refer to the /dev directory for information on possible device files you can specify. Also review "Recovering from a System Crash" in Chapter 11 of the *SCO UNIX System V/386 Operating System Administrator's Guide*. Review MESSAGES (ADM) for information on the *panic* message.

3.7.1 Creating a Crash Dump File

After a system crash and during the reboot process, the system displays:

```
There may be a system dump memory image in the swap device.
Do you want to save it? (y/n)_
```

If you enter *y*, the system responds:

```
Use floppy drive 0 (/dev/rfd0) by default

Press ENTER to use default device.
Enter valid Floppy Drive number to use if different.
Enter "t" to use tape.
```

The following example uses a tape drive device to capture the crash dump image:

```
>t

Enter choice of tape drive :

1 - /dev/rct0
  - /dev/rctmini
n - no,QUIT

>1

Insert tape cartridge and press return, or enter q to quit. >
Wait.
dd if=/dev/swap of=/dev/rct0 bs=120b count=274 skip=0

250+0 records in
250+0 records out

Done. Use /etc/ldsysdump to copy dump from tape or diskettes
Press return to continue >
```

When you press Return, the system reboots.

3.7.2 Copying the Crash Dump back onto the System

Before you analyze the crash dump image, you must copy the dump file from the dump media back onto the system after it has rebooted. To get the crash dump file back onto the system, enter the following, specifying a file name for <dumpfile name>:

```
#/etc/ldsysdump <dumpfile name>
Use Floppy Drive 0 (/dev/rfd0) by default.
```

The system responds:

```
Press ENTER to use default.
Enter valid Floppy Drive number to use if different than default.
Enter "t" to use tape drive.
```

Continuing the example using a tape drive:

```
>t

Enter choice of tape drive :

1 - /dev/rct0
2 - /dev/rctmini
n - no,QUIT

>1

Insert tape cartridge and press return, or enter q to quit. >
Wait.
dd if=/dev/rct0 bs=120b count=274
250+0 records in
250+0 records out

System dump copied into <dumpfile name>. Use crash (ADM) to
analyze dump.
```

3.7.3 Analyzing the Crash Dump

The utility that SCO UNIX provides for crash dump analysis is the crash (ADM) utility. The command to invoke the utility is:

```
#/etc/crash -d <filename> -n <namelist> -w <outputfile>
```

where:

<filename> is the dumpfile name specified with the /etc/ldsysdump command
<namelist> is either the default (/unix) or a namelist you specify
<outputfile> is either stdio or a file name

The crash utility returns an angle (>) prompt. Enter *?* to observe the crash commands that can be used.

Table 3–1 lists three of the most useful commands.

Table 3–1 Crash Commands

Command	Description
panic	Print the latest system notices, warnings, and panic messages
proc	Print the process table
trace	Print the kernel stack trace

3.8 Setting Up a VT420 for Use with SCO UNIX

In order to use a VT420 with SCO UNIX, you must alter the terminal's factory default settings. Instructions for the setup changes are as follows:

1. Invoke the VT420 setup screen by pressing F3 on the keyboard.
2. In setup, use the arrows keys to highlight your selection. Press the Enter to invoke the next menu or to select a feature.
3. Select the Display menu.
4. Use the arrow keys to highlight the No Auto Wrap feature. Press Enter to change the selection to Auto Wrap.
5. Change the Smooth-2 Scroll selection to Jump Scroll.
6. Return to the main directory and select the Keyboard menu.
7. Change the <X] selection from Delete to Backspace.
8. Change the <> Key selection from its default setting to Sends '~ .
9. Change the '~ Key selection from its default setting to Sends ESC. (This makes the key marked ESC send an ESC character.)
10. Return to the main setup menu and SAVE the setup features. These setup features will now be used each time the terminal is powered on.

All other default terminal setup features can be used in their default settings.

These terminal settings must be used when the terminal is a console terminal or a user terminal connected to a terminal concentrator.

CHAPTER 4

4 Boot Sequence

4.1 The Boot Sequence

When power is first applied to the system, the firmware is activated and begins operation. This BIOS firmware prepares the system for operation, and then begins the boot sequence.

The boot sequence has the following four basic steps:

1. Power-On Self Tests (POST)
2. ROM Resident Diagnostics (RRD) prompt (if enabled)
3. Boot from floppy (if diskette is present)
4. Boot from hard disk SCSI ID 0 (if there was no boot from a floppy diskette)

The power-on self tests provide a brief test of memory and CPU presence. If the power-on self tests pass, the system proceeds with the RRD prompt (*), if enabled. If the RRD prompt is not enabled, the system proceeds directly to booting from Drive A, the floppy diskette drive.

The RRD prompt (*) is displayed only if the RRD is enabled in the setup screen. Section 6.2 provides information on how to enable RRD. When the RRD is enabled, the system pauses at the RRD prompt and waits for your input. You can take one of the following three actions:

- Enter *runall* to run the RRD
- Enter *b* to bypass the RRD and continue the boot procedure
- Wait 10 seconds for the system to autoboot

Section 4.2.1 describes the screen display for the boot sequence when the RRD is enabled. Section 4.2.2 describes the screen display when the RRD is disabled.

The system always attempts to boot from Drive A first. Drive A is factory configured to be the 3.5-inch floppy diskette drive. The 5.25-inch diskette drive can be configured to be Drive A, if desired. See Section 2.5.3, for details on how to change the boot drive jumpers.

Note

Do not leave nonbootable diskettes in Drive A during the boot sequence. If you do, the system attempts to boot from the diskette and will hang.

If there is no diskette in Drive A, the system attempts to boot from the hard disk SCSI ID 0 on the SCSI bus controlled by the ISA SCSI adapter. If the operating system is present on this disk, the system boots the operating system and begins operation.

4.2 Booting the System

To boot the system from a diskette, use the following procedure:

1. Insert the diskette into Drive A. The 3.5-inch diskette drive is factory configured as Drive A.
2. Power up the system, or, if the system is already powered up, press the reset switch on the bridge module.
3. If the RRD prompt is enabled, the RRD prompt is displayed. Enter *b* at the RRD prompt or wait for the system to autoboot.

The system begins the boot sequence as described above and then loads and begins execution of the program on the diskette.

If the operating system is installed on the hard disk, boot the system as follows:

1. Power-on the system or press the reset switch.
2. If the RRD prompt is enabled, the RRD prompt is displayed. Enter *b* at the RRD prompt or wait for the system to autoboot.

The system loads the operating system from the hard disk and begins execution.

4.2.1 Boot Sequence with RRD Enabled

If the POST is successful and the setup menu is set to enable the RRD tests, the following messages are displayed on the console screen:

- Quadtel BIOS identifier message
- applicationDEC 433MP system identifier message
- RRD asterisk (*) prompt

4.2.2 Boot Sequence with RRD Disabled

If the RRD is disabled, the boot sequence executes only the following tests:

- The Power-On Self-Tests (POST)
- The first seven RRD tests that set up the ISA extensions

If the POST is successful and the setup menu is set to bypass the RRD tests, the following messages are displayed on the console screen:

- Quadtel BIOS identifier message
- VGA identifier, if applicable
- Memory size
- Vendor identifier messages

CHAPTER 5

5
Power-On Self-Test (POST)

This chapter describes the Power-On Self-Tests (POST).

5.1 Overview

During the boot sequence, the applicationDEC 433MP system calls the system diagnostics beginning with the POST. The POST verifies memory, nonvolatile RAM, DMA controllers, floppy diskette drives, and the real-time clock.

While the POST is executing, the system also calls some of the RRD routines to initialize memory boards and slave CPUs.

5.2 Power-On Self-Test Success

When POST executes successfully, an "Extended RAM Passed" message is printed.

Note

Even if a fatal error condition occurs and a hardware problem exists, the system might boot and appear to work normally. You should investigate error messages that display before the system prompt appears. These error messages are erased from the screen when the system prompt is displayed.

5.3 Power-On Self-Test Failure

POST notifies you of an error in three ways:

- Beep codes are issued if the power-on self-tests encounter a fatal error before the monitor or terminal has been initialized. See Section 5.3.1.
- Two-digit error codes are displayed if the power-on self-tests encounters a fatal error after the monitor or terminal has been initialized. See Section 5.3.2.

- Error messages are displayed if the power-on self-tests encounter a non-fatal recoverable error. The power-up sequence continues if possible. See Section 5.3.3.

Each of these types of error messages are described below.

5.3.1 Beep Codes Generated by the POST

Table 5–1 lists the beep codes generated by the power-on self-test and the corrective action you should take.

Table 5–1 POST Beep Codes Generated by the Power-On Self-Test

Beep Code	Problem	Suggested Corrective Action
1 long beep, 2 short beeps	(1) Monitor not connected (2) Faulty monitor (3) Faulty ROM module that does not properly checksum	(1) Connect monitor (2) Replace monitor (3) Replace VGA module
4 short beeps	Faulty bridge module	(1) Reseat bridge module in backplane (2) Replace bridge module
5 short beeps	Memory error	(1) Check that SIMM modules have been installed sequentially. SIMM modules must be inserted sequentially starting with slot J20 and descending to slot J1. There must be no empty slots between SIMMs. (2) Reseat memory module in backplane. (3) Replace memory module.

5.3.2 Error Codes Generated by the POST

Table 5–2 lists each two-digit fatal error code and the corrective action you should take.

Note

Before replacing any module, reseat the module in the backplane and rerun the power-on tests. For errors involving the bridge or base module, reconnect the cable between the two modules in addition to reseating the modules.

Table 5–2 POST Two-Digit Fatal Error Codes

Error Code	Test Description	FRU and Corrective Action
02-04	Reserved	
06	System Hardware Initialization	Replace base CPU module Replace bridge module
08	Initialize chip set registers	Replace base CPU module Replace bridge module
0A	BIOS ROM checksum	Replace base CPU module Replace bridge module
0C	DMA Page Register	Replace bridge module Replace base CPU module
0E-12	Reserved	
14	8237 DMA initialization	Replace bridge module Replace base CPU module
16	Initialize 8259/reset coprocessor	Replace base CPU module Replace bridge module
18-28	Reserved	
2A	Autosize memory chips	Replace base CPU module
2C-30	Reserved	
32	System board memory size	Replace base CPU module Replace bridge module
34	Relocate shadow RAM if configured	Replace base CPU module Replace bridge module
36	Configure E.M.S. System	Replace base CPU module Replace bridge module
38	Reserved	
3A	Retest 64K base RAM	Replace base CPU module
3C	CPU speed calculation	Replace base CPU module
3E-40	Reserved	
42	Initialize Interrupt vectors	Replace base CPU module
44	Verify Video configuration	Replace VGA module Replace base CPU module
46	Reserved	

(continued on next page)

Table 5–2 (Cont.) POST Two-Digit Fatal Error Codes

Error Code	Test Description	FRU and Corrective Action
48	Test Unexpected interrupts	Replace base CPU module Replace bridge module
4A-54	Reserved	
56	Unexpected exception	Replace base CPU module Replace bridge module
58-5A	Reserved	
5C	Determine AT or XT keyboard	Replace base CPU module
5E	Reserved	
60	Base memory test	Check all SIMMs are contiguous (no empty slot) Replace memory module.
62	Base memory address test	Check all SIMMs are contiguous (no empty slot) Replace memory module.
64-68	Reserved	
6A	Determine memory size	Replace base CPU module Replace bridge module
6C	Reserved	
6E	Copy BIOS to shadow memory	Replace base CPU module Replace bridge module
70-74	Reserved	
76	Initialize hardware interrupt vectors	Replace base CPU module Replace bridge module
78	Reserved	
7A	Determine COM ports available	Replace bridge module Replace base CPU module
7C	Determine LPTR ports available	Replace bridge module
7E	Initialize BIOS data area	Replace base CPU module
80	Determine floppy/fixed controller	Replace bridge module Replace ISA SCSI module
82-84	Reserved	

(continued on next page)

Table 5–2 (Cont.) POST Two-Digit Fatal Error Codes

Error Code	Test Description	FRU and Corrective Action
86	External ROM scan	Replace bridge module Replace base CPU module
88-B0	Reserved	

5.3.3 Error Messages Generated by the POST

Table 5–3 lists POST textual error messages and the corrective action you should take.

Table 5–3 POST Error Messages

Error Message	Problem	Suggested Corrective Action
Bad Boot Record — Press any key	Displayed when BIOS attempts to load the boot record from a floppy and finds it incompatible for booting.	Insert a good replacement diskette in floppy drive and re-attempt the booting procedure.
Color Graphics Adapter Error	A color adapter is present but fails its power-on tests.	Replace VGA module.
Diskette Drive A Error	POST floppy (drive A or B) test failure.	(1) Access the setup menu and verify that Drive A is configured. (2) Replace drive A diskette.
Extended RAM Failed at Offset	Error in the extended memory area. The K address that failed is displayed. (Offset in 64K block where error occurred.)	(1) Replace SIMM if applicable. (2) Replace base CPU module. (3) Replace bridge module.
Extended RAM Passed	Displayed while the extended memory test is running. Amount of RAM tested will be displayed before this message.	This is the status message.

(continued on next page)

Table 5–3 (Cont.) POST Error Messages

Error Message	Problem	Suggested Corrective Action
Failing Bits	Memory test failure. This message may be displayed while performing the system, extended, or shadow-related memory tests. A hex number is displayed, which is a map of the bits that have failed the test. A "1" bit of the number displayed is a failing bit.	(1) Replace SIMM if applicable. (2) Replace memory module. (3) Replace base CPU module. (4) Replace bridge module.
Fixed Disk 0 Failure	POST hard disk 0 or 1 test failure.	(1) Check that the SCSI cable is attached to the 209 MB RZ24 hard disk at SCSI ID 0. (2) Replace the RZ24.
Fixed Disk Controller Failure	POST hard disk controller test failure.	Replace ISA SCSI module.
Incorrect Drive A Type — Run *setup*[1]	The floppy drive type detected by the BIOS does not match the type defined in setup and stored in CMOS.	
Keyboard Controller Error	POST keyboard controller test failure.	Replace bridge module.
Keyboard Error	POST Keyboard stuck. Key test failure. Before error message is displayed the "stuck" key code will be displayed.	(1) If this message appears while you are entering the key sequence to invoke the setup screen, ignore the message. (2) Make sure the keyboard is securely connected. (3) Replace keyboard.

[1] The *setup* command is disabled. Section 6.2 provides information about how to access the setup menu.

(continued on next page)

Table 5–3 (Cont.) POST Error Messages

Error Message	Problem	Suggested Corrective Action

Memory Size does not match CMOS setup — Run *setup*[1]	Extended memory size stored in CMOS memory (built by the setup utility) does not match the amount of extended memory detected by the BIOS.	(1) If the amount of extended memory found by BIOS is correct: Access the setup menu and change the amount of extended memory to match. Memory must be set as follows:
		`8 MB - 7168`
		`12 MB - 11244`
		`16 MB and up - 14336`
		`16 MB and up w/mux - 13312`
		`(also set S7 on SW1 - base module)`
		(2) If the amount of extended memory found by BIOS is not what was expected:
		(a) Replace SIMM if applicable.
		(b) Replace memory module.
		(c) Replace base CPU module.
		(d) Replace bridge module.

Monitor type does not match CMOS — Run *setup*[1]	Monitor adapter type does not match the type defined in setup and stored in CMOS memory.	Access the setup menu (option 9), and confirm or alter monitor type.
Monochrome Adapter Error	A monochrome adapter is present but fails its power-on tests.	Replace VGA module.
Previous Boot Incomplete	POST was terminated by a reset or a power-down before it had completed.	Access the setup menu and confirm configuration, then reboot.
Real-Time Clock Error	(1) Battery failed (2) Bridge module failed	(1) Replace battery on bridge module. (2) Replace bridge module.

[1]The *setup* command is disabled. Section 6.2 provides information about how to access the setup menu.

(continued on next page)

Table 5–3 (Cont.) POST Error Messages

Error Message	Problem	Suggested Corrective Action
Shadow RAM failed at offset	Error in the shadow memory area. The K address that failed is displayed. (Offset in 64K block where error occurred.)	(1) Replace SIMM if applicable. (2) Replace memory module. (3) Replace base CPU module. (4) Replace bridge module.
Shadow RAM Passed	Displayed while the Shadow memory test is running. Amount of RAM tested will be displayed before this message.	
System Battery is Dead — Replace and Run *setup*[1]	Battery is dead.	Replace battery. (Battery tabs break easily.)
System CMOS Checksum Bad — Run *setup*[1]	CMOS has been modified improperly by a software program or CMOS is corrupted.	(1) Access the setup menu and reconfigure the system. (2) Replace base CPU module.
System RAM Failed at Offset	Error in the RAM of system memory. The K address that failed is displayed. (Offset in 64K block where error occurred.)	(1) Replace SIMM if applicable. (2) Replace memory module. (3) Replace base CPU module. (4) Replace bridge module.
System RAM Passed	Displayed while the system memory test is running. Amount of RAM tested is displayed before this message.	
System Timer Error	POST system timer test failure.	Replace base CPU module.

[1]The *setup* command is disabled. Section 6.2 provides information about how to access the setup menu.

CHAPTER 6

6

ROM Resident Diagnostics (RRD)

6.1 Overview

The ROM Resident Diagnostics are firmware diagnostics that can be run whether the system has an operating system installed or not. The RRD must be enabled prior to use. When enabled, the boot sequence is interrupted and an RRD prompt (*) appears. At the RRD prompt, you can execute the diagnostics with a *runall* command, or bypass the RRD and proceed with the boot sequence with the *boot* command. If you do nothing, the RRD times out in ten seconds and the boot sequence continues.

The following sections describe these aspects of the RRD:

- Enabling RRD in the setup screen
- Using the runall command
- Interpreting error messages
- Additional information about other RRD commands and procedures

6.2 Enabling RRD in the Setup Screen

The RRD is enabled with an option in the setup screen. The setup screen is obtained by entering the proper keystrokes during the boot sequence. The keystrokes are listed in Table 6–1.

Table 6–1 Key Sequence to Interrupt the Boot Process and Access the Setup Menu

Console Type	Key Sequence
Graphics monitor (VGA)	Press Ctrl/Alt/S
Terminal (COM1)	Press Ctrl/3; then press Shift S

The key sequence can be entered anytime after the "Extended RAM Passed" message and before the booting of the operating system. If the "Keyboard Error" message is posted when you enter the key sequence, it can be ignored.

An applicationDEC 433MP system with one diskette drive and 8 MB of memory will display the following information on the setup screen:

```
BIOS Setup Version 3.05
Copyright 1990 Quadtel Corporation.  All rights reserved.

 1> Current Date.................: 09/19/1990
 2> Current Time.................: 19:42:05
 3> Diskette Drive A.............: 3.50-inch (1.44 MB)
 4> Diskette Drive B.............: Not Installed
 5> Fixed Disk Drive 0 Type......: None
 6> Fixed Disk Drive 1 Type......: None
 7> Base Memory Size (KB)........: 640
 8> ISA Extended Memory Size (KB): 7168
 9> Video Adapter................: EGA/VGA/Super VGA
10> Base Processor Cache.........: On
11> RRD Menu Status..............: Off
12> Memory Refresh...............: Off
13> Boot Device..................: ISA Bus
14> Save Current Options

Select option to change [0 to Exit]:
```

To enable RRD in the setup menu, select option 11 from the setup menu, enter 1, and press Return. The RRD is then invoked during the boot sequence.

Note

If the RRD was enabled prior to servicing the system, be sure to disable the RRD after service is complete.

6.3 Note on Loopback Connectors

Tests 49 and 50 are run only if a loopback connector is installed on the CPU/SIO ports. Use the normal terminal concentrator communications cable for a loopback. Disconnect the cable from the terminal concentrator side of the connection and attach it to a CPU/SIO port. Ports A and C should be connected together and ports B and D should be connected together.

The loopback flag must be set to run tests 49 and 50.

If no loopback is installed, tests 49 and 50 are skipped.

6.4 Executing the *runall* Command

When the RRD is enabled, the RRD prompt appears during the boot sequence. At the RRD prompt, enter the *runall* command to execute most of the RRD tests sequentially. (Loopback and some memory tests are excluded. See Section 6.7.1.)

To run RRD, enter the *runall* command at the asterisk (*) prompt as follows:

```
* runall
```

As each test executes successfully, the number and name of the test are displayed on the console screen.

The RRD test takes between 10 and 30 minutes, depending on the system configuration.

Note

If you do not press a keyboard key within 10 seconds after the RRD prompt appears, the operating system begins the autoboot procedure.

6.5 Exiting RRD

If the RRD tests execute successfully, you can exit RRD by typing *b* at the RRD prompt. This will continue with the boot sequence and allow you to boot the operating system.

6.6 Interpreting RRD Errors

In the event of an RRD error, the RRD diagnostics continue. If an error message is overwritten, you can review the error messages when the prompt appears with the *summary* command.

```
* summary
```

The Summary command lists the tests which failed and the number of failed tests. You should rerun the failed tests for complete information on the failed FRU.

You can either rerun the individual test that failed (by entering the test number), or set the abort flag on and rerun runall, as follows:

```
* abort on
* runall
```

When the abort flag is on, the RRD stops when it encounters an error.

6.6.1 RRD Error Messages

When an error message occurs, look up the corrective action in Table 6–2. The RRD error message identifies the test number and slot number of the module.

Before replacing the indicated module or device, check that the modules are:

- Located in the correct backplane slot
- Firmly seated in the slot
- Firmly connected to any cables

Table 6–2 RRD Error Messages

Error Message	Corrective Action
addr *memory address*, was *n*, exp *expected-pattern* memory module *n*, SIMM *n*	Replace SIMMs. Replace memory module.
addr *memory address*, was *n*, exp *memory address* memory module *n*, SIMM *n*	Replace SIMMs. Replace memory module.
addr *memory address*, was *n*, exp 0 memory module *n*, SIMM *n*	Replace slave CPU module. Replace SIMMs. Replace memory module.
addr *memory address*, was *n*, exp *expected-value* memory module *n*, SIMM *n*	Replace slave CPU module. Replace SIMMs. Replace memory module.
address range overlaps diagnostic ram	User error; reenter.
address range overlaps undefined system bus region	User error; reenter.
address range must be between *logical_addr1* (physical_addr1) and *logical_addr2* (physical_addr2)	User error; reenter
base exp 0x66, was *n*	Replace slave CPU module. Replace base processor module.
base, already unlocked	Replace slave CPU module. Replace base processor module.
1 bit error not corrected, exp *expected-value*, got *n*, addr *memory address* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.

(continued on next page)

Table 6–2 (Cont.) RRD Error Messages

Error Message	Corrective Action
1 bit error address bad, exp *expected-address*, got *actual-address* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
2 bit error address bad, exp *expected-address*, got *actual-address* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
2 bit error syndrome bad, got *syndrome-number* (bits *bit-number-1* and *bit-number-2*) memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
1 bit then 1 bit error address bad. exp *expected-value* got *n* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
1 bit then 1 bit syndrome bad, exp *expected-syndrome-number* got *actual-syndrome-number* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
1 bit then 2 bit error address bad, exp *expected-address*, got *actual-address* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
1 bit then 2 bit syndrome bad, got *syndrome-number* (bits 2 and 3) memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
2 bit then 2 bit error address bad, exp *expected-address*, got *actual-address* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
2 bit then 2 bit error syndrome bad, got *syndrome-number* (bits 4 and 5) memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
2 bit then 1 bit error address bad, exp *expected-address*, got *actual-address* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.
2 bit then 1 bit syndrome bad, exp *expected-syndrome-number*, got *actual-syndrome-number* memory module *n*, SIMM *n*	ECC logic is not functioning. Before you replace SIMMs, move them to a new memory module.

(continued on next page)

Table 6–2 (Cont.) RRD Error Messages

Error Message	Corrective Action
ch *channel-number* reg *register-number* was *n*, expected *expected-value*	Check loop-back wires. Replace slave CPU module.
cpu arbitration failed to complete	Remove all slave CPU modules and reinsert one module at a time; repeat the test after you add each module. Replace slave CPU module. Replace base processor module.
cpu did not start	Replace slave CPU module. Replace base processor module.
cpu not running	Replace slave CPU module. Replace base processor module.
cpu *slot n* invalid cpu type *type-number*	Replace slave CPU module. Replace base processor module.
cpu *slot n* shutdown during cflush	Replace bridge module. Replace base processor module. Replace slave CPU module.
cpu *slot n* cflush failure seg *segment-number*	Replace bridge module. Replace base processor module. Replace slave CPU module.
cpu *slot n* did not finish cflush	Replace bridge module. Replace base processor module. Replace slave CPU module.
code bad verify at *memory address*, exp *code-value*, was *actual value*	Replace bridge module. Replace base processor module.
count too large	User error; reenter.
data, was *actual-sync-data*, expected *expected-sync-data*	Replace slave CPU module.
data, was *actual-sdlc-data*, expected *expected-sdlc-data*	Check for loop-back wires. Replace slave CPU module.
data at *memory-address* changed from 0x99 to *n*	User error; reenter.
finit did not complete	Replace slave CPU module. Replace base processor module.
fld did not complete	Replace slave CPU module. Replace base processor module.

(continued on next page)

Table 6–2 (Cont.) RRD Error Messages

Error Message	Corrective Action
fmul did not complete	Replace slave CPU module. Replace base processor module.
fstp did not complete	Replace slave CPU module. Replace base processor module.
fstsw did not complete	Replace slave CPU module. Replace base processor module.
fwait did not complete	Replace slave CPU module. Replace base processor module.
interrupt to base used vector *vector-number*	RRD software failure. Contact a Digital Equipment Corporation representative.
interrupt to cpu *slot n* used vector *n*	Replace slave CPU module. Replace base processor module.
invalid address range	User error; reenter.
Keymodule Error: Input Buffer Full bit stuck at 1	Make sure VGA keymodule is connected. Replace VGA adapter. Replace bridge module.
Keymodule Error: No ack received from keymodule	Make sure VGA keymodule is connected. Replace VGA adapter. Replace bridge module.
LED not clear	Replace bridge module. Replace base processor module. Replace slave CPU module if test number is 34 or 35.
LED not set	Replace bridge module. Replace base processor module. Replace slave CPU module if test number is 34 or 35.
lmsw did not complete	Replace slave CPU module. Replace base processor module.
lock timeout	Replace slave CPU module. Replace base processor module.
no co-processor installed, status *status_value*	Replace slave CPU module. Replace base processor module.
no previous command	User error; reenter.

(continued on next page)

Table 6–2 (Cont.) RRD Error Messages

Error Message	Corrective Action
n out of 10 interrupts succeeded interrupts from base to base not working	Replace bridge module. Replace base processor module.
n out of 10 interrupts succeeded interrupts from cpu *slot n* to base not working	Replace slave CPU module. Replace bridge module.
n out of 10 interrupts succeeded interrupts from base to cpu *slot n* not working	Replace slave CPU module. Replace base processor module.
out of poke entries	RRD software failure. Contact a Digital Equipment Corporation representative.
product *product-number* was *value*, exp *same-value*	Replace slave CPU module. Replace base processor module.
result not stored	Replace slave CPU module. Replace base processor module.
result not returned	Replace slave CPU module. Replace base processor module.
SCC *scc_identifier* reg *register-number* timeout, was *actual-register-value*, expected *expected-register-value*	Replace slave CPU module.
SCC *scc_identifier* reg *register-number*, was *actual-register-value*, expected *expected-register-value*	Replace slave CPU module.
SCC *scc_identifier* reg 12 was *actual-register-value*, expected *expected-register-value*	Replace slave CPU module.
SCC *scc_identifier* reg 13 was *actual-register-value*, expected *expected-register-value*	Replace slave CPU module.
slave command done timeout *dbg=debug-flag*	User error; reenter. Replace slave CPU module.
slave cpu *slot-number* does not exist	User error; reenter.
slave cpu *slot-number* already running	User error; reenter.
slave did not start	User error; reenter.

(continued on next page)

Table 6–2 (Cont.) RRD Error Messages

Error Message	Corrective Action
slave died	Replace slave CPU module. Replace base processor module.
slave error, count was *actual value*, exp *n*	Replace slave CPU module. Replace base processor module.
slave linear address *memory address*, *number-of* pages	Replace base processor module. Run memory tests and replace correct memory module.
slave *slot n* died	Replace slave CPU module. Replace base processor module.
slave *slot n*, error at *memory address*, exp *expected-value* memory module *n*, SIMM *n*	Replace slave CPU module. Replace SIMMs. Replace memory modules.
slave *slot n*, addr *memory address*, exp *expected-value*, was *actual value* + *error-number* others memory module *n*, SIMM *n*	Replace slave CPU module. Replace SIMMs. Replace memory modules.
slave *slot n*, addr *memory address*, was *actual value*, exp *expected-pattern* or *1's-complement-expected-pattern* memory module *n*, SIMM *n*	Replace slave CPU module. Replace SIMMs. Replace memory modules.
slave reports bad command *dbg=debug-flag*	Replace slave CPU module. Replace base processor module.
starting address too small	User error; reenter.
TC timeout, DMA channel *channel-number*	Check loop-back wires. Replace slave CPU module.
unknown condition, *trace-value*	Replace slave CPU module. Replace base processor module.

6.7 Additional Information About RRD

In addition to the *runall* command, RRD tests can be run individually. When this is done, you may wish to set additional flags for greater control of the tests.

6.7 Additional Information About RRD

The following sections contain additional information on:

- RRD Tests
- RRD Flags
- RRD Commands

6.7.1 RRD Tests

RRD is a sequence of numbered tests that verify the functionality of the system hardware through a series of tests that proceed from the simplest to the most complex function.

Note

It is important to run the tests in order because higher level tests assume correct operation of certain system functionality that has been tested in a lower level. After you have used the *runall* command, which executes all the standard RRD tests in order, you can execute any individual RRD test.

The ROM Resident Diagnostic (RRD) tests set up the ISA extensions, check memory, bus cycles and multiprocessor capability. The tests:

- Proceed from testing the simplest to the most complex function
- Can be run individually or as a package
- Isolate a system problem to a single module

The *runall* command runs all of the RRD diagnostic tests with the exception of the following:

- Tests 11-16 — Memory tests that require almost an hour to execute
- Tests 49-50 — CPU/SIO Serial I/O tests that require loopback connectors

After you have used the *runall* command, which executes all the standard RRD tests in order, you can execute any individual RRD test.

Section 6.7.4 provides information about how to run individual RRD tests. If you want to run one test continuously, see Section 6.7.6. If you want to run several tests continuously, see Section 6.7.7.

Table 6–3 lists the RRD numbered tests. The test name that displays on the screen is shown in parentheses after the more descriptive test name.

Appendix A contains a full description of each test.

Table 6–3 ROM Resident Diagnostic Tests

Test Number	Description
Test 1	Reset System Bus CPUs and Flush Bridge Cache (reset)
Test 2†	Reset System Bus CPU (creset)
Test 3†	Poll System Bus Slots (carb)
Test 4	Flush all System Bus CPUs (cflush)
Test 5†	Determine CPU Type (ctype)
Test 6	Bridge Cache Integrity (bflush)
Test 7	Size Memory (msize)
Test 8	Check Bits with Memory Fill Ones (mones)
Test 9	Check Bits with Memory Fill Zeros (mzeroes)
Test 10	Check Addresses (maddr)
Test 11	Check Bits with Memory Walking Ones (mwones)
Test 12	Check Bits with Memory Walking Zeros (mwzeros)
Test 13	Memory Inversions (minv)
Test 14	Memory Inversions with Flush (minvf)
Test 15	Memory Address Inversions (madrinv)
Test 16	Memory Address Inversions with Flush (madrinvf)
Test 17	Memory Error Correcting Code (ECC) (memory ECC)
Test 18	Reset DMA Controller and Initialize the 8237 Registers (bdma reset)
Test 19	Verify Access to DMA Controller (bdma reg I/O)
Test 20†	Base to Base Interrupt (bintb)
Test 21	CPU to Base Interrupt (cintb)
Test 22†	Base to CPU Interrupt (bintc)
Test 23†	Verify Bridge Map RAM Register (bram)
Test 24†	Base CPU Blinks Bridge LED (bLEDb)
Test 25†	Slave CPU Blinks Bridge LED (bLEDc)
Test 26	Base CPU Blinks LED on Default CPU (cLEDc)
Test 27†	Start and Reset the Default CPU (cnop)
Test 28	Read/Write by Default CPU (cr/w once)
Test 29†	Read/Write in a Loop by Default CPU (cr/w)
Test 30†	Check Multiplication (cfloat)
Test 31†	Check Locking Mechanism (exch)
Test 32†	Check Slave CPUs and Blink Base LED (cminv cLED)
Test 33	Check Slave CPUs and Blink Bridge LED (cminv bLED)
Test 34†	Check Slave CPUs and Run Data Inversion (cminv bminv)

†Indicates that the test can be used with the RRD *scopeloop* command. This allows you to run a test in loop mode.

(continued on next page)

Table 6–3 (Cont.) ROM Resident Diagnostic Tests

Test Number	Description
Test 35†	Check Slave CPUs and Operation of All CPUs (cminv bck)
Test 36†	Check Slave CPUs and Run Address Inversions (cmadrinv bck)
Test 37†	Verify Memory (cminv mI/O)
Test 38†	Check Slave CPUs and Run Address Inversions (mult cpu mchk)
Test 39†	Run Memory Inversions on Slave Processor with Flush (mult cpu mchkf)
Test 40†	Reset SIO DMA Controller Using Zero Fill (dzero)
Test 41†	Reset SIO DMA Controller Using Ones Fill (dones)
Test 42	Reset the SIO DMA Controller/Initialize the 8237 Registers (dr)
Test 43†	Check the SIO DMA Controller (dsrI/O)
Test 44†	Check the SIO DMA Controller with Rotating Pattern (drI/O)
Test 45†	Check SCC Controller on SIO Module (srI/O)
Test 46†	Check SCC Controller on the SIO Module(SDasync)
Test 47†	Test Channel A of the SCC Controller (Sasyncloop)
Test 48†	Test the 8530 Using 8237 Controller (SDasyncloop)
Test 49†	Test Channels A and C of the SCC Controller (A-C)
Test 50†	Test Channels B and D of the SCC Controller (B-D)
Test 51†	Check FIFO and Configuration Registers in SCSI I/O Controller (SCSI I/O reg)
Test 52†	Check the 486 SCSI Module DMA Transmit Buffer (SCSI tr buf)
Test 53†	Check the 486 SCSI Module DMA Receive Buffer SCSI (rcv buf)
Test 54†	Verify Entries in the DMA Page Map (SCSI dma map)
Test 55†	Check Page Index Counter (SCSI pg ndx cntr)
Test 56†	Check DMA Control Logic — Main Memory to FIFO (SCSI tr dma)
Test 57†	Check DMA Control Logic — FIFO to Main Memory (SCSI rcv dma)
Test 58†	Check DMA Control Logic — Misaligned Byte Boundary SCSI (rcv odd)

†Indicates that the test can be used with the RRD *scopeloop* command. This allows you to run a test in loop mode.

6.7.2 RRD Flags

You can use flags to control the RRD diagnostics. For example, you can choose whether to stop testing if an error is encountered and whether to display or suppress error messages.

Each flag command takes ON or OFF as an argument.

To change the status of a flag, enter the flag name and the desired setting at the RRD prompt. For example, to set the abort flag to **on** (and stop testing on error), enter the following:

```
* abort on
```

To set the abort flag to **off** (and continue testing on error), enter the following:

```
* abort off
```

Table 6–4 describes each flag.

Table 6–4 RRD Flags

RRD Flags	Default	Description
Abort	Off	Abort test when the first error is encountered. The Abort flag is automatically set to OFF when an abort occurs. If the Abort flag is OFF, the RRD tests continue to execute and test status messages scroll across the screen monitor.
Flags		Display the state of all flags.
Loopback on/off	Off	Run the two tests that check channels A and C, B and D. If the Loopback flag is OFF, the system displays a warning that these tests can not be run.
Quiet	Off	Display only error messages; suppress informative messages about each test status.
Scopeloop	Off	Execute the specified test in loop mode. (Not all tests are run with scopeloop flag on. See Table 6–3). A test run with the Scopeloop flag set executes faster because it repeats without reexecuting initialization code. A test that runs with the Scopeloop flag set can only be stopped by an error abort or Ctrl/C. The Scopeloop flag is automatically disabled when the test aborts.
Silent	Off	Suppress all messages, including error messages. (Use the *summary* command to review errors that occurred while the Silent flag was set.)
Verbose	Off	Display error messages and informative messages about each test status as the test executes.

6.7.3 RRD Commands

The RRD commands can be categorized as follows:

- Screen commands
- Test commands
- Command loops
- Peek and poke commands
- Commands to display memory within a specified range
- Commands to search memory

- Commands to test memory
- cpu commands
- Error Correcting Code (ECC)
- Commands for Symbol Control

The peek and poke commands can be used on both ISA and system bus memory. The memory test commands can only be used for system bus memory.

Table 6–5 describes all RRD commands.

Table 6–5 RRD Commands

RRD Command	Description
	Screen Commands
?	List all interactive commands.
!!	Repeat last command.
Ctrl/C	Abort test.
Ctrl/S	Halt screen output.
Ctrl/Q	Resume screen output.
	Running Tests
runall	Run selected numbered tests. The *runall* command runs most of the numbered tests. It omits some tests, including time-consuming memory tests (11-16). The RRD help screen indicates, with an asterisk, tests that are not executed by the *runall* command.
summary	Display the number of errors in the most recently executed list of tests. The *summary* command allows you to run one test or loop of tests for long periods of time without losing error messages that scroll off the screen.
1—99	Run all numbered tests.
t	List all tests.
n	Run the specified test. (If more than one test is specified, the tests are forced to run in ascending numerical order.)
n n n	Run the specified list of tests.
n—n	Run the specified range of tests.

(continued on next page)

Table 6–5 (Cont.) RRD Commands

RRD Command	Description
	Command Loops
cloop	Begin a command loop definition. During a loop definition, the RRD prompts you for test numbers with a + prompt instead of the usual * prompt. You can enter up to twenty test numbers or commands. Press *Return* with no command to terminate the loop definition. Enter *L* to execute the command loop definition.
L	Execute a command loop definition. Enter an uppercase L to run this command.
lloop	List the current command loop definition.
	Peek and Poke Commands (Applies to ISA and System Bus Memory)
cib *address*	Input byte from system bus to a user-specified address.
cob *address user-specified data*	Output user-specified data byte to a user-specified system bus I/O address.
ib *address*	Input byte from a user-specified ISA I/O address.
iw *address*	Input word from a user-specified ISA I/O address.
ob *address user-specified data*	Output a user-specified byte to a user-specified ISA I/O address.
ow *address user-specified data*	Output a user-specified word to a user-specified ISA I/O address.
rb *address*	Read a byte from a user-specified address.
rw *address*	Read a word from a user-specified address.
rl *address*	Read a longword from a user-specified address.
wb *address user-specified data*	Write a user-specified byte to a user-specified address.
ww *address user-specified data*	Write a user-specified word to a user-specified address.
wl *address user-specified data*	Write a user-specified longword to a user-specified address.

(continued on next page)

Table 6–5 (Cont.) RRD Commands

RRD Command	Description
Peek and Poke Commands (Applies to ISA and System Bus Memory)	
xb *address user-specified data*	Exchange a user-specified byte with the byte at a user-specified address.
xw *address user-specified data*	Exchange a user-specified word with the word at a user-specified address.
Memory Display within Specified Range	
db *addr1* [*addr2*]	Display hexadecimal addresses, in bytes, in the range specified.[1]
dw *addr1* [*addr2*]	Display hexadecimal addresses, in words, in the range specified.[1]
dl *addr1* [*addr2*]	Display hexadecimal addresses, in longwords, in the range specified.[1]
Memory Search	
sb *addr1 addr2d1* [*d2 d3 d4*]	Search specified address range for up to four byte patterns.[1]
sw *addr1 addr2d1* [*d2 d3 d4*]	Search specified address range for up to four word patterns.[1]
sl *addr1 addr2d1* [*d2 d3 d4*]	Search specified address range for up to four longword patterns.[1]
Memory Test (Applies to system bus Memory Only)	
afill *addr1 addr2*	Fill each longword with its own address in the user-specified address range. Make a second pass to verify the data.[1]
fb *addr1 addr2* [*pattern*]	Fill specified address range with byte pattern.[1,2]
fw *addr1 addr2* [*pattern*]	Fill specified address range with word pattern.[1,2]

[1]The *range* command sets the address range for any numbered test or series of tests.
addr1 specifies the starting address.
addr2 specifies the ending address.
If *addr2* is less than *addr1*, *addr2* becomes the number of bytes.
addr2 defaults to 0x1ffff.

[2]Fill includes two passes: the first to fill, the second to verify. If *pattern* is not specified, the default is 0.

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Table 6–5 (Cont.) RRD Commands

RRD Command	Description
Memory Test (Applies to system bus Memory Only)	
fl *addr1 addr2* [*pattern*]	Fill specified address range with longword pattern.[1,2]
invb *addr1 addr2 pattern*	Perform byte inversions on specified address using specified pattern.[1,3]
invw *addr1 addr2 pattern*	Perform word inversions on specified address using specified pattern.[1,3]
invl *addr1 addr2 pattern*	Perform longword inversions on specified address using specified pattern.[1,3]
CPU Commands	
cpu	List CPUs. If you enter the *cpu* command without a slot number, a list of all CPUs and their status is displayed.
cpu *slot number*	Select default CPU.
cache *slot number* off	For the specified CPU, turn cache off.[4]
cache *slot number* on	For the specified CPU, turn cache on.[4]
slave	Start or resume slave CPU execution.
sinv *addr1 addr2 pattern*	Start inversion tests on slave CPU. [3]
shalt	Abort the slave execution and reset the slave CPU.
base	Switch to base without halting slave. Restore control to the base CPU, while leaving the slave executive running. If the *slave* command is issued later, the RRD knows that the executive is still running and can quickly switch back into slave mode.

[1]The *range* command sets the address range for any numbered test or series of tests.
addr1 specifies the starting address.
addr2 specifies the ending address.
If *addr2* is less than *addr1*, *addr2* becomes the number of bytes.
addr2 defaults to 0x1ffff.

[2]Fill includes two passes: the first to fill, the second to verify. If *pattern* is not specified, the default is 0.

[3]The inversions algorithm includes six passes.

[4]The *cache* command controls whether the internal cache of the selected CPU is turned on. If no processor is specified, the *cache* command uses the default processor. If no parameters are specified, the status of the default CPU is returned.

(continued on next page)

Table 6–5 (Cont.) RRD Commands

RRD Command	Description
	Error Correcting Code (ECC)
ecc *user-specified data*	Compute the ECC check byte value for the specified longword.
ecc	Print the ECC bit table.
map	Display map of system bus memory.
eccoff	Disable ECC checking. ECC is on by default; it is reenabled if Test 7, the memory sizing test, is run.
	Symbols
list	List symbols and values.
set *symbol value*	Assign longword value to symbol.
	Miscellaneous
b[oot]	Boot the operating system.
map	Display map of system bus memory.
setup	See Section 6.2 for information about how to access the setup menu.
mfg	Reserved for Digital.

6.7.4 Executing Individual RRD Tests

Enter a test number at the prompt to execute individual tests. For example, if you want to determine the type and location of all secondary processors in the system, execute test 5 at the prompt as follows:

```
* 5
```

Run tests in numerical order to ensure that preliminary tests have been run.

6.7.5 Executing Tests on CPU/SIO and CPU/SCSI Modules

When you execute the *runall* command, the RRD automatically tests the base processor and every slave CPU module (processing capability of CPU/SCSI and CPU/SIO modules). However, if you run individual RRD numbered tests, only the slave CPU that has been designated as the default CPU is tested.

Note

A slave CPU is a CPU/SCSI or CPU/SIO. Slave CPUs are identified by slot number. The default CPU is either the CPU in the highest numbered system bus slot (closest to the base processor), or the CPU you have designated as the default with the *cpu* command.

Before you run individual tests on a specific SIO or SCSI module, you might have to use the *cpu* command to designate the module as the default CPU.

By default, the RRD selects the secondary processor in the highest-numbered slot as the default CPU. The numerical value of the slot numbers on the backplane increases from top to bottom. Therefore, if there is an SIO module in slot three (the third slot from the top of the backplane) and a SCSI module in slot 5 (the fifth slot from the top), the SCSI module in slot 5 is designated as the default CPU.

To select a CPU as the default CPU, use the *cpu* command and the slot number of the module you want to test. For example, if you want to test the module in slot number 5:

```
* cpu 5
```

If you attempt to run a SCSI test on an SIO module, or if you attempt to run an SIO test on a SCSI module, the system returns the following error message:

```
warning, test n requires a SCSI or SIO
CPU -- test not run
```

6.7.6 Executing One Test Continuously

The Scopeloop flag allows you to run a test in loop mode. A test runs faster in loop mode because it repeats without reexecuting initialization code. Section 6.7.1 provides a list of RRD tests you can use with the *scopeloop* flag.

If you want to run one numbered test continuously, set the Scopeloop flag **on** at the RRD prompt as follows:

```
* scopeloop on
```

Enter the number of the RRD test you want to run at the RRD prompt. Use Ctrl/C if you want to interrupt testing.

6.7.7 Executing Several Tests Continuously

The *cloop* command accepts up to 20 entries. (Each entry might include a series of tests.) To execute tests with *cloop*, use the following procedure:

1. Enter the *cloop* command at the RRD prompt. (The system displays a Plus sign (+) prompt.)
2. At the + prompt, enter the number of one test or a range of tests.
3. Press Enter. (The system again displays a Plus sign prompt.)
4. Continue to enter the number of one test and press Enter at the prompt until you have entered the numbers of all tests you want to run.
5. Press Enter at the Plus sign prompt.
6. Enter *L* to execute the loop. (The *L* command must be entered as upper case.)
7. Enter Ctrl/C to stop execution of the loop.

You can use the *summary* command to gain information about tests that failed during the execution of the loop.

For example, if you use *cloop* with the *summary* command to run tests 10 through 12, test 19, and test 27, the system prompts you as follows:

```
* cloop
+
+ 10-12
+
+ 19
+
+ 27
+ summary
+
+ L
```

The error report, produced by the *summary* command, is overwritten when you

You can also use *cloop* with the *runall* command as follows:

```
* cloop
+
+ runall
+
+ summary
+
+ L
```

CHAPTER 7

7 System Exerciser

7.1 Overview

The applicationDEC 433MP system exerciser is a standalone, floppy-diskette-based diagnostic that detects and isolates hardware problems to the FRU level. The system exerciser tests each system unit simultaneously with peripheral and communication transfers to detect interactive errors.

The system exerciser verifies the following unit parts:

- All CPU and memory modules
- Bridge module
- Serial I/O logic on the CPU/SIO module
- SCSI logic on the CPU/SCSI module
- RRD42 CD-ROM drive
- 320/525 MB TZK10 QIC tape drive
- 204 MB RZ24 disk drive, 665 MB RZ56 disk drive, 1.0 GB RZ57 disk drive

You can run the system exerciser in two ways:

- The Installation Verification Procedure (IVP) performs a 15 minute test session that returns the system status.
- The *run* command executes the system exerciser tests continuously.

Enter Ctrl/C to halt the system exerciser at any time.

The system exerciser commands lets you run, halt, and block tests. In addition, you can display the following information:

- System configuration
- Data at specified locations

- Status of tests
- Error reports

You can dedicate CPU resources to specified tests by blocking unwanted tests. Section 7.6.4.1 provides information on how to block tests.

7.2 Loading the System Exerciser

Load the system exerciser as follows:

1. Insert the system exerciser floppy diskette into the 3.5-inch floppy diskette drive.
2. Boot the system from the floppy diskette in either of the following ways:
   - Powerup
   - Reset switch on bridge module I/O panel

If a bad checksum message is displayed, see Section 7.4.

7.3 Running the System Exerciser

When the system exerciser boots sucessfully, you will see a start-up screen resembling the following:

```
03/15/91         10:44:11                                    00:00:00

        applicationDEC System Exerciser - REV 1.0        2/28/91

Copyright..................................................etc...

        Verifying program loaded correctly

        Configuration Table:

        Slot     Type

        01       Memory -Base Address = 0 Size =16MB SIMM size = 1MB
        05       486 Serial I/O
        06       486 Serial I/O
        08       ISA Bridge
        09       ISA Base

        Load Scratch media into all drives to be tested in write-read mode
        Hit any key when ready
```

After loading the drives to be tested, press the Return key. The following message will be displayed.

```
Sizing SCSI and ISA (please wait - up to 5 minutes)
```

Then you will be prompted to select destructive or nondestructive testing for each drive.

```
        Test Mode selection. Use keyboard to make selections
SPACE key selects destructive teseting (write-read) Enter key protects media
```

Caution

If you choose to test in destructive mode, you must have scratch media in all media drives. Data is destroyed in any hard disk that is tested in destructive mode.

If destructive testing is selected, the following message will be displayed.

```
"       DESTRUCTIVE TESTING ENABLED "
```

The screen should resemble the following during and after test mode selections have been selected.

```
        BUS Configuration:
Slot    ID      UNIT    DEVICE          type    REV     SELECTION
9       0       0       DISK            RZ24    1D18    WRITE-READ
9       0       1       DISK            RZ24    1D18    READ-ONLY
9       0       2       TAPE            TZK10   ????    READ-ONLY
9       0       6       CD-ROM          RRD42   CDu-51  READ-ONLY
```

Next, you will be prompted to enable or disable the external loopback testing as follows:

```
        Loopback Selection Hit SPACE to enable external loopback

                                Hit Return to disable

05      486 Serial I/O          A-C             B-D

06      486 Serial I/O          A-C             B-D
```

Note

If loopback testing is enabled, loopback connectors must have been previously installed on the serial I/O ports of the CPU/SIO module or SIO related tests will fail.

The next display shows the tests that the system exerciser will execute based on the selections made previously and the recognized system configuration.

```
          Scheduled Tests:

Test      Name                     Rev

1.        Memory                   0
2.        Cache Coherency          0
3.        Multi-CPU Bus Lock       0
4.        Serial I/O (slot 5)      0
5.        Serial I/O (slot 6)      0
6.        Base Tests (slot 9)      0
7.        Console                  0
8.        SCSI disk 9:0:0          0
9.        SCSI disk 9:1:0          0
10.       SCSI tape 9:2:0          0
11.       SCSI CD-ROM 9:6:0        0

Type "HELP" for information, "RUN or IVP" to begin testing

HLT>
```

Note

If you had selected destructive testing previously, the following would also be displayed.

```
*****************************************************************************

      WARNING! Destructive testing enabled. Data will be lost!

*****************************************************************************
```

With the HLT> prompt displayed, you can now run the fifteen minute installation verification procedure by typing the *ivp* command and pressing Return.

```
HLT> ivp
```

The following is displayed once the IVP is executing.

```
Installation Verification Procedure Running
```

Also, the HLT> prompt will change to RUN> to indicate the exerciser is running.

If no errors are detected after fifteen minutes, a success message is displayed and the HLT> prompt reissued.

```
"Installation Verification Procedure Complete: No Errors Detected"
```

If an error is detected, an error message is displayed immediately. See Section 7.5 for details on how to interpret the message.

If you wish to rerun the IVP for any reason, you must reboot the system exerciser. (Typing *ivp* again does not rerun the IVP.) However, it is possible to run the same tests as the IVP without rebooting by typing the *run* command. In this case, the tests run continuosly without the fifteen minute timeout. Type *status* to see error summaries. Press Ctrl/C to stop the tests. Type *quit* to reboot.

7.4 Failure in Loading the System Exerciser

The system exerciser has loaded correctly if the following message is displayed on the console terminal without an additional error message following it:

```
Verifying program loaded correctly
```

If the error message "Checksum error detected at load time" appears, take the following action:

1. Reload the floppy diskette to see if the same diskette loads correctly.
2. If rebooting fails to correct the problem, boot a different system exerciser floppy diskette in case the first diskette is bad.
3. If this load attempt also fails, check for failed memory or a bad load path. A bad load path means that either the floppy diskette drive itself is bad or the cable to the floppy drive is bad. Section 2.6 provides information on memory modules. Section 8.10 provides information on replacing memory modules.
4. Run the RRD tests again for possible further information.

7.5 Interpreting System Exerciser Error Messages

If the IVP detects an error condition, an error message is printed. By default, the system exerciser stops execution when an error occurs.

Error messages are listed in Table 7–1. The failing FRU can be identified by the information presented in the error message.

Before replacing a FRU identified by the system exerciser, check the following:

1. Check that the module in the designated slot is the appropriate module for the slot. (Table 2–1 provides information on how to correctly locate each system bus module.)
2. Check that all switches and jumpers are set correctly on the module. (Chapter 2 provides information on correct settings for each module.)

3. Check any cable connections.
4. Reseat modules in the backplane.

After verifying the above items, rerun the system exerciser. If the same FRU is called out again, replace the FRU.

System Exerciser Error Messages

If the system exerciser identifies a FRU as failing, an error message is displayed on the screen and simultaneously written to the error log. (Information in the error log can be displayed using the *log* command.)

Each error message calls out the FRU directly. Because there may be more than one of any type of FRU in the system, additional information is provided to identify which of the multiple units has failed:

- For modules, the slot number indicates the module which has failed.
- For SIMM failures, the socket number of the failed SIMM is indicated.
- For SCSI storage devices, the bus ID and logical unit number of the device is indicated. Also, for SCSI devices, the slot number of the associated adapter is identified. SCSI devices controlled by a CPU/SCSI are identified by the slot number of the CPU/SCSI. In this way, the exact failing SCSI device can be identified.
- SCSI devices controlled by the ISA SCSI adapter are identified by slot number of the controller. However, since the ISA architecture does not provide a means for identifying the slot number, you must carefully check which slot is used by the ISA controller. The first ISA adapter found will be identified as either in slot 9 or 10. The second ISA adapter found is identified as being in slot 11. These slot numbers will probably not match the actual slot numbers in which the adapter is installed. You must carefully determine which slot the ISA Adaptec controller is in, especially if there are two ISA SCSI adapters in the system. (Factory installed ISA SCSI adapters are installed in slot 10.)

The system exerciser continues testing after an error unless the Halt flag is set to **on**.

Table 7–1 System Exerciser Error Messages

Error Message
FRU = slot *n* 486 ISA Base
FRU = slot *n* 486 Serial I/O
FRU = slot *n* 486 SCSI
FRU = Memory board in slot *n*, SIMM = *n*
FRU = RRD42 (CD-ROM) *slot-number*: *bus id*: *logical unit number*
FRU = TZK10 (QIC tape) *slot-number*: *bus id*: *logical unit number*
FRU = RZ24 PCB *slot-number*: *bus id*: *logical unit number*
FRU = RZ24 HDA *slot-number*: *bus id*: *logical unit number*

7.6 Additional Information about the System Exerciser

The following sections describe additional features of the system exerciser:

- System exerciser test descriptions
- System exerciser modes
- System exerciser flags
- System exerciser commands
- Suspending testing
- Exiting system exerciser

7.6.1 System Exerciser Test Descriptions

Table 7–2 describes the system exerciser tests.

Table 7–2 System Exerciser Tests

Test Name	Functionality Tested
Memory test	Main memory
Cache coherency test	Cache coherency logic on the processor modules
Bus lock test	Bus locking feature of Intel CPU
Serial I/O	SIO-specific logic on the CPU/SIO processor modules
Base tests	Tests logic specific to the base/bridge intercommunication
Console	Writes test patterns to the console for visual verification

(continued on next page)

Table 7–2 (Cont.) System Exerciser Tests

Test Name	Functionality Tested
SCSI Disk	Write/read (destructive) or read-only (non-destructive) verification: user selectable
SCSI CD-ROM	Read-only verification: requires that CD-ROM be installed in device
SCSI Tape	Write/read verification: requires that tape cartridge be installed in device

7.6.2 System Exerciser Modes

The system exerciser has two modes:

Table 7–3 System Exerciser Modes

Mode	Prompt	Meaning
Halt	HLT>	Tests have not been started or testing is suspended.
Run	RUN>	Tests are running.

You can run all system exerciser commands from either prompt and place the system in Halt mode at any time by entering Ctrl/C.

Note that if you wish to rerun the IVP for any reason, you must reboot the system exerciser. Typing IVP again does not rerun the IVP procedure.

7.6.3 System Exerciser Flags

You can set flags to control whether:

- Information sent to the operator's console and to the error log should include data about memory allocation, task swapping, and segment descriptors.
- Information is sent to the operator's console in one-screen segments.
- Testing should continue when an error is encountered.

Flags are set with the *flag* command.

Table 7–4 describes the system exerciser flags.

Table 7–4 System Exerciser Flags

Flag	Default	Description
Halt	On	Stop testing when error is reported; return to halt mode prompt. If off, continue testing when an error is reported.
Long	Off	Include test environment information in the error report. This information describes the machine state during the most recent task swaps, segment descriptor data and the memory allocation table. If off, generate an abbreviated error report that contains only the header block and text.
More	Off	Displays information on the console in single screen segments. Press Enter to display the next line of information. Press Spacebar to display the next screen of information. Press Q to quit. If off, any information containing more than 23 lines will scroll off the operator's console.

To change the status of a flag, use the *flag* command. Use of this command, with arguments, is as follows:

1. *flag* or *f*
2. The desired setting *on* or *off*
3. The name of the flag

For example, to set the Long flag, enter the following:

```
HLT> flag on long
```

If you boot the system, the system exerciser flags return to the default settings.

7.6.4 System Exerciser Commands

Additional system exerciser commands are available. Table 7–5 lists the system exerciser commands. The commands are not case sensitive and may be abbreviated.

Table 7–5 System Exerciser Commands

System Exerciser Command	Description
B[lock]	Prevent specified tests from running.
B[lock] (no argument)	Display all tests that are currently blocked from running.
Ca[lculate]	Make a calculation in one of three radices: decimal, octal, or hexadecimal. Hexadecimal is the default radix.
Co[nfiguration]	Display the configuration of the system.
Ctrl/C	Halt testing; return to the halt mode prompt.
D[isplay]	Display the data at specified locations in memory.
E[xamine]	Examine the data at a specified location in memory. You can also deposit data at the specified location in memory.
F[lags]	Modify the flags settings.
F[lags] (no argument)	Display the flags settings. There are three system exerciser flags: halt, long, and more.
Help	Obtain information on any command.
ivp	Run 15 minute Installation Verification Procedure.
L[og]	Play back or delete previous error reports. [1]
Q[uit] Ctrl/Alt/Delete (VGA) Ctrl/Backslash (COM1)	Stop all tests and reboot the system.
R[un]	Begin or resume testing (change from halt mode to run mode.)
Sh[ow]	Show machine state.
St[atus] or Ctrl/T	Display which tests are running, whether they are blocked and how many test passes have been made
U[nblock]	Allow tests that have been blocked to resume running
U[nblock] (no argument)	Display all tests that are currently unblocked.

[1]The size of the error log is limited. When the error log is full, new error reports are not included in the error log. For example, if the Long flag is not set, the error log usually contains over one-hundred error messages; if the Long flag is set, the error log might stop collecting error messages after fifteen error messages have been logged.

7.6.4.1 Block

Use the *block* command to prevent one or more tests from running. This might be helpful if you want to focus CPU time on one test. For example, you might want to eliminate a test from which you have already gathered sufficient error information, or you might want to eliminate constantly scrolling error messages from a failing test.

Table 7–6 describes the options that can be used with the *block* command.

Table 7–6 Block Command Options

Command	Description
b[lock]	Display all tests that are currently blocked
b[lock] t	Block the specified test
b[lock] t-t	Block a range of tests that begins with the first test number specified and ends with the second test number specified

For example, to block Test 1:

```
RUN> b 1
```

If you display the test status, the screen display indicates that Test 1 is blocked by placing the letter *B* next to the number of the test.

To block Test 1 and Test 3, use either of the following:

```
RUN> b 1 3
RUN> b 1,3
```

To block Test 1, Test 2, and Test 3:

```
RUN> b 1 - 3
```

7.6.4.2 Calculate

The *calculate* command lets you make calculations and includes functions similar to a pocket calculator, such as addition, subtraction, multiplication, and division. In addition, it provides support for the following three radices:

- Octal
- Decimal
- Hexadecimal (default)

The result of the calculation is displayed in all three radices in the order octal, decimal, hexadecimal.

The *calculate* command is a convenient way to convert radices.

To set the default radix for all numbers in a calculation, use the following command qualifiers:

Command	Description
ca[lculate]/o	Calculate using the octal radix
ca[lculate]/d	Calculate using the decimal radix
ca[lculate]/h	Calculate using the hexadecimal radix

Hexadecimal is the default radix; if you set the default radix to decimal or octal, the system immediately defaults to hexadecimal when the calculation is finished.

To convert the value of 100 octal to hexadecimal or decimal, use the following command:

```
ca/o 100
100, 64, 40
```

To convert the value of 100 decimal to octal or hexadecimal, use the following command:

```
ca/d 100
144, 100, 64
```

To see the value of 100 hexadecimal in the three radices, use the following command:

```
ca 100
400, 256, 100
```

Note that because hexadecimal is the default, you do not have to specify */h* when calculating in hexadecimal.

If you use more than one radix in a calculation, use the following symbols to specify the radix of an individual number.

Radix	Symbol	Example
Decimal	.	10.
Hexadecimal	H	10H
Octal	o	10o

For example, in the equation that follows, the number 13 is hexadecimal, 59 is decimal, and 100 is octal:

```
ca 13 + 59. + 100o
    216, 142, 8e
```

You can use the following functions with the *calculate* command:

- Add (+)
- Subtract (-)
- Multiply (*)
- Divide (/)
- Exponentiation (^)

The order of precedence is:

- Exponentiation (highest precedence)
- Multiply or divide
- Add or subtract (lowest precedence)

Use parentheses to change the order.

7.6.4.3 Configuration

The *configuration* command lets you display the system configuration:

```
RUN> co
```

7.6.4.4 Ctrl/C

Enter Ctrl/C at any time to suspend testing and enter halt mode.

Note that although testing is stopped when suspended, the clock that measures elapsed test time continues to operate. The clock will always reflect the elapsed time since you started testing; if you suspend testing, the clock does not reflect the actual test time.

7.6.4.5 Display

The *display* command lets you display data at specified locations in memory. Data can be displayed in the following formats:

- Byte
- Word (default)
- Doubleword
- ASCII

To choose a display format, use the following command qualifiers:

Command	Display Type
d[isplay]/b	Byte
d[isplay]/w	Word
d[isplay]/d	Doubleword
d[isplay]/a	ASCII

If you do not designate an address, the system defaults to address 0 or to the last address selected for display. For example, to view the data in default format at location 0 in segment 8, enter the following:

```
d 0
```

7.6.4.6 Examine

The *examine* command lets you analyze and modify data at a specified location in memory.

When data is displayed, the system cursor remains in place and waits for you to input new data. The Up Arrow key examines data at the previous location in memory. The Down Arrow key examines data at the next location in memory. If you do not wish to change the data in memory, press Return.

The Enter key exits *examine* mode.

You can examine the contents of memory as bytes, words, doublewords, or as ASCII by using the following command qualifiers:

Command	Display Type
e[xamine]/b	Byte
e[xamine]/w	Word
e[xamine]/d	Doubleword
e[xamine]/a	ASCII

7.6.4.7 Installation Verification Procedure (ivp)

The *ivp* command lets you verify system functionality within 15 minutes of testing.

To run the 15-minute IVP, enter *ivp* at the HLT prompt, as follows:

```
HLT> ivp
```

When the IVP starts, the system displays the following message:

```
Installation Verification Procedure Running:
```

If no errors are detected, at the end of fifteen minutes, the system displays status information with the following message:

```
Installation Verification Procedure Complete: No Errors Detected
```

If the diagnostics locate a problem with any CPU, memory module, or peripheral, an error message and a description of the FRU is displayed. Table 7–1 lists the system exerciser error messages.

IVP can only be run at the initial start time, immediately after the system exerciser is booted. If you wish to rerun the IVP procedure, you must reboot the system exerciser. Type *run* to continue running system exerciser tests, but without the fifteen minute timeout.

7.6.4.8 Log

The *log* command lets you either play back error reports that have been logged or remove reports from the log.

Table 7–7 describes options that can be used with the *log* command.

Table 7–7 Log Command Options

Command	Description
l[og]	Display error log summary
l[og] play entry-number	Play back specific error reports
l[og] play	Play back all error reports
l[og] clear entry-number	Remove specific error reports
l[og] clear	Remove all error reports

To display error log summary reports, enter the *log* command at the prompt, as follows:

```
RUN> log
```

Table 7–8 illustrates a typical log summary report.

Table 7–8 System Exerciser Error Report

Entry	Error	Test	Log Address
0	1	9	28316
1	2	6	27FFA
2	3	15	27AB2

The Entry column denotes which entry from the error log is being described.

The Error column denotes whether this is the first, second, third, or nth encounter of an error in the test run.

The Test column denotes which of the system exerciser tests reported the error.

The Log Address column describes where in memory the report is logged.

To review an error report from the log, use the *log play* command and specify the entry number of the error. For example, to review entry 0 from the sample report in Table 7–8:

```
RUN> log play 0
```

You can specify one entry number to review a single error report or a range of entry numbers to review several error reports. However, you cannot enter both single numbers and a range of numbers on the same command line.

There is memory space available for more than 50 error reports.

Note

When the error log is full, new error reports are not included in the error log. Errors must be cleared before new error reports can be included.

To remove an error report from the log, use the *log clear* command and specify an entry number obtained from the error summary report. For example, to remove entry 0 from the sample report in Table 7–8:

```
RUN> log clear 0
```

Note

Error reports that have been removed from the error log are permanently deleted; they cannot be restored.

You can specify one entry number to remove a single error report or a range of entry numbers to remove several error reports. However, you cannot enter both single numbers and a range of numbers on the same command line.

7.6.4.9 Quit

You can use the *quit* command at the system exerciser prompt.

Table 7–9 lists the key sequences that duplicate the *quit command*. These key sequences can be used any time to duplicate the *quit* command.

Table 7–9 Key Sequence to Exit System Exerciser

Console Type	Key Sequence
Graphics monitor (VGA)	Press Ctrl/Alt/Delete
Terminal (COM1)	Press Ctrl/Backslash

7.6.4.10 Run

The *run* command lets you run system exerciser tests continuously. To start or resume testing, enter *run* or *r* at the *HLT* prompt as follows:

```
HLT> r
RUN>
```

All unblocked tests begin executing immediately; devices are tested concurrently. Testing continues until you enter Ctrl/C or unless an error is encountered while the Halt flag is **on**. Section 7.6.3 provides information on how to use the system exerciser flags.

While the tests run, you can execute the *status* command at the RUN> prompt to obtain information about the system exerciser tests.

7.6.4.11 Show

The *show* command lets you examine the entries in both the Global Descriptor Table (GDT) and Interrupt Descriptor Table (IDT).

7.6.4.12 Status

The *status* command (or Ctrl/T) lets you display the following:

- Test number and description
- The letter *B* to the left of the test name, if a test is blocked
- Test module revision level
- Total number of test passes made
- Total number of errors detected in each test
- Total number of page faults encountered in each test

For example, to obtain the status of all system exerciser tests, enter *status* or *st* at the prompt:

```
RUN> st
```

Table 7–10 lists the options for the *status* command.

Table 7–10 Status Command Options

Command	Description
st[atus]	Display status of all tests
st[atus] t	Display status of specified test
st[atus] t-t	Display a range of tests that begins with the first test number specified and ends with the second test number specified

7.6.4.13 Unblock

The *unblock* command lets you resume a test that was prevented from running by the *block* command.

Table 7–11 describes the options that can be used with the *unblock* command.

Table 7–11 Unblock Command Options

Command	Description
u[nblock]	Display tests that are currently unblocked.
u[nblock] t	Unblock the specified test.
u[nblock] t-t	Unblock a range of tests that begins with the first test number specified and ends with the second test number specified.

For example, to unblock Test 1:

```
RUN> u 1
```

To unblock Test 1 and Test 3:

```
RUN> u 1 3
RUN> u 1,3
```

To unblock Test 1, Test 2, and Test 3:

```
RUN> u 1 - 3
```

If you use the *unblock* command without an argument, a list of all unblocked tests is displayed on the screen.

CHAPTER 8

8
Removal and Replacement

8.1 Precautionary Steps

Before opening the applicationDEC 433MP system, do the following:

1. Notify users to log off (if a multiuser system).
2. If the operating system is running, enter *shutdown*. This closes all open files, and prepares hard disk drives and other hardware for loss of power.
3. Remove any diskettes from the diskette drives. (When power is reapplied, the system will attempt to boot from the diskette drive if a diskette is installed.)
4. Remove power from the system. Turn the ON/OFF switch to the OFF or (o) position. Remove the power cord from the wall socket.

Caution

Prior to removing or installing any option in the applicationDEC system, ensure that the operating system has been safely halted with the *shutdown* command, and that power is removed from the system.

8.2 Opening the System Box

To add a module to the backplane:

1. Remove the top cover.
2. Remove the left side panel.
3. Remove the card cage door.

To add a storage or media device to the system, it is necessary to:

1. Remove the top cover.
2. Remove the right side panel. (If installing a QIC tape drive or 3.5-inch diskette drive, it may not be necessary to remove the side panel.)

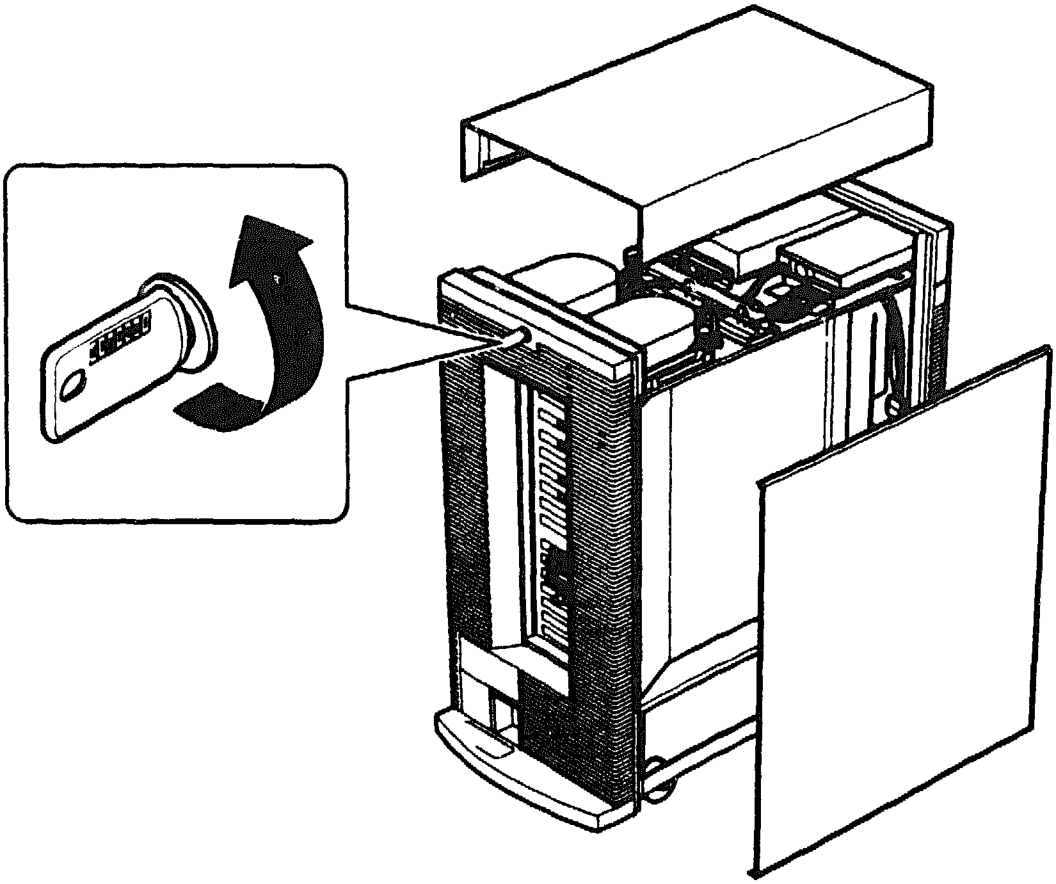
The rear bezel must be removed to replace the power supply.

8.2.1 Top Cover and Side Panels

Figure 8–1 shows how to remove the top cover and side panels. The steps are:

1. Disconnect the power cord.
2. Unlock the system lock by turning the key counter-clockwise to the unlocked position.
3. Pull the top cover back and then up to release it.
4. Remove the side panels by lifting them up and away from the system.

Figure 8–1 Top Cover and Side Panel



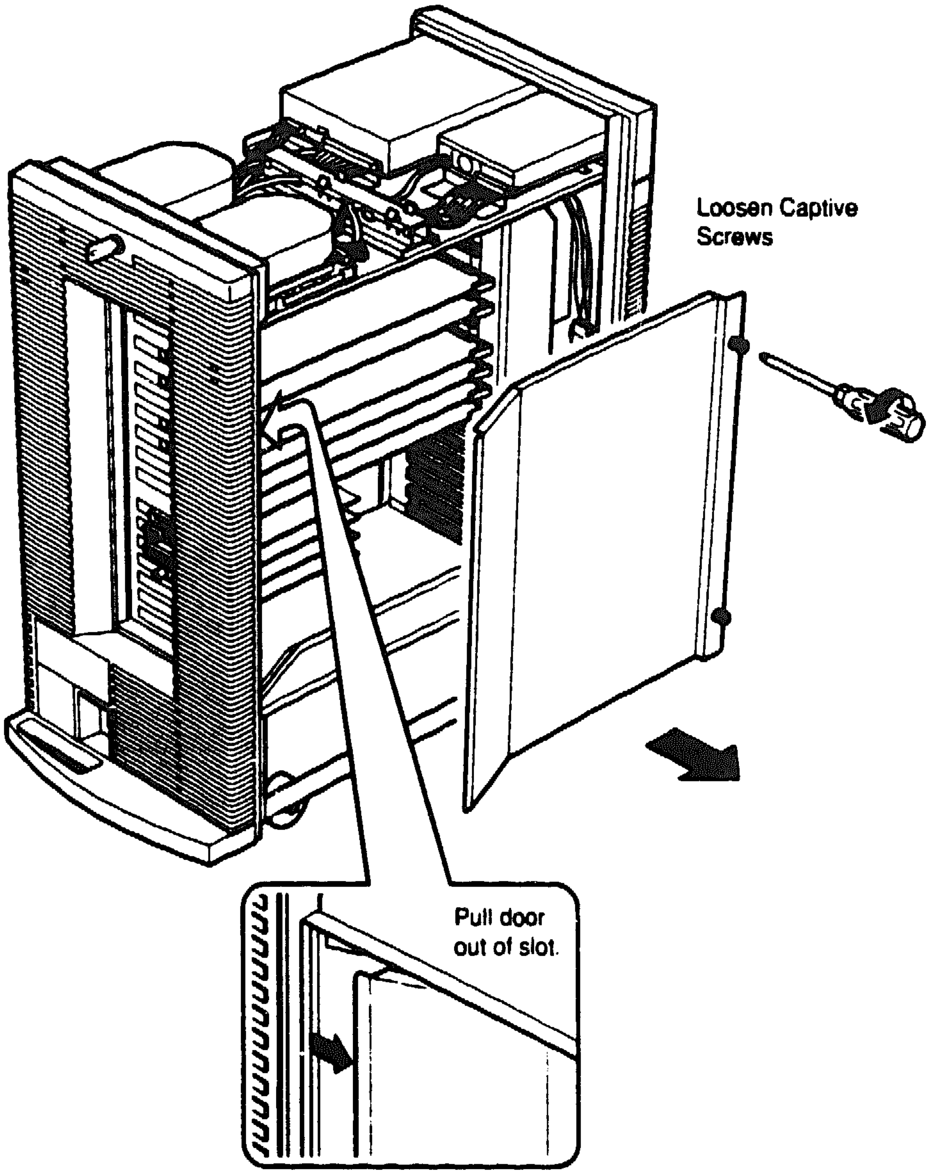
To reinstall the top cover or side panels, reverse the above procedure.

8.2.2 Card Cage Door

Figure 8–2 shows how to remove the card cage door to gain access to the backplane. The steps are:

1. Loosen the two captive screws holding the door.
2. Pull the door open slightly and pull the door out of the slot in the left-hand side of the chassis.
3. Remove the card cage door.

Figure 8–2 Card Cage Door Removal



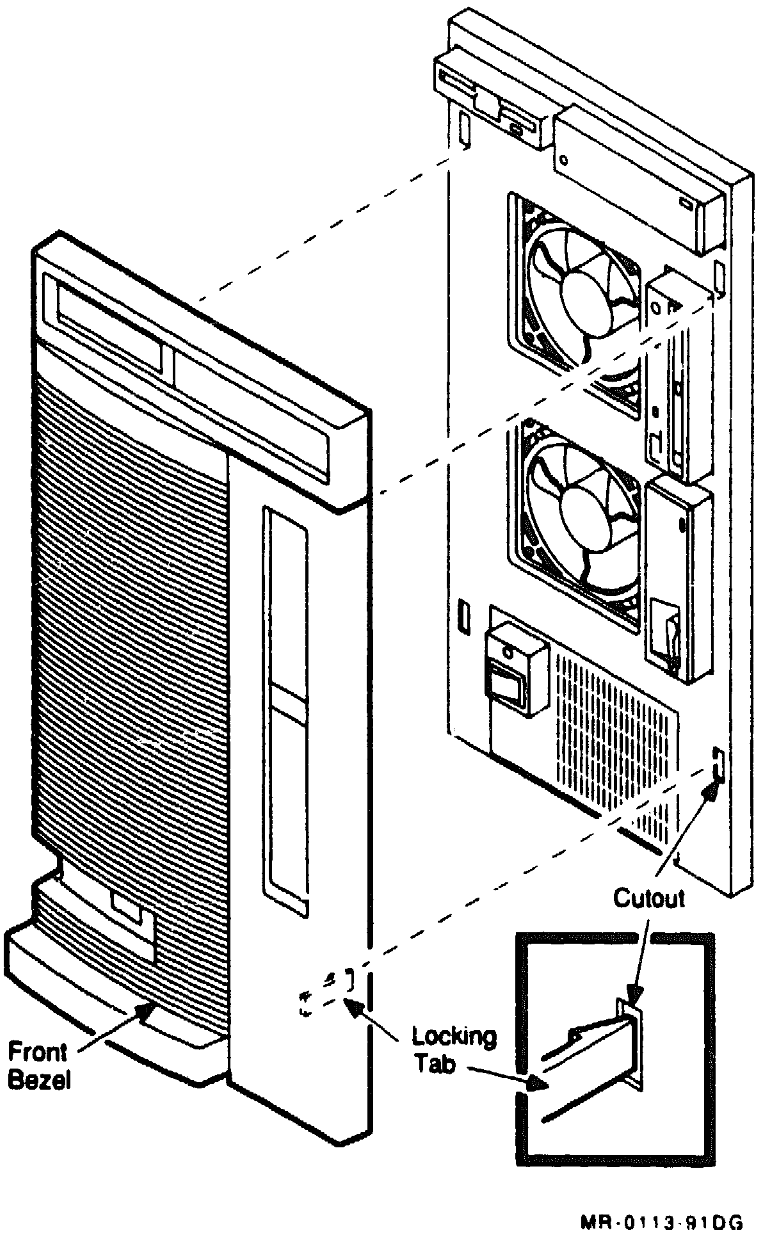
To replace the card cage door, reverse the above steps. Check that the card cage door is in the retaining slot before tightening the captive screws.

8.3 Front Bezel

The following steps describe the removal procedure for the front bezel. Four flexible wedge-shaped locking tabs on the bezel snap-fit into matching cutouts on the system box chassis to hold the bezel in place. There are no retaining screws. See Figure 8–3.

1. Disconnect the power cord.
2. Remove the top cover and side panels, as described in Section 8.2.1.
3. Reach behind the bezel and press the top two locking tabs to release them. While pressing the tabs, pull the top of the bezel away from the system box chassis.
4. Similarly, reach behind the bezel and release the bottom two locking tabs. Remove the bezel.

Figure 8–3 Front Bezel Removal



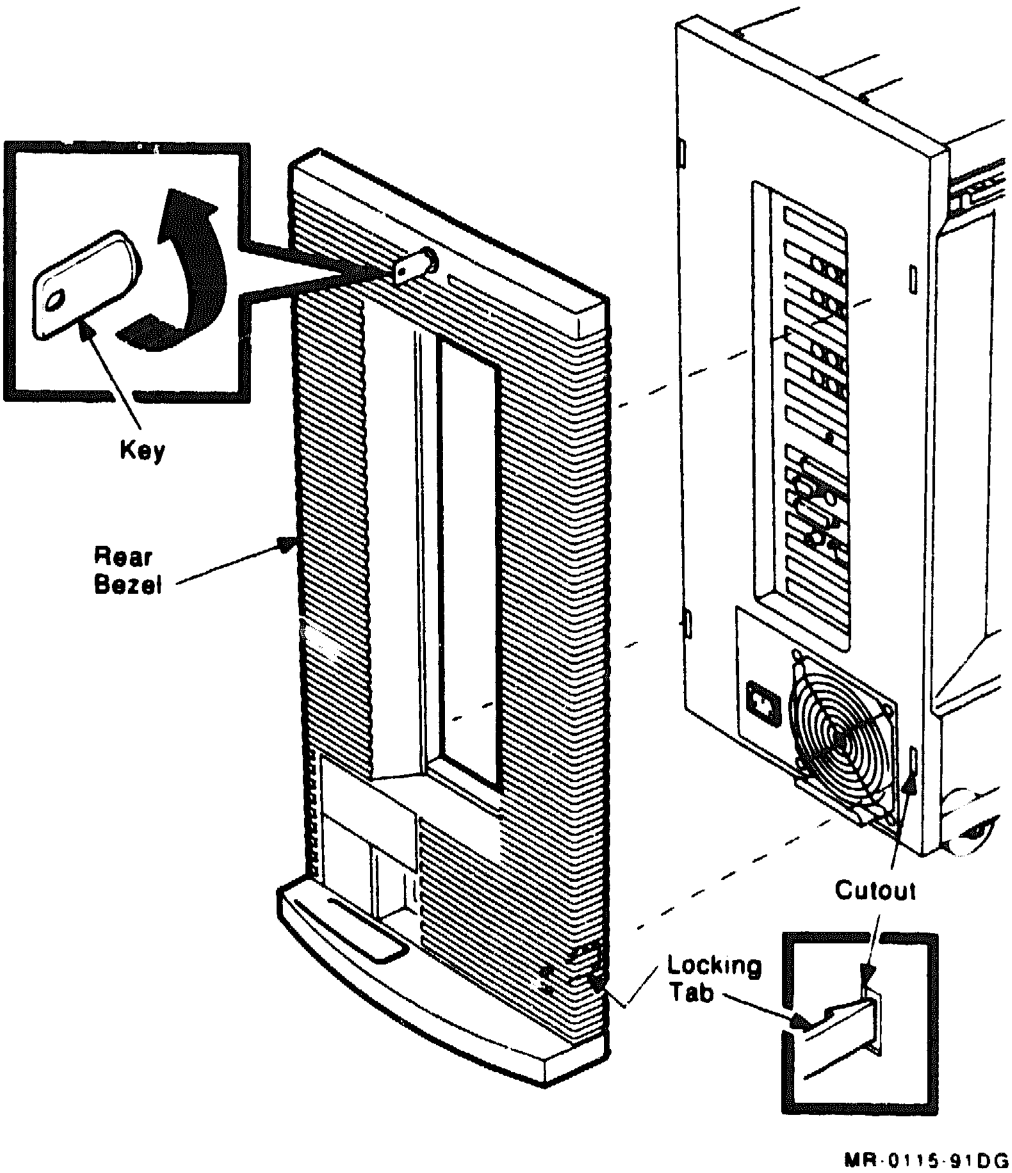
To replace the bezel, simply hold the bezel in position against the system box and push until it locks into place. Alignment pins on the bezel help to guide it into the proper position.

8.4 Rear Bezel

The following steps describe the removal procedure for the rear bezel. Four flexible wedge-shaped locking tabs on the bezel snap-fit into matching cutouts on the system box chassis to hold the bezel in place. Refer to Figure 8–4.

1. Disconnect the power cord.
2. Remove the top cover and side panels, as described in Section 8.2.1.
3. Remove the card cage door, as described in Section 8.2.2.
4. Reach behind the bezel and press the top two locking tabs to release them. While pressing the tabs, pull the top of the bezel away from the system box chassis.
5. Similarly, reach behind the bezel and release the bottom two locking tabs. Remove the bezel.

Figure 8–4 Rear Bezel Removal



To replace the bezel, simply hold the bezel in position against the system box and push until it locks into place. Alignment pins on the bezel help to guide it into the proper position.

8.5 System Bus Modules

Remove a system bus module as follows. See Figure 8–5.

1. Disconnect any cables attached to the modules or distribution panel.
2. Remove the top cover and side panels, as described in Section 8.2.1
3. Remove the card cage door, as described in Section 8.2.2
4. Loosen the captive screw on the module's distribution panel. (This screw holds the panel to the chassis.) Reverse the instructions illustrated in Figure 8–5.
5. Hold the module by the finger grips, pull the module toward you, and slide the module out of the backplane slot.

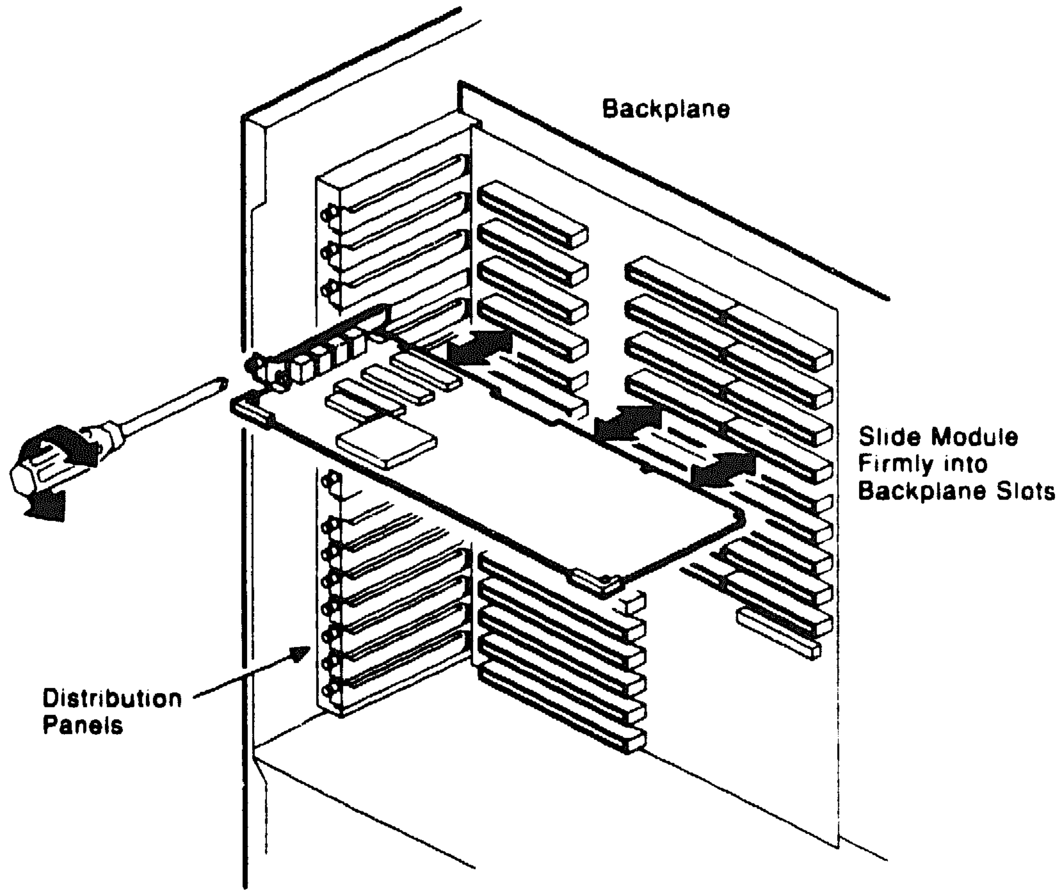
Install a system bus module as follows. See Figure 8–5.

1. Hold the module by the finger grips and slide the module into the backplane slot with the component side facing up. Make certain that the fingers of the module are fully inserted into the backplane slot.
2. Align the module's distribution panel with the screw hole in the chassis and tighten the captive screw. The system bus module is now installed in the backplane.
3. Replace the card cage door and install the top cover and side panels before applying power to the system.

Caution

Because system bus modules must be inserted in certain slots, the backplane receptacles for the module fingers are keyed for each module. Make certain that the system bus slot into which you are installing a module is appropriate for the module. If you encounter resistance installing a system bus module, double check that the slot is correct. If you attempt to install a system bus module in an incorrect slot, you may damage the module.

Figure 8–5 Installing and Removing a System Bus Module in the Backplane

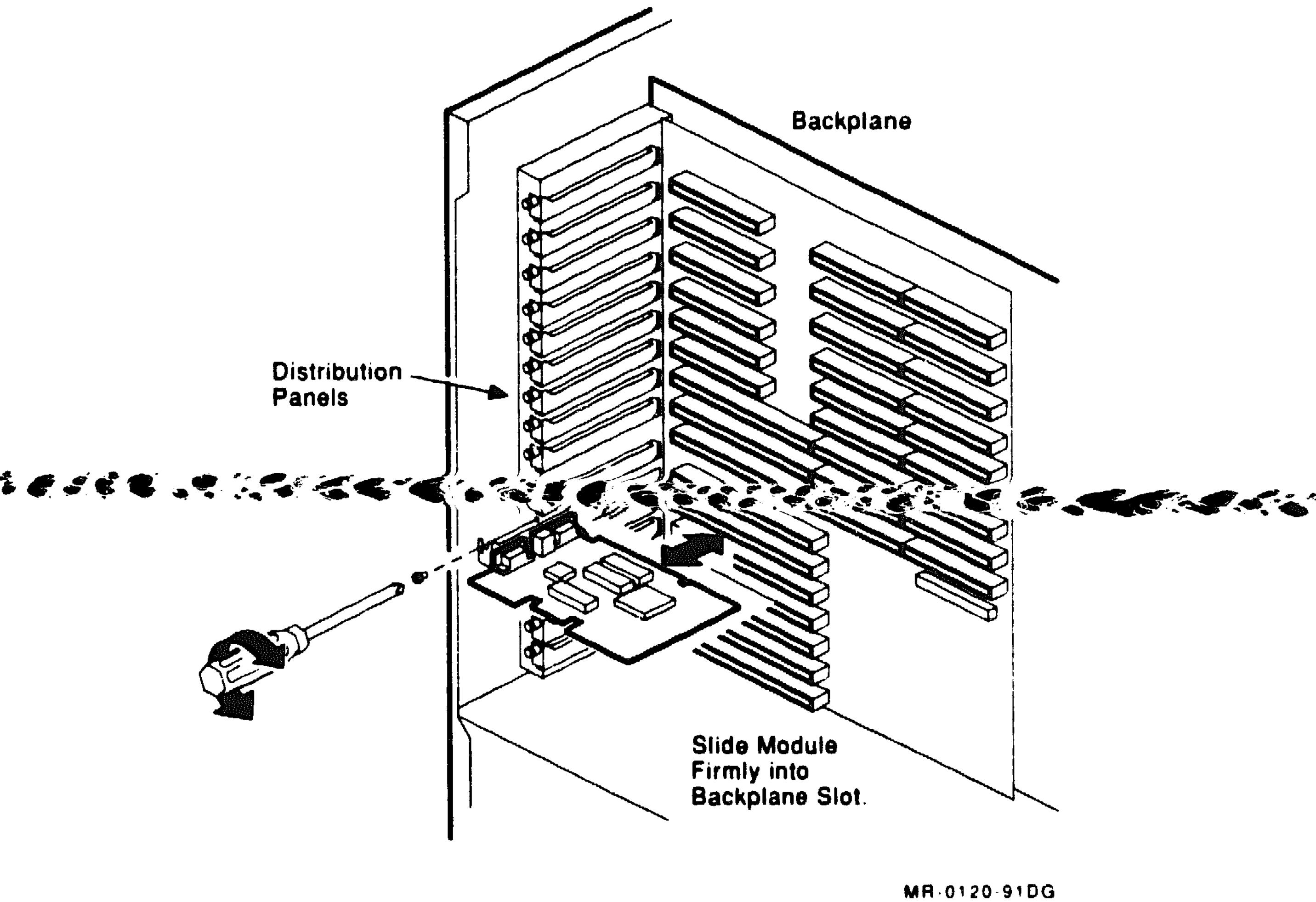


8.6 ISA Module

Remove an ISA bus module as follows. See Figure 8–6.

1. Remove the top cover and side panels, as described in Section 8.2.1
2. Remove the card cage door, as described in Section 8.2.2
3. Remove the screw on the module's distribution panel. (This screw holds the panel to the chassis.)

Figure 8–6 Installing an ISA Module in the Backplane



4. Hold the module by the finger grips, pull the module toward you, and slide the module out of the backplane slot. See Figure 8–6.

ISA option modules may be installed in any ISA slot in the backplane. Install ISA modules as follows. See Figure 8–6.

1. Slide the module into the backplane slot with the component side facing up. Make certain that the fingers of the module are fully inserted into the backplane slot.
2. Align the module's distribution panel with the screw hole in the chassis and replace the screw. The ISA module is now installed in the backplane.
3. Replace the card cage door and install the top cover and side panels before applying power to the system.

Note

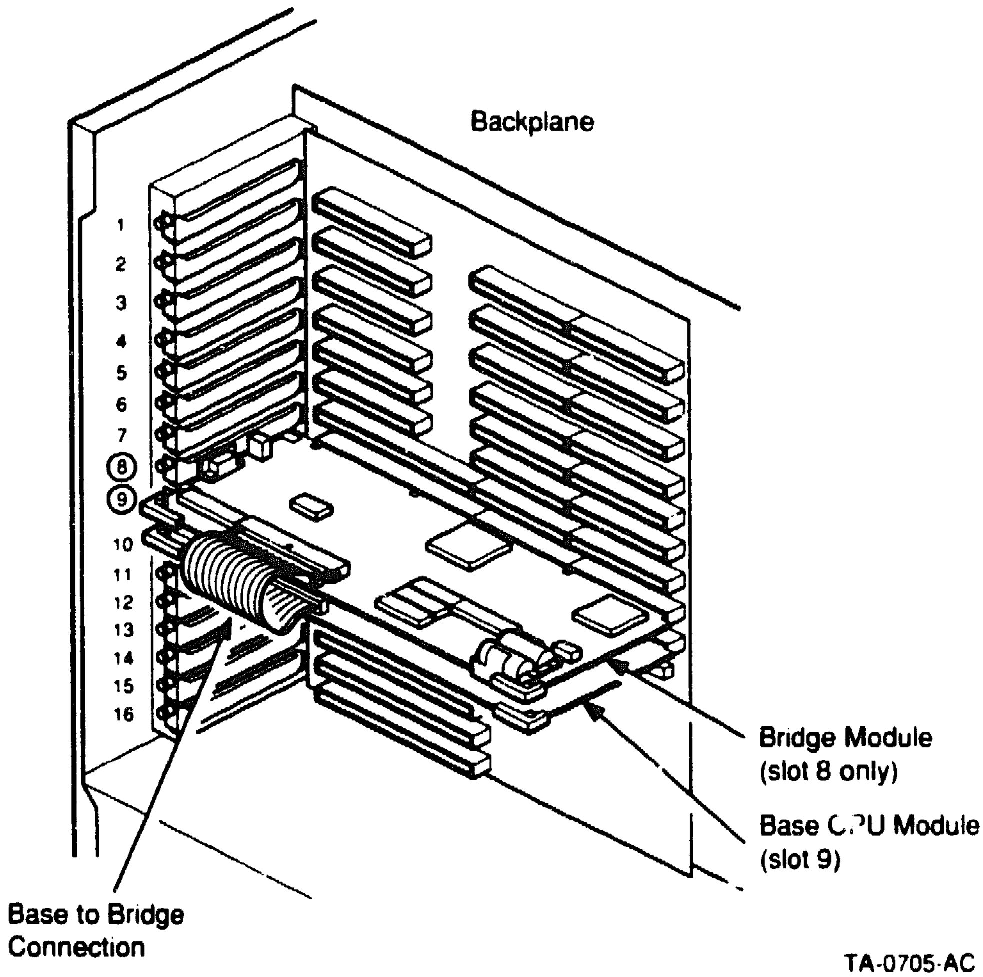
All connections to modules installed in the backplane are made through the distribution panels in the back of the applicationDEC 433MP system box. The distribution panels are part of each module.

8.7 Base Processor Module

Remove the base processor module as follows:

1. Remove the top cover and left side panel, as described in Section 8.2.1.
2. Remove the card cage door, as described in Section 8.2.2.
3. Disconnect the attached cable from the base processor to the bridge module. See Figure 8–7.

Figure 8–7 Base Processor



4. Remove the module. Removal of a system bus module is described in Section 8.5.

Replace the base processor module as follows:

1. Set the switches as they were set on the failed module. (The switches in S1 designate ISA memory space needed by your ISA options. See Section 2.4.1.)
2. Install the module in backplane slot 9. (See Figure 8–7.) Installation of a system bus module is described in Section 8.5.

3. Connect the attached cable from the base processor to the bridge module. See Figure 8–7.
4. Close the system by replacing the card cage door and the side panel and top cover.

8.8 Bridge Module

The following steps describe the removal procedure for the bridge module.

1. Disconnect the attached cable from the base processor to the bridge module. See Figure 8–7.
2. Remove the module. Removal of a system bus module is described in Section 8.5.

The following steps describe the replacement procedure for the bridge module.

1. Set the switches in S2 as they were set on the failed module. These switches designate whether the console connector is COM1: or COM2: and which diskette drive is the boot drive. See Section 2.5.3.
2. Install the module into backplane slot 8. (See Figure 8–7.) Installation of a system bus module is described in Section 8.5.
3. The bridge module is a standard system bus module and follows the installation procedure described in Section 8.5.
4. Connect the bridge module to the base processor module with the base processor's short ribbon cable.
5. Close the system box by replacing the card cage door and the top and side panels.

8.8.1 Battery

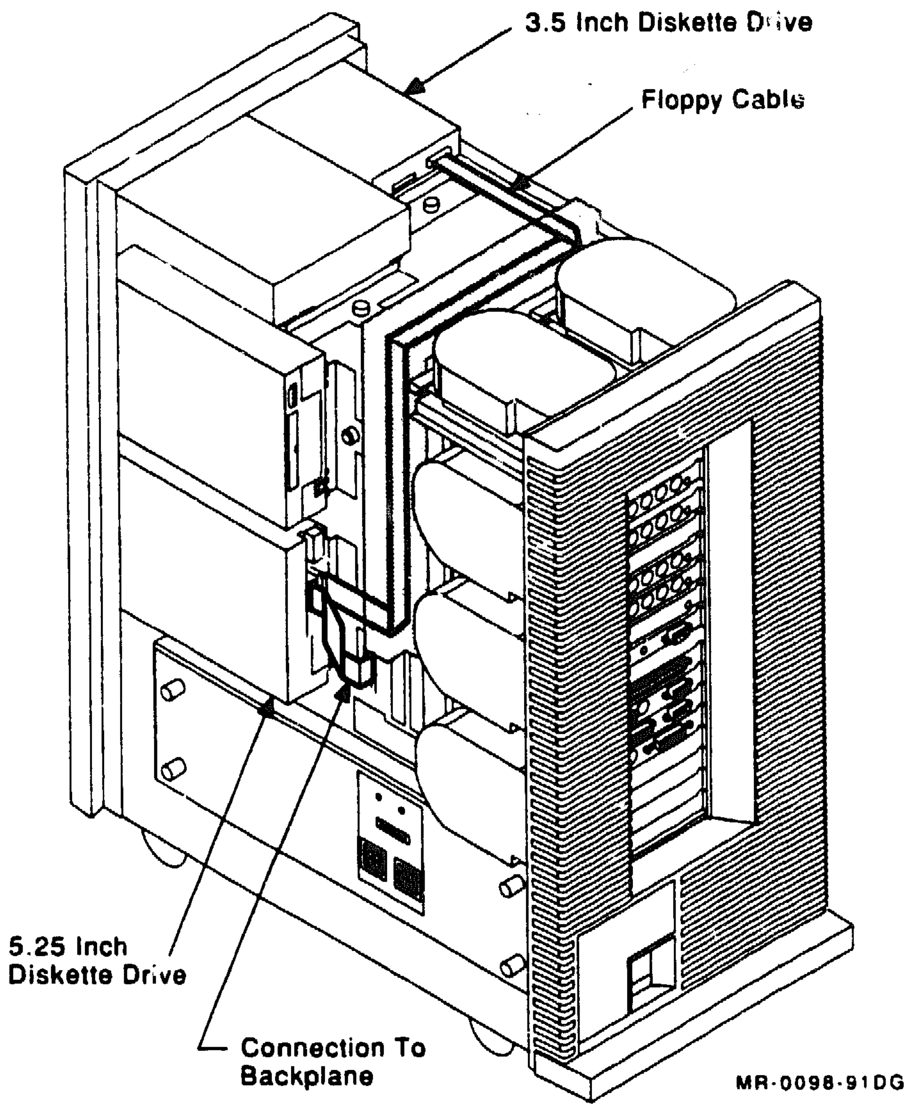
Use the following steps to replace the battery on the bridge module.

1. Remove the bridge module from the backplane.
2. Pull back the two tabs holding the battery.
3. Push up on the battery from beneath the module. There is a cutout in the module for this purpose.
4. When replacing the battery, ensure that you have the polarity correct. Insert the new battery by orienting the battery directly over the battery holder and pushing straight down.

8.9 Diskette Cable

The bridge module also controls the 1.44 MB 3.5-inch RX23 diskette drive and the 1.2 MB 5.25-inch RX33 diskette drives. The cable connecting the module to the diskette drives is factory installed as part of the cable harness. Figure 8–8 illustrates this cable in the cable harness.

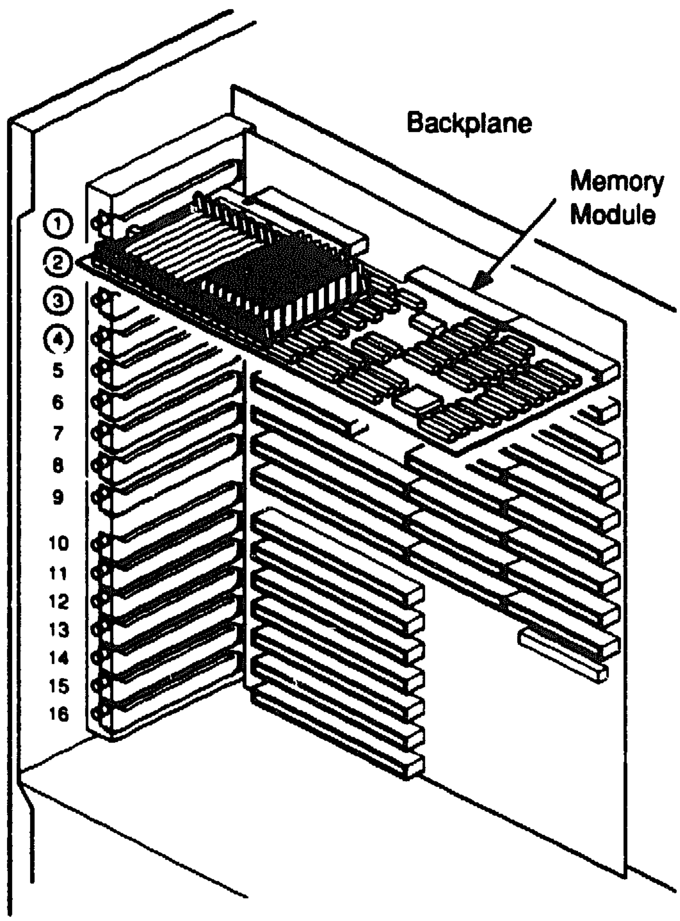
Figure 8–8 Diskette Cabling from Bridge Module to Cable Duct



8.10 Memory Module

1. Remove the top cover and left side panel, as described in Section 8.2.1.
2. Remove the card cage door as described in Section 8.2.2.
3. Memory modules can be installed in the top four slots of the backplane. These are slots 1, 2, 3, and 4, as shown in Figure 8–9.

Figure 8–9 Memory Module Backplane Locations



4. Remove the module. Removal of a system bus module is described in Section 8.5.

Replace a memory module as follows:

1. Install any additional SIMMs. See Section 8.11. (Option level memory modules are shipped without SIMMs installed.)
2. Install the module. Installation of a system bus module is described in Section 8.5. Memory modules can be installed in the top four slots of the backplane. These are slots 1, 2, 3, and 4, as shown in Figure 8–9. Memory modules should be installed sequentially starting from the top slot. In other words, the first memory module should be in slot 1, the second in slot 2, the third in slot 3, and the fourth in slot 4.
3. Replace the card cage door, top cover, and side panel.

8.11 SIMMs

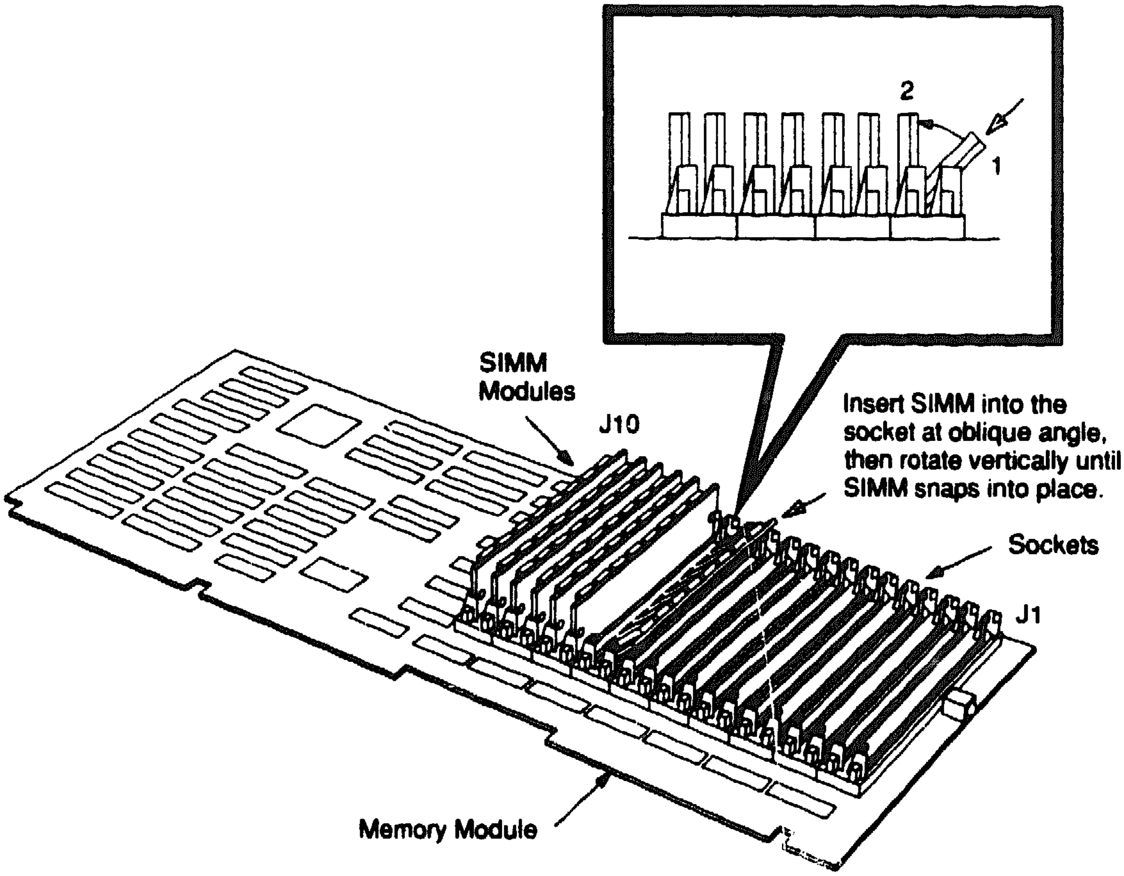
SIMMs are removed by pulling back on the two tabs at either end of the SIMM, tilting the SIMM back, and pulling it out of its slot. You must remove all of the SIMMs in the lower numbered slots before you can remove the identified SIMM. In other words, if you have a failed SIMM in slot 18, you must remove any SIMMs in slot 17, 16, 15, and so on, before the SIMM in slot 18 can be removed.

Caution

Exercise caution when bending back the SIMM holding tabs. They are fragile.

SIMMs are installed in slots in the memory module. SIMMs must be inserted in the module, as shown in Figure 8–10. SIMMs must be inserted sequentially starting with slot J10 and descending to J1. There must be no empty slots between SIMMs.

Figure 8–10 Installing SIMMs

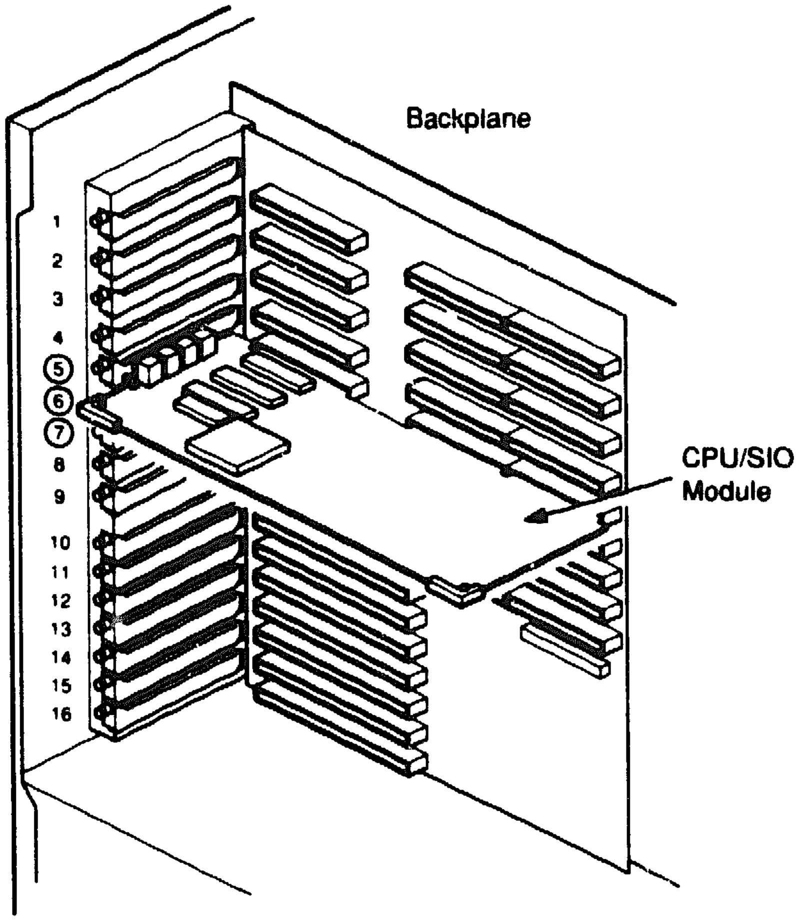


8.12 CPU/SIO Module

Remove the CPU/SIO module as follows:

1. Remove the top cover and left side panel, as described in Section 8.2.1.
2. Remove the card cage door, as described in Section 8.2.2.
3. Locate the CPU/SIO module in backplane slot 5, 6, or 7, as shown in Figure 8–11.

Figure 8–11 CPU/SIO Module and Backplane Location



4. Disconnect any terminal concentrators that are connected to the CPU/SIO terminal multiplexer ports.
5. Remove the module. Removal of a system bus module is described in Section 8.5.

Replace the CPU/SIO module as follows:

1. The CPU/SIO module may be installed in backplane slot 5, 6, or 7, as shown in Figure 8–11.
2. Install the module. Installation of a system bus module is described in Section 8.5.
3. Replace the card cage door, top cover, and side panel.
4. Connect any terminal concentrators to the CPU/SIO terminal multiplexer ports.

Refer to the *SCO / UNIX MPX Release and Installation Notes* for information on how to define the terminal devices used on the CPU/SIO.

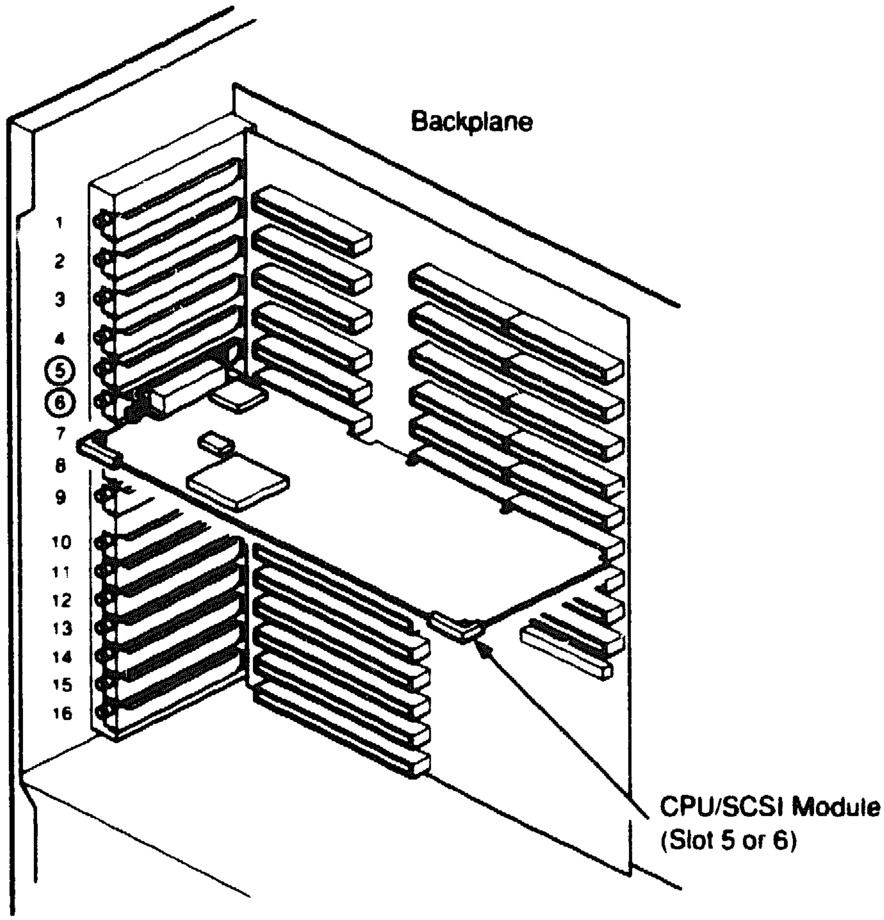
For each CPU/SIO board installed in the system, you must install one license and copy of the MPX extensions. Refer to the *SCO MPX Release Notes and Installation Guide* for details on how to install the MPX extensions.

8.13 CPU/SCSI Module

Remove the CPU/SCSI module as follows:

1. Remove the top cover and left side panel, as described in Section 8.2.1.
2. Remove the card cage door, as described in Section 8.2.2.
3. Locate the failed module. Slot 5 is for control of the internal SCSI bus in a dual SCSI system. Slot 6 is for control of the external SCSI bus only. Figure 8–12 describes the backplane slots for the CPU/SCSI module.

Figure 8–12 CPU/SCSI Backplane Location



4. Disconnect any external storage expansion box or remove terminators from the module's external connector.

   Table 8–1 summarizes the slots for the CPU/SCSI module.

Table 8–1 CPU/SCSI System Bus Slot Locations

Slot	Use
5	Adapter for internal SCSI bus, and external, if desired.
6	Adapter for external connections only.

5. Remove the module. Removal of a system bus module is described in Section 8.5.

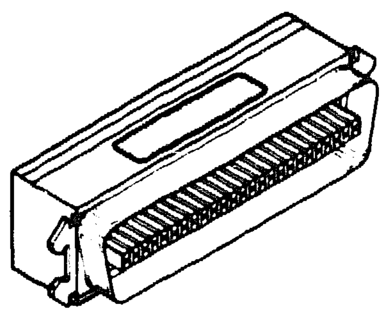
Replace the CPU/SCSI module as follows:

1. Install the CPU/SCSI module into backplane slot 5 or 6. Installation of a system bus module is described in Section 8.5. Slot 5 is for control of the internal SCSI bus in a dual SCSI system. Slot 6 is for control of the external SCSI bus only. See Figure 8–12, CPU/SCSI Backplane Location, and Table 8-1 for more information about the slots for the CPU/SCSI module.
2. Reconnect any storage expansion box cables. If there were none, reinstall the SCSI terminator on the module's external connector.

8.13.1 Terminator

The CPU/SCSI adapter has an external connector for attachment of additional SCSI devices. When external devices are not connected, a SCSI terminator (H8574-A) must be installed on this connector to terminate the SCSI bus. Figure 8–13 shows the terminator needed.

Figure 8–13 SCSI Terminator

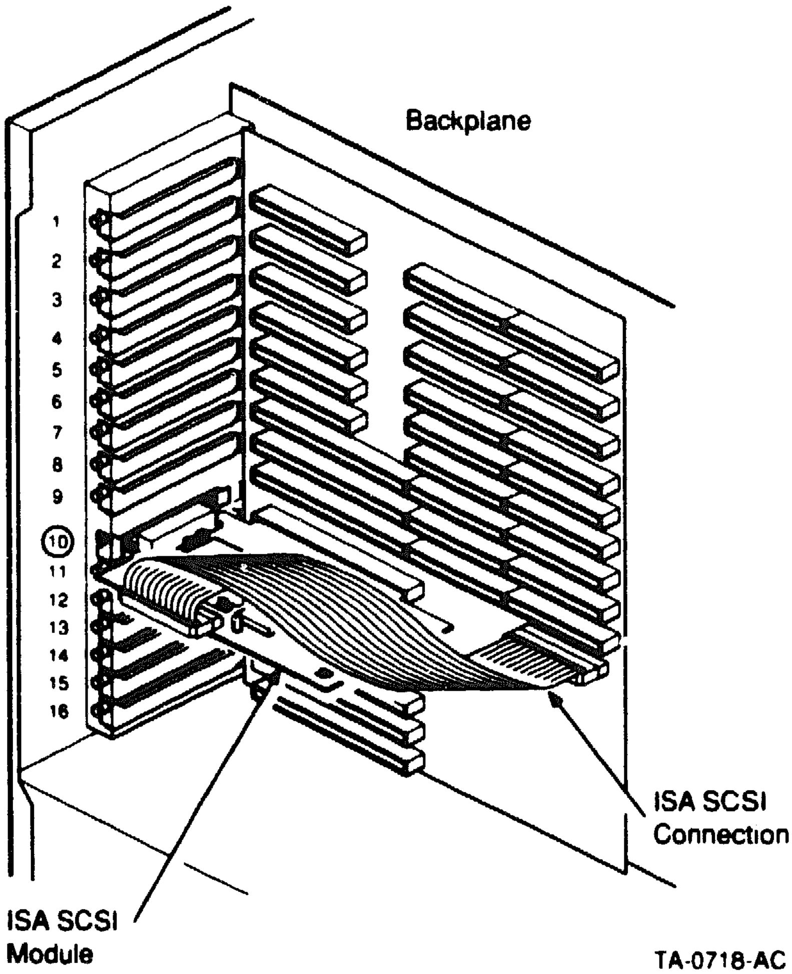


8.14 ISA Bus 16-Bit SCSI Host Adapter

Remove the ISA SCSI adapter using the following steps:

1. Remove the top cover and left side panel, as described in Section 8.2.1.
2. Remove the card cage door, as described in Section 8.2.2.
3. Locate the ISA SCSI adapter in backplane slot 10, the top ISA backplane slot, directly below the base CPU module, as shown in Figure 8–14.

Figure 8–14 ISA SCSI Adapter Installation and Cabling



4. Disconnect any devices attached to the ISA SCSI adapter.
5. Disconnect the ribbon cable that attaches the ISA SCSI adapter to the backplane. Figure 8–14 shows this connection.
6. Hold the module by the finger grips, pull the module toward you, and slide the module out of the backplane slot. See Figure 8–6.

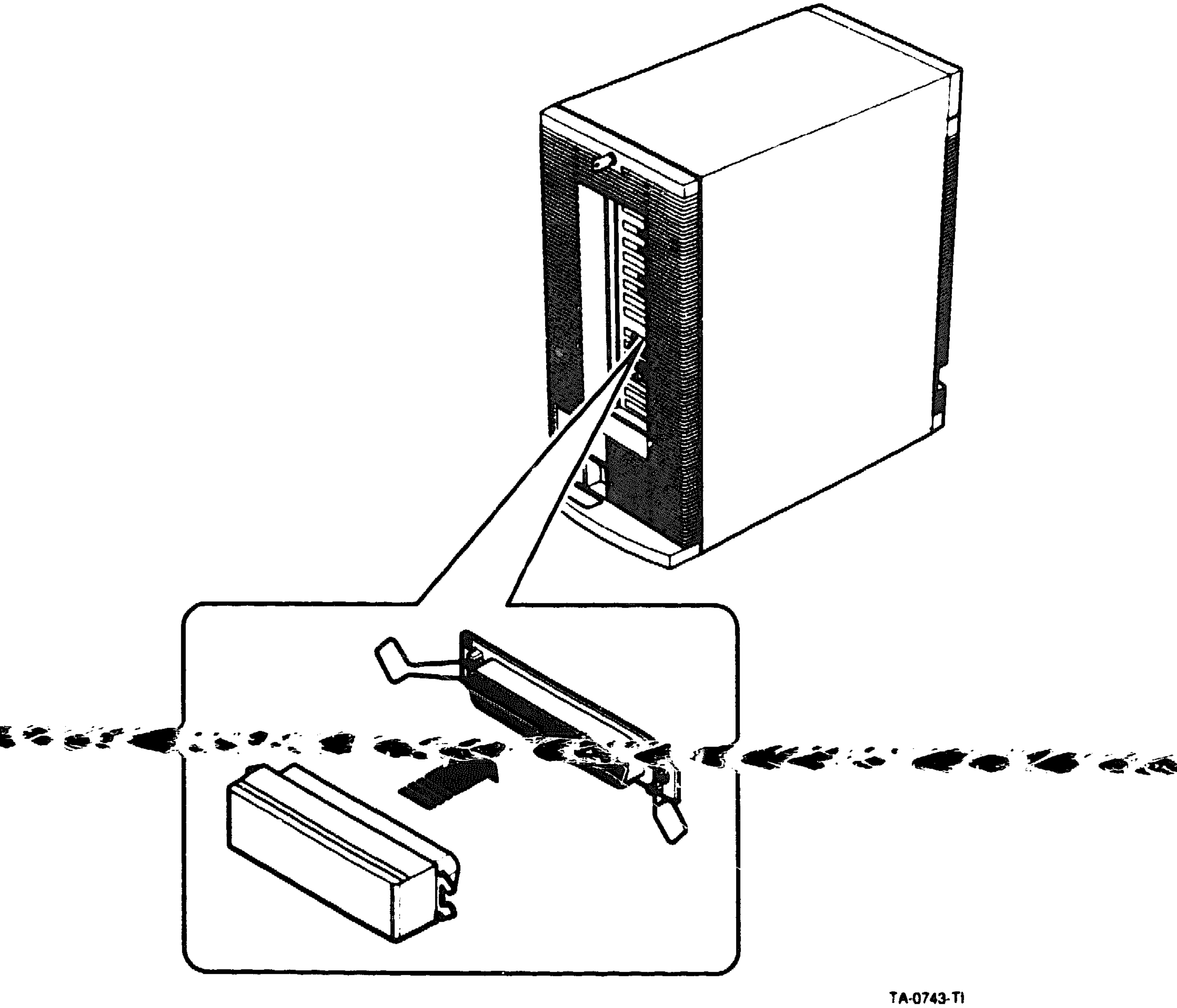
Replace the ISA SCSI adapter as follows:

1. Slide the module into the backplane slot with the component side facing up. Make certain that the fingers of the module are fully inserted into the backplane slot.
2. Align the module's distribution panel with the screw hole in the chassis and insert the screw saved from step 1.
3. Replace the card cage door and install the top cover and side panels before applying power to the system.

8.15 Terminator

The ISA SCSI adapter has an external connector on it for attaching additional SCSI devices. When external devices are not connected, a SCSI terminator (H8574-A) must be installed on this connector to terminate the SCSI bus. Figure 8–15 shows the terminator needed.

Figure 8–15 SCSI Terminator Installed on External Connector



8.16 Serial/Parallel Adapter

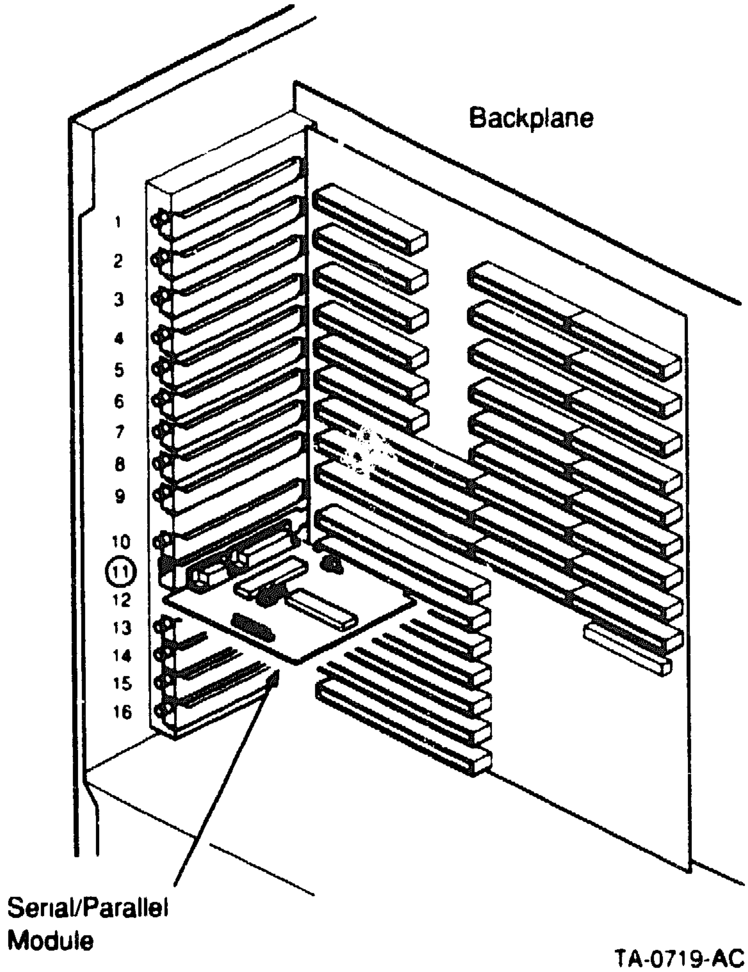
Remove the serial/parallel module as follows:

1. Remove the top cover and left side panel, as described in Section 8.2.1.
2. Remove the card cage door, as described in Section 8.2.2.
3. Locate the serial/parallel module that is factory-installed in slot 11, as shown in Figure 8–16.
4. Disconnect any cables attached to the serial or parallel ports. There are no internal cables or other connections to the module.
5. Remove the ISA module, as described in Section 8.6.

Replace the serial/parallel module as follows:

1. Check that the module is jumper-configured the same as the removed module.
2. The serial/parallel module is factory-installed in slot 11 as shown in Figure 8–16. If replacing the factory-installed serial/parallel module, install it into slot 11.

Figure 8–16 Installing the Serial/Parallel Board in the Backplane

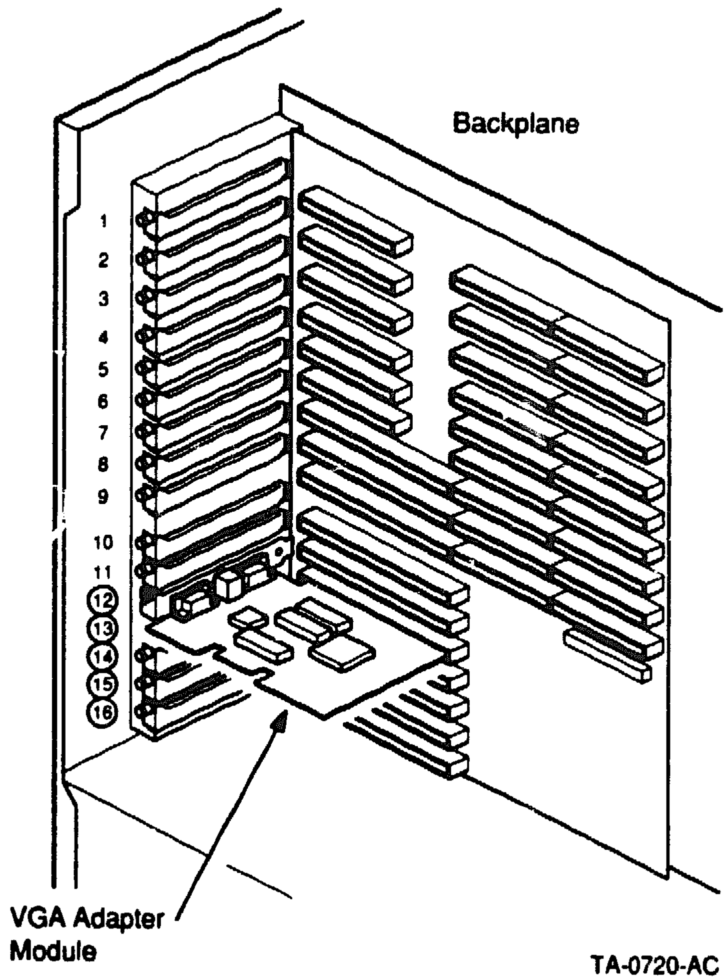


3. Installation of an ISA module is described in Section 8.6.
4. Close the system box by replacing the card cage door and top and side panels.
5. Reconnect any cables that were attached to the serial or parallel ports.

8.17 Video Graphics Adapter (VGA)

The VGA module is located in the ISA bus. The ISA BUS backplane slots are slots 10-16. For more information about the backplane slots, see Figure 8–17.

Figure 8–17 VGA Graphics Adapter Backplane Location



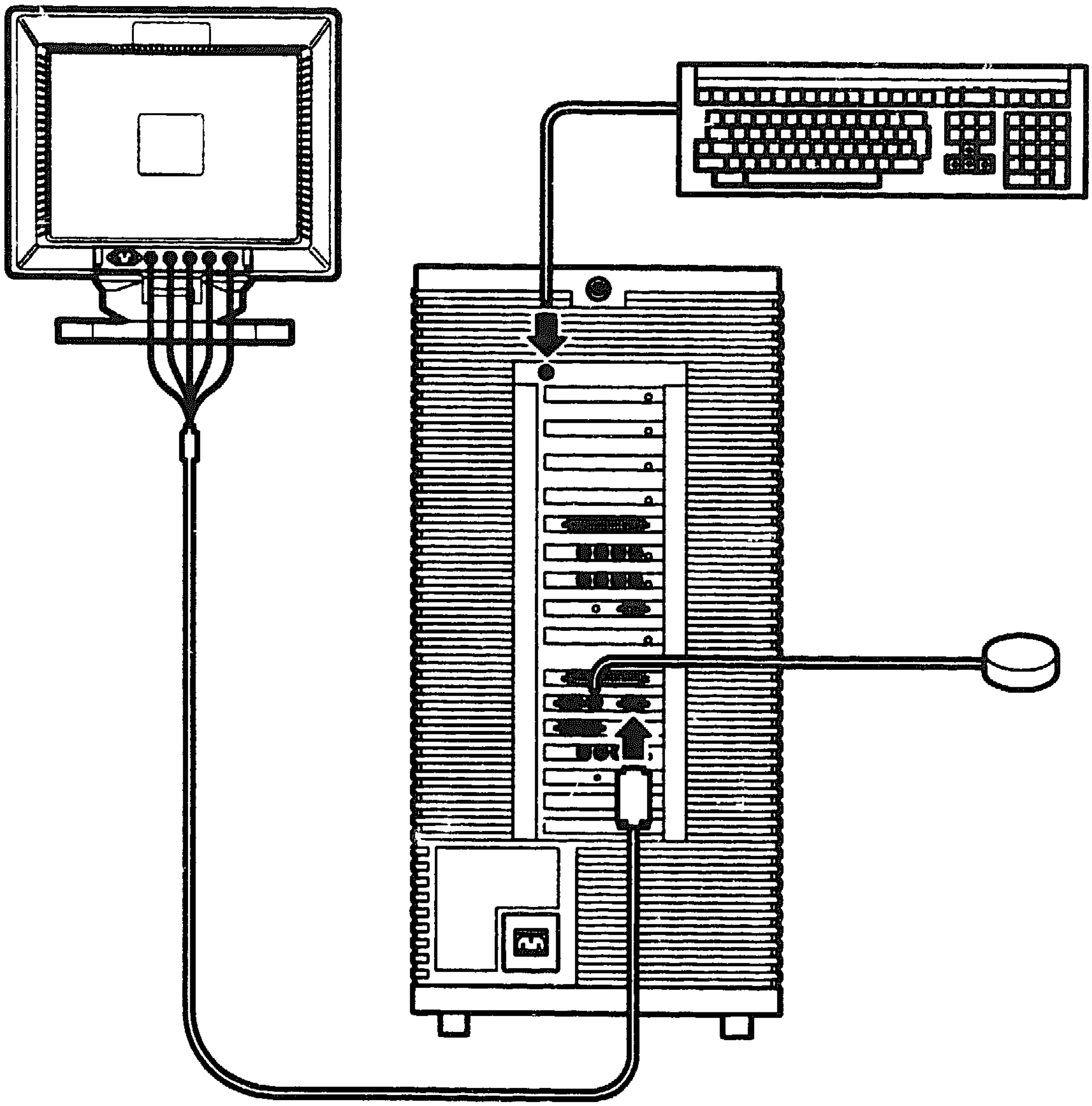
Remove the VGA adapter as follows:

1. Disconnect the VGA monitor and mouse. Connections are shown in Figure 8–18.
2. Remove the top cover and left side panel, as described in Section 8.2.1.
3. Remove the card cage door, as described in Section 8.2.2.
4. Remove the ISA module, as described in Section 8.6.

Replace the VGA adapter as follows:

1. Install the VGA adapter, as described in Section 8.6.
2. Install the ISA module in any ISA backplane slot, as shown in Figure 8–17.
3. Close the system box.
4. Connect the VGA monitor. Connections are shown in Figure 8–18.

Figure 8–18 Connecting a VRC16 VGA Monitor

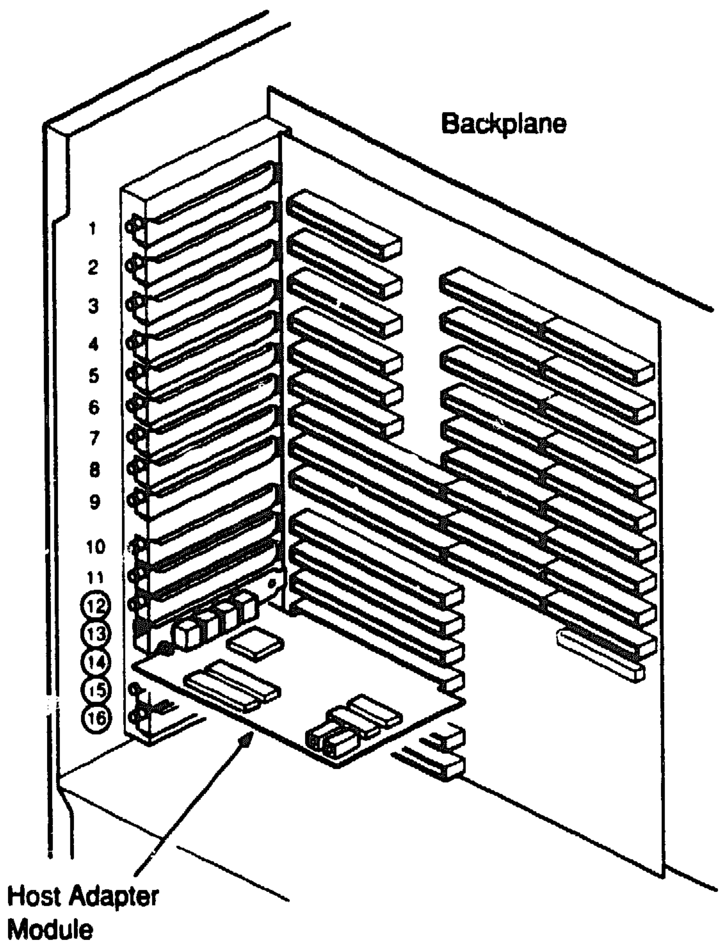


8.18 Terminal Multiplexer Module

Remove the terminal multiplexer module as follows:

1. Locate the terminal multiplexer in any backplane slot, as shown in Figure 8–19.

Figure 8–19 Terminal Multiplexer Backplane Locations



2. Disconnect any terminal concentrator attached to the terminal multiplexer module.
3. Remove the top cover and left side panel, as described in Section 8.2.1.
4. Remove the card cage door, as described in Section 8.2.2.
5. Remove the ISA module, as described in Section 8.6.

Install the terminal multiplexer module as follows:

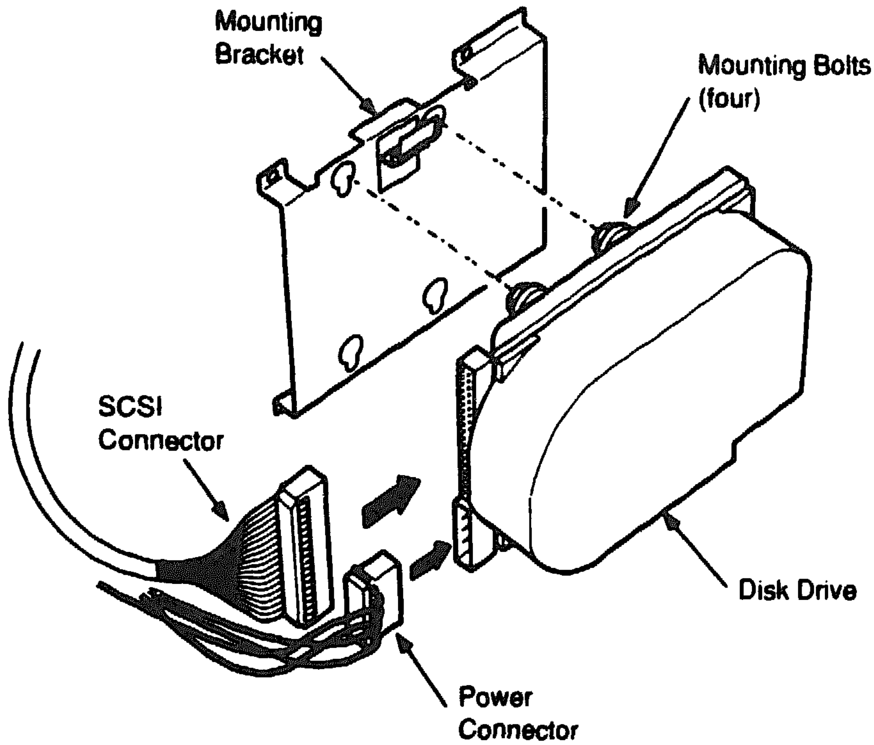
1. Check that the terminal multiplexer address is set correctly. The first terminal multiplexer should be set to E1, the second should be set to E2. For more information about the terminal multiplexer, see Section 2.12.
2. Install the MUX in the same slot as the removed MUX. Slide the module into the backplane slot with the component side facing up. Make certain that the fingers of the module are fully inserted into the backplane slot.
3. Align the module's distribution panel with the screw hole in the chassis and insert the screw saved from step 1. The module is now installed in the backplane.
4. Connect any terminal concentrator that was attached to the failed terminal multiplexer module.

8.19 209 MB Disk Drive RZ24

Remove the 209 MB hard disk drive as follows:

1. Disconnect the power cable from the power receptacle on the drive.
2. Disconnect the SCSI cable from the drive. See Figure 8–20.

Figure 8–20 209 MB Disk Drive



3. Remove the top cover and right side panel, if necessary, as described in Section 8.2.1.
4. Depress the clip that holds the drive in place.
5. Slide the drive up in the mounting holes so that the mounting bolts are in the large section of the mounting bolt holes.
6. Lift the drive away from the mounting bracket.

Install the 209 MB hard disk drive as follows:

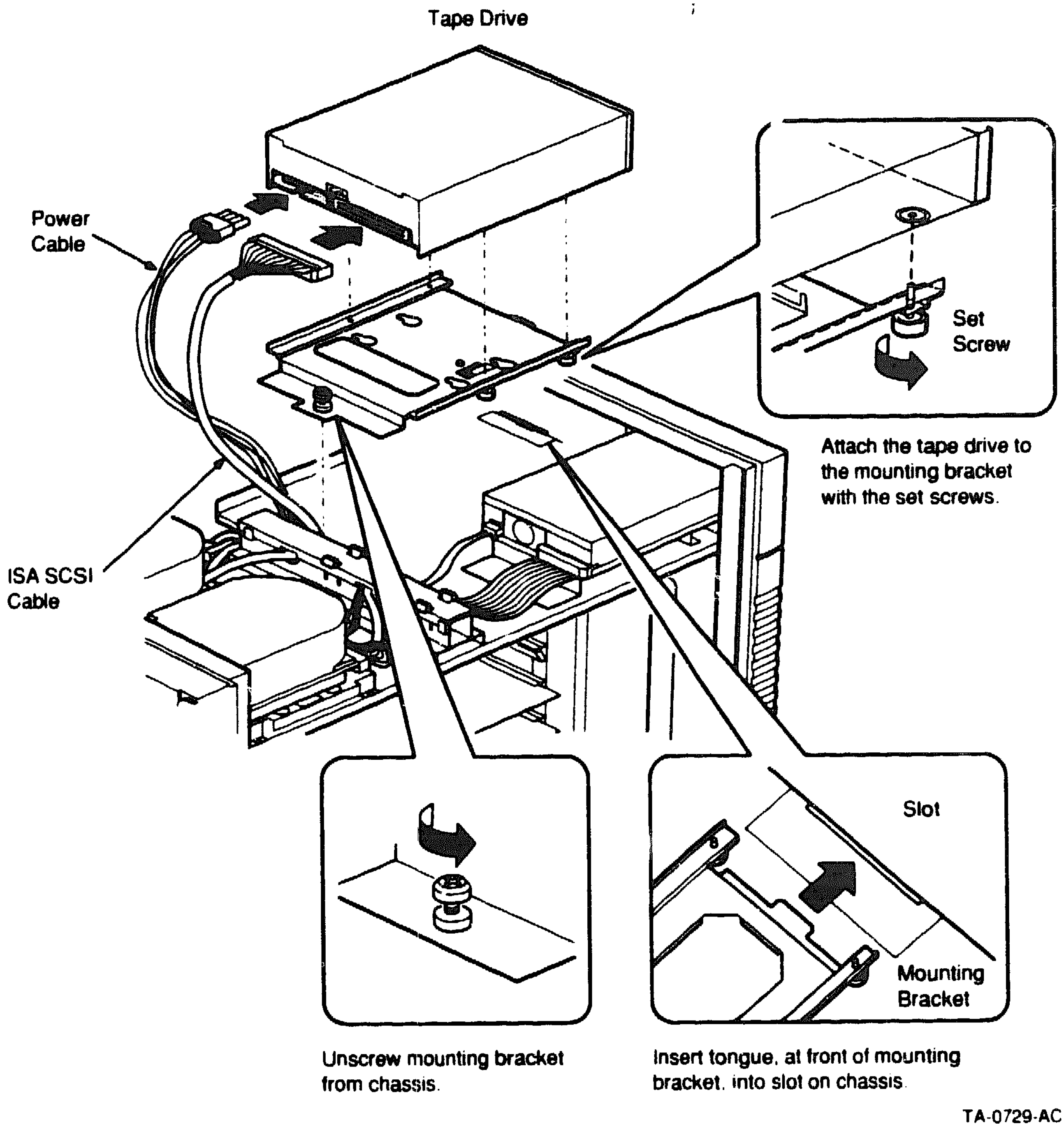
1. Align the disk drive mounting bolts with the mounting bracket holes. The grommets over the mounting bolts provide protection against shock and vibration. See Figure 8–20.
2. Insert the disk drive mounting bolts into the mounting bracket holes.
3. Slide the disk drive sideways to lock the mounting bolts into the bracket holes.
4. Connect the power cable to the power receptacle on the drive. See Figure 8–20.
5. Connect the SCSI cable to the drive. See Figure 8–20.
6. Replace the top cover and side panels.

8.20 320/525 MB Quarter-Inch Tape Drive TZK10

Remove the QIC tape drive as follows:

1. Remove the top cover and right side panel, as described in Section 8.2.1.
2. Disconnect the power cable and the SCSI cable from the back of the tape drive.
3. Loosen the large mounting screw at the back of the bracket that connects the mounting bracket to the system chassis.
4. Remove the tape drive and mounting bracket assembly.
5. Loosen the four feet (captive screws) that hold the drive to the mounting bracket.
6. Remove the drive from the bracket. See Figure 8–21.

Figure 8–21 QIC Tape Mounting Bracket and Cabling



Replace the QIC tape drive as follows:

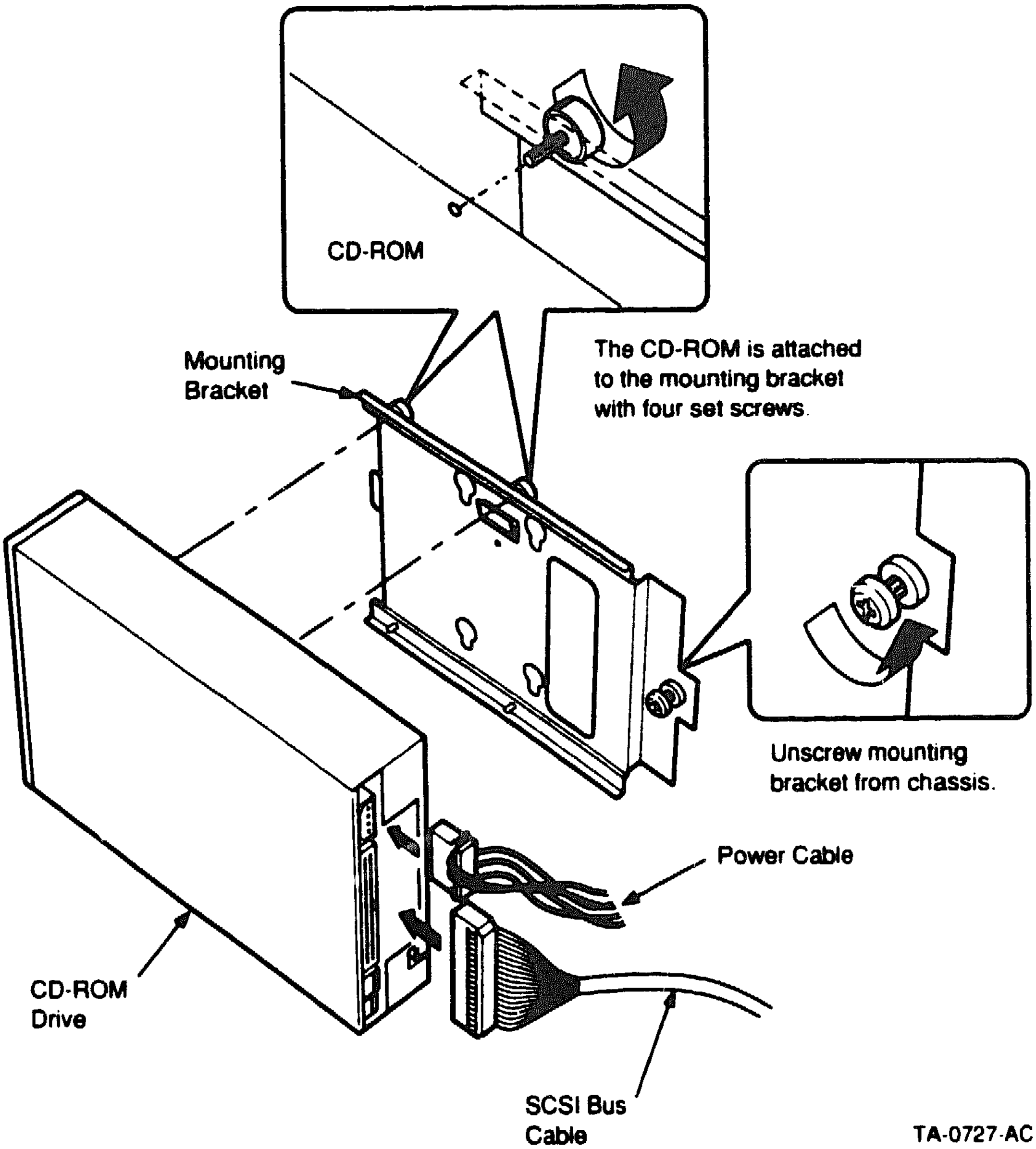
1. Align the four holes in the QIC tape drive with the mounting bracket set screws. Tighten the screws to attach the drive to the mounting bracket.
2. Place the front of the QIC tape through the front bezel opening while placing the mounting bracket tab into the metal lip of the chassis.
3. Align the mounting bracket set screw over the hole in the system chassis and tighten it to attach the mounting bracket to the chassis.
4. Connect the SCSI bus cable to the back of the QIC drive.
5. Connect the power connector to the back of the QIC drive.

8.21 CD-ROM Drive RRD42

Remove the CD-ROM as follows:

1. Remove the top cover and right side panel, as described in Section 8.2.1.
2. Disconnect the power connector from the back of the CD-ROM.
3. Disconnect the SCSI bus data cable from the CD-ROM.
4. Remove the CD-ROM mounting bracket by loosening the large mounting screw at the rear of the mounting bracket.
5. Lift the drive and the mounting bracket away from the system chassis. See Figure 8–22.

Figure 8–22 CD-ROM Installation



6. Loosen the four setscrews on the mounting bracket. See Figure 8–22.
7. Remove the CD-ROM from the mounting bracket.

Install the CD-ROM as follows:

1. Attach the CD-ROM to the mounting bracket. Align the four setscrews with the holes in the CD-ROM outercase and tighten the screws. The front of the CD-ROM must be opposite the mounting bracket's large setscrew. See Figure 8–22.
2. Place the front of the CD-ROM through the front bezel opening while placing the mounting bracket tab into the metal lip of the chassis. Align the mounting bracket setscrew over the hole in the system chassis and tighten it to attach the mounting bracket to the chassis.
3. Connect the power connector to the back of the CD-ROM.
4. Connect the SCSI bus data cable to the CD-ROM.

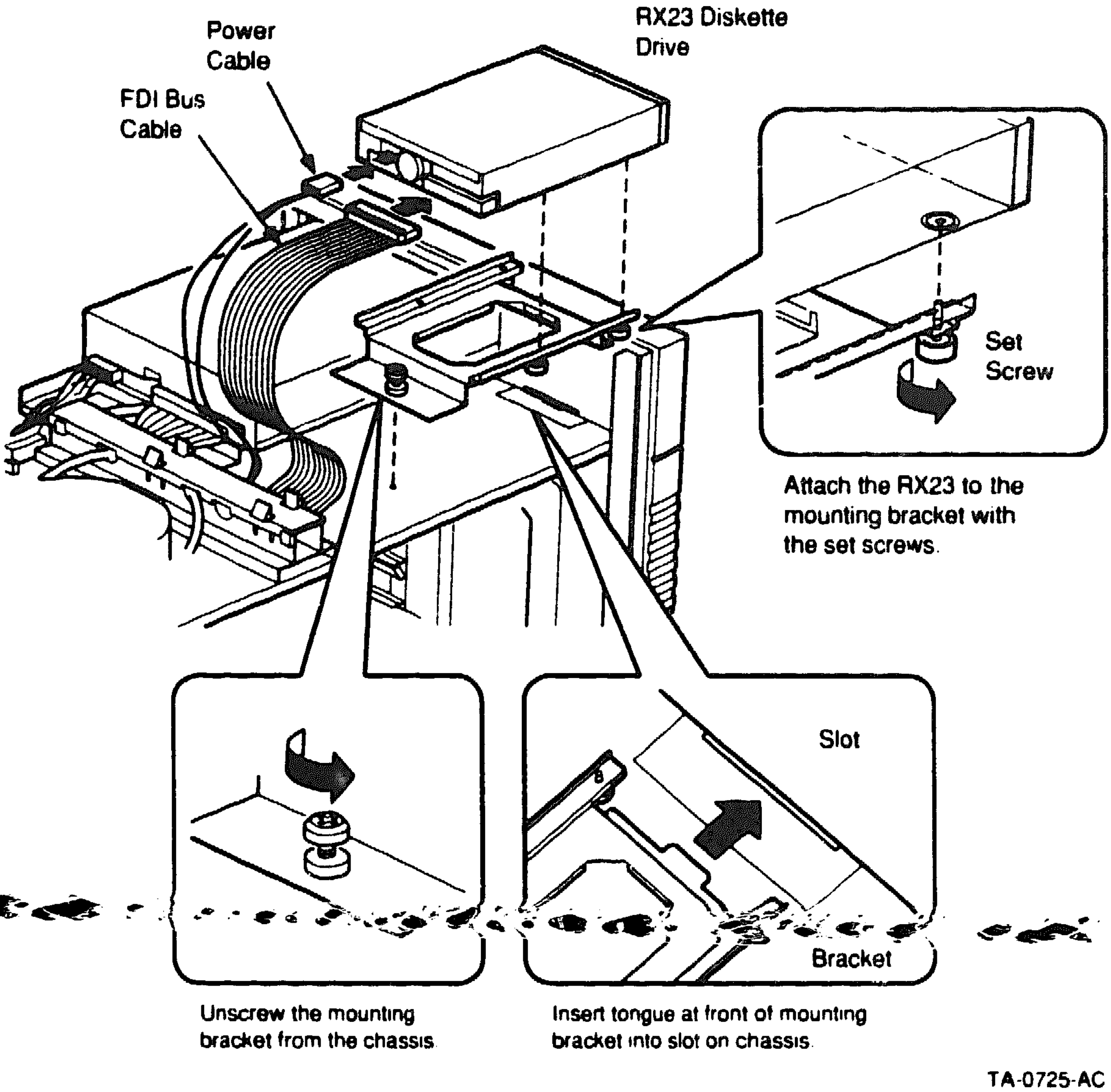
8.22 3.5-inch 1.44 MB Diskette Drive RX23

Before replacing a 3.5-inch 1.44 MB Diskette Drive RX23 as faulty, ensure that the drive ID switch, on the right side of the drive, is set to ID 1.

Remove the RX23 as follows:

1. Disconnect the power cable from the rear of the diskette drive.
2. Disconnect the flat ribbon cable.
3. Remove the top cover and right side panel, as described in Section 8.2.1.
4. Loosen the single large screw at the back of the mounting bracket. (This connects the diskette drive mounting bracket to the system chassis.) See Figure 8–23.

Figure 8–23 RX23 3.5-Inch 1.44 MB Floppy Disk Drive Mounting Bracket



5. Lift the diskette drive and the mounting bracket away from the system chassis. See Figure 8–23.
6. Loosen the four setscrews that attach the RX23 to the mounting bracket. See Figure 8–23.
7. Remove the drive from the mounting bracket.

Install the RX23 as follows:

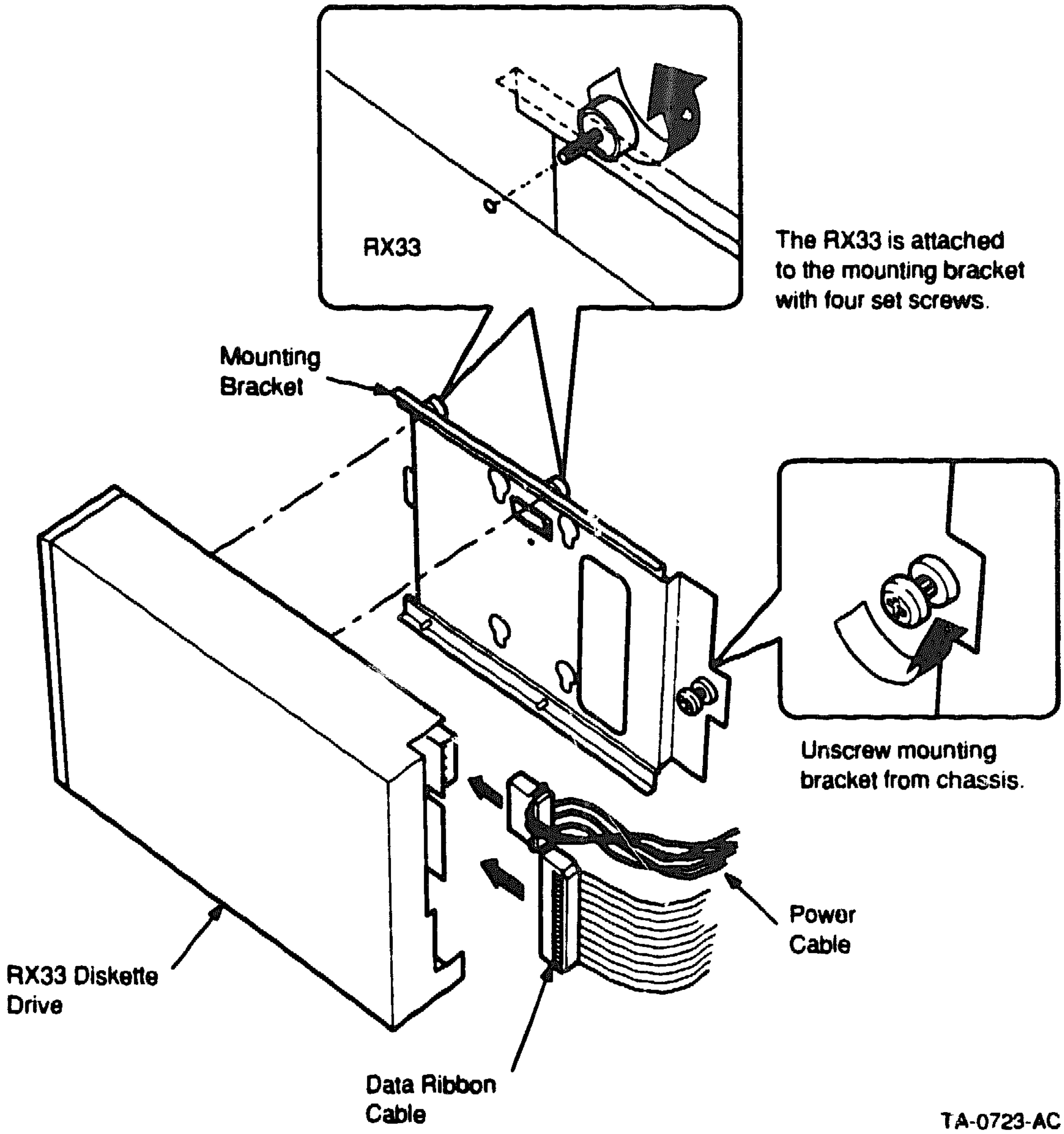
1. Check that the drive ID switch on the right side of the drive is set to ID 1.
2. Attach the RX23 to the mounting bracket. Align the four setscrews with the holes in the RX23 outercase and tighten the screws. See Figure 8–23.
3. Slide the RX23 into position on the side of the chassis and tighten the mounting bracket screw to attach the mounting bracket to the chassis. See Figure 8–23.
4. Attach the power cable to the rear of the diskette drive.
5. Attach the flat ribbon cable to the back of the diskette drive.

8.23 5.25-inch 1.2 MB Floppy Disk Drive RX33

Remove the 5.25-inch diskette drive as follows:

1. Disconnect the power cable to the rear of the diskette drive.
2. Disconnect the flat ribbon cable from the back of the diskette drive.
3. Remove the top cover and right side panel, as described in Section 8.2.1.
4. Remove the diskette drive mounting bracket from the system chassis by loosening the single large screw at the back of the bracket. See Figure 8–24.

Figure 8–24 5.25-inch 1.2 MB Floppy Disk Drive



5. Loosen the large screw that attaches the mounting bracket to the chassis.
6. Remove the RX33 and its mounting bracket by sliding it through the front bezel opening. See Figure 8–24.

7. Loosen the four setscrews that attach the RX23 to the mounting bracket. See Figure 8–24.
8. Remove the drive from the mounting bracket.

Install the 5.25-inch diskette drive as follows:

1. Before you replace the 5.25-inch diskette drive in the applicationDEC system, verify that the drive is jumper-configured, as shown in Figure 2–33.
2. Remove the top cover and right side panel, as described in Section 8.2.1.
3. Remove the diskette drive mounting bracket from the system chassis by loosening the single large screw at the back of the bracket. See Figure 8–24.
4. Attach the RX33 to the mounting bracket. Align the four setscrews with the holes in the RX33 outercase and tighten the screws. The front of the RX33 must be opposite the large setscrew on the mounting bracket.
5. Slide the RX33 mounting bracket through the front bezel opening and under the metal lip on the chassis. Tighten the mounting bracket screw to attach the mounting bracket to the chassis. See Figure 8–24.
6. Attach the power cable to the rear of the diskette drive.
7. Attach the flat ribbon cable to the back of the diskette drive.

   The 5.25-inch diskette drive is now installed, and the top and side panels can be replaced.

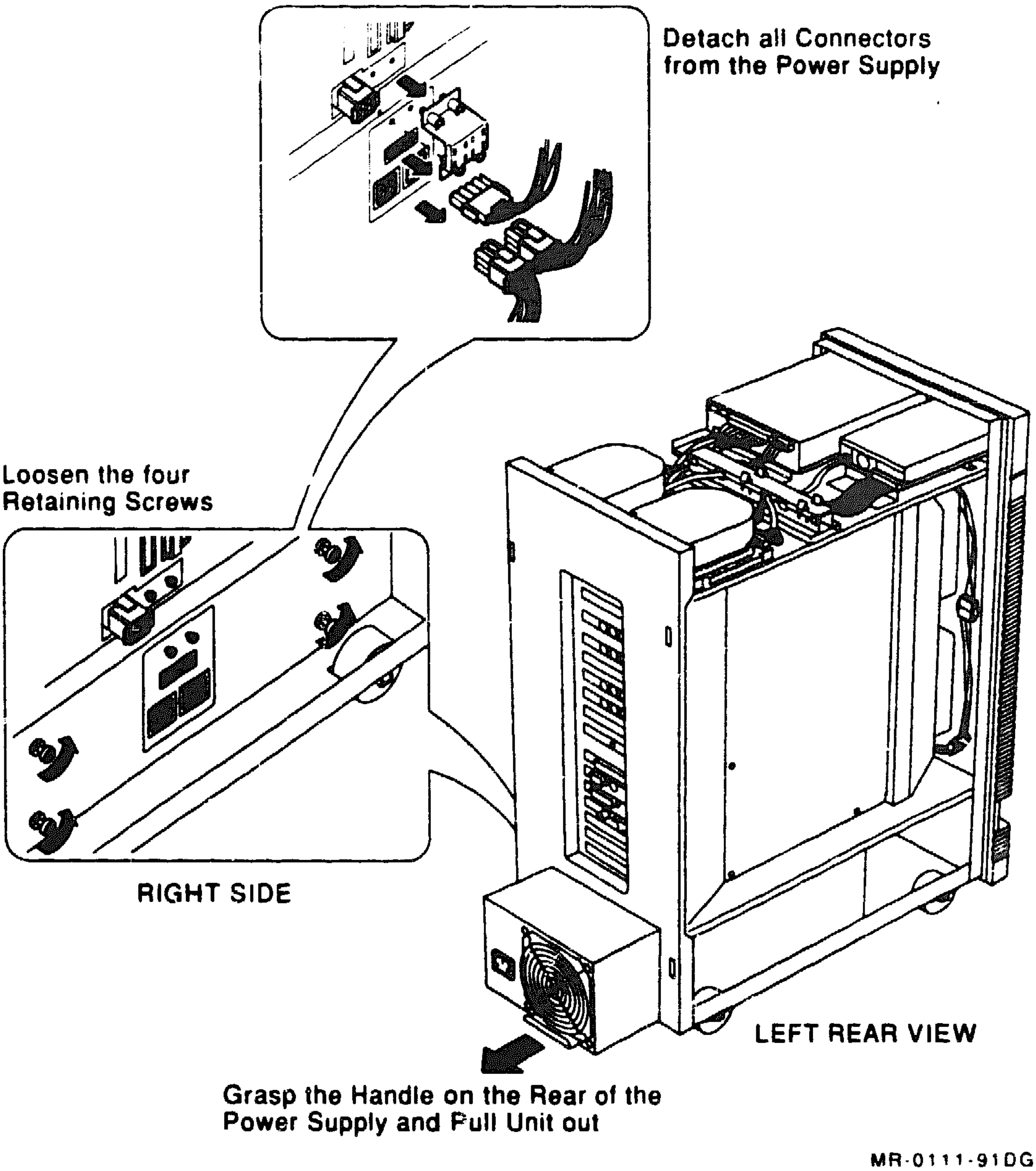
8.24 Power Supply

The following steps describe the removal procedure for the power supply. See Figure 8–25.

1. Disconnect the power cord.
2. Remove the top cover and side panels, as described in Section 8.2.1.
3. Remove the rear bezel, as described in Section 8.4.
4. Disconnect all connectors and the bus bar from the power supply. Bus bar removal is detailed in Section 8.26.
5. Loosen the four screws holding the power supply in place.
6. Grasp the handle on the rear of the power supply and pull the power supply out of the system box.

Reverse the above procedure to reinstall a power supply.

Figure 8–25 Power Supply Removal



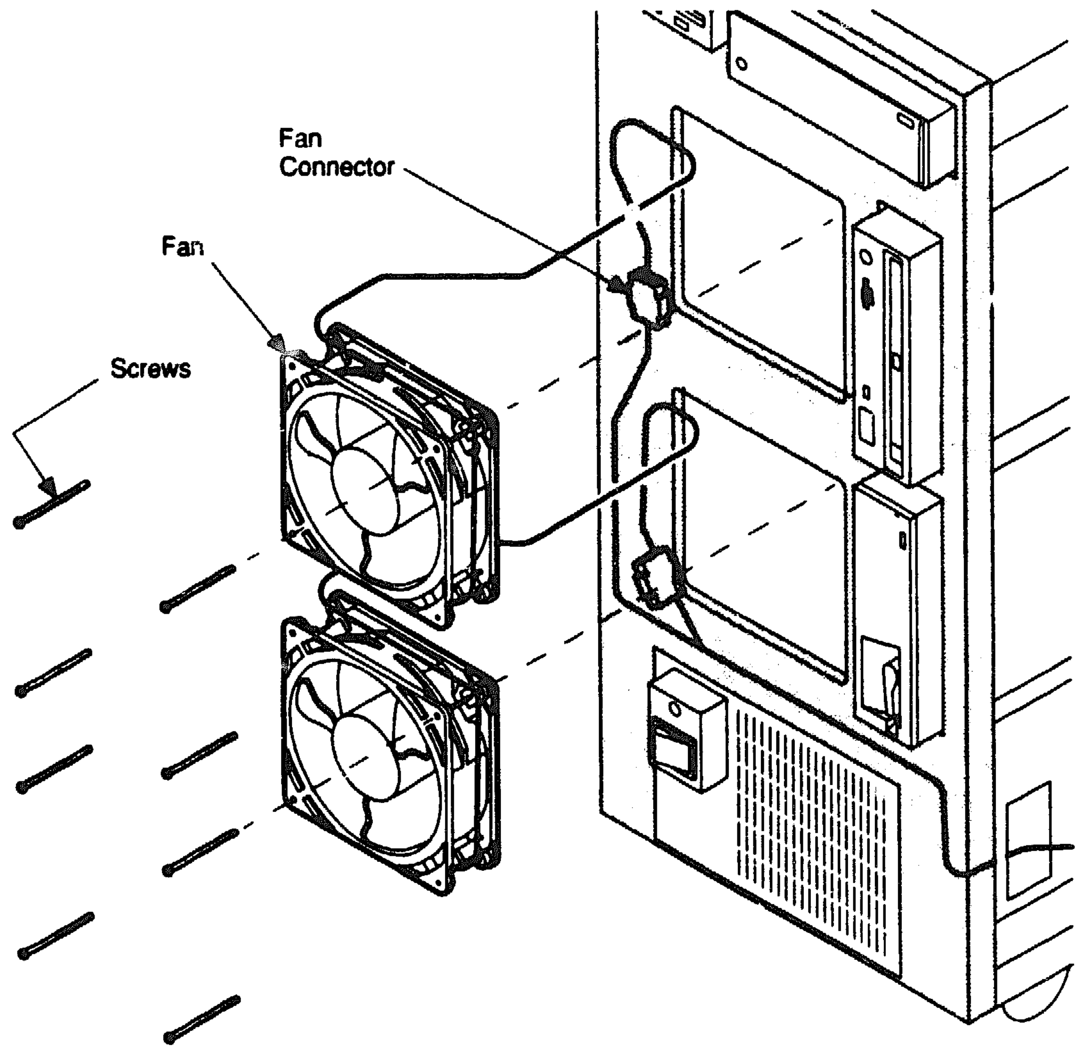
8.25 Fans

The following steps describe the removal procedure for a fan. See Figure 8–26.

1. Disconnect the power cord.
2. Remove the top cover and side panels, as described in Section 8.2.1.
3. Remove the front bezel, as described in Section 8.3.
4. Disconnect the fan connector.
5. Loosen the four screws holding the fan to the system box chassis.
6. Remove the fan.

Reverse the above procedure to reinstall a fan.

Figure 8–26 Fan Removal



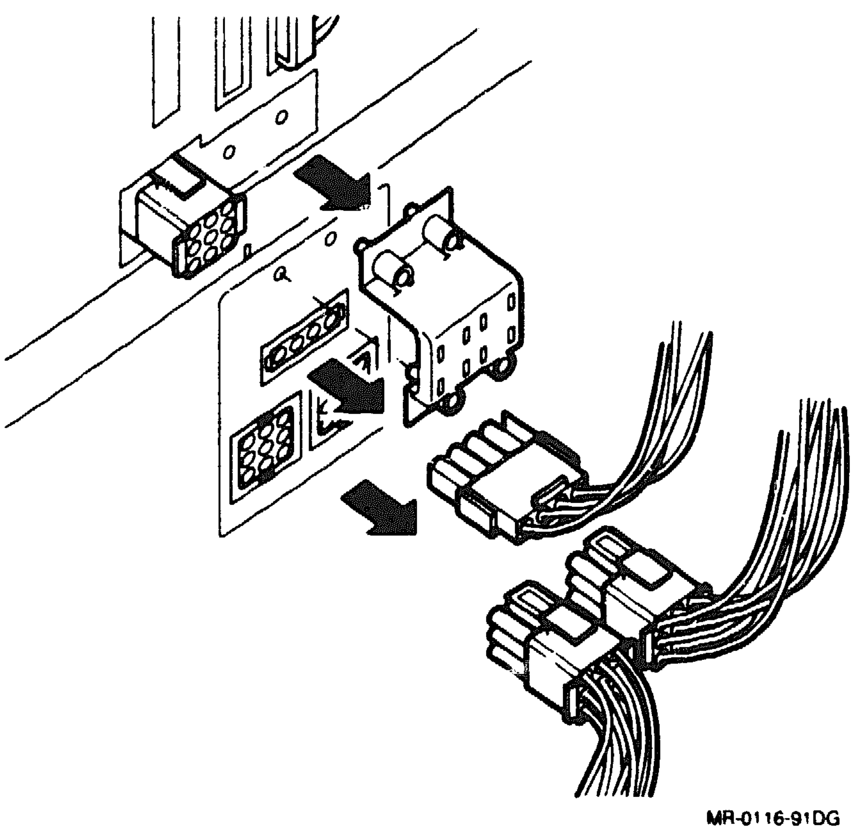
8.26 Bus Bar

The following steps describe the removal procedure for the bus bar. The bus bar connects between the power supply and the backplane. See Figure 8–27.

1. Disconnect the power cord.
2. Remove the top cover and side panels, as described in Section 8.2.1.
3. Loosen the four screws connecting the bus bar to the the power supply and backplane.
4. Remove the bus bar.

Reverse the above procedure to reinstall a bus bar.

Figure 8–27 Bus Bar Removal



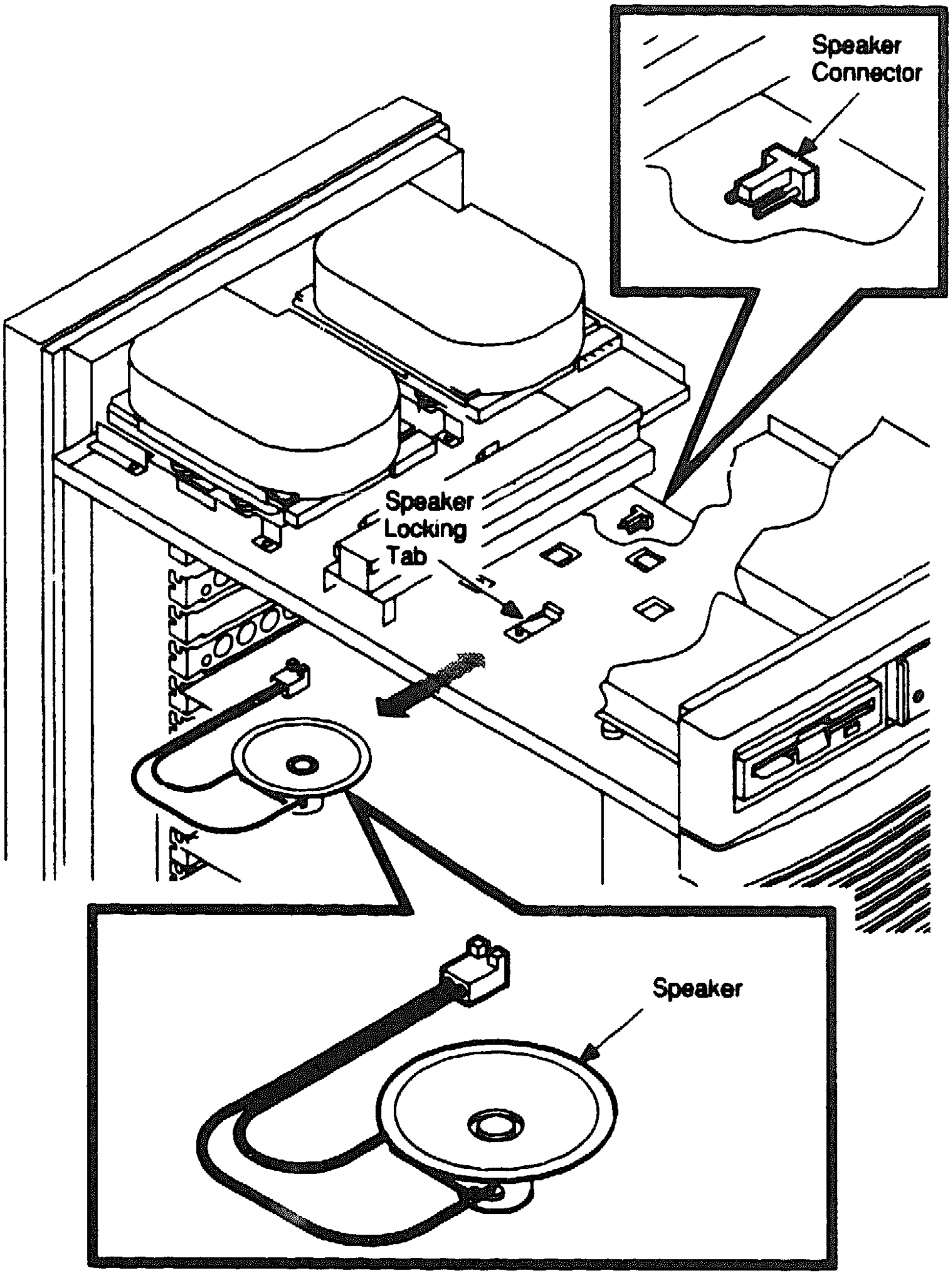
8.27 Speaker

The following steps describe the removal procedure for the speaker. See Figure 8–28.

1. Disconnect the power cord.
2. Remove the top cover and side panels, as described in Section 8.2.1.
3. Remove the card cage door, as described in Section 8.2.2.
4. If installed, remove the modules from the card cage in the two slots directly below the speaker.
5. Disconnect the speaker connector.
6. Lift the speaker locking tab on the top of the system box chassis (behind the RX23) and pull the speaker out of the system box.

Reverse the above procedure to reinstall a speaker.

Figure 8–28 Speaker Removal



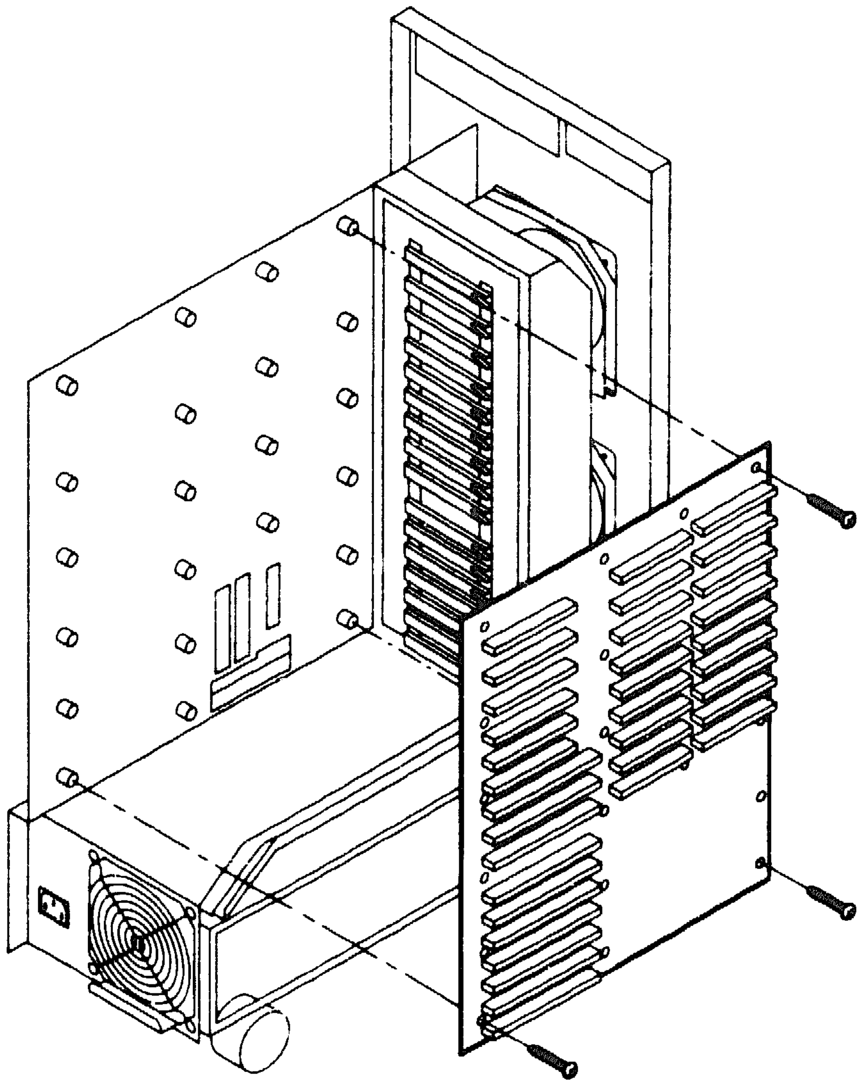
8.28 Backplane

To remove the backplane, use the following steps. See Figure 8–29.

1. Open the box, as described in Section 8.2.
2. Remove the bus bar, as described in Section 8.26.
3. Disconnect the SCSI cables.
4. Disconnect the power connection to the backplane.
5. Disconnect any cables attached to the I/O connections in the back of the system. Remove all modules from the backplane. Note their slot location for reinsertion.
6. Remove the 22 screws that hold the backplane in place.
7. Slowly pull the backplane away from the chassis.

To install a new backplane, reverse the above directions. Make certain that all modules are reinstalled in their original slots and that all external connections are reconnected.

Figure 8–29 Backplane Removal



CHAPTER 9

9 Other Diagnostics

This chapter describes additional diagnostics capabilities that are available for the applicationDEC 433MP.

The PC Diagnose, Hardware Diagnostics for the PC, product (manufactured by Teknosys, Inc.) can be used for assistance in diagnosing the applicationDEC 433MP. PC Diagnose requires that the system have a VGA monitor attached. PC Diagnose is useful because of the additional testing of diskette floppy drives it provides. Refer to the manual supplied with the PC Diagnose product for full instructions on running the diagnostic software. (Note: PC Diagnose contains a test of an 80387 math co-processor which is not present on the applicationDEC 433MP. Ignore any errors from the co-processor test.)

There are separate diagnostic floppy diskettes for the following Digital Equipment Corporation products:

- Terminal multiplexer host adapter
- PS1XG-AA video graphics adapter

Diagnostics for these are described in the following sections.

In addition, the following reference-sell items may be found in an applicationDEC 433MP system:

- Western Digital WD8003 Ethernet module
- 3COM 3C503 Ethernet module

Reference-sell items are items sold by a source other than Digital Equipment Corporation. It is recommended that your customer purchase these two items because they are fully supported by SCO UNIX Release 3.2 version 2.

Diagnostics for both of these reference items are shipped with the modules. Refer to the manuals shipped with each module for information on how to use the diagnostic floppy diskettes from Western Digital and 3COM.

9.1 Terminal Multiplexer Host Adapter Diagnostics

The terminal multiplexer diagnostic is included on the terminal multiplexer software driver diskette.

The diagnostics are loaded as part of the software driver. If the terminal multiplexer software driver is installed, the diagnostics are available. You do not need to boot the diskette to run the diagnostics.

The terminal multiplexer processor diagnostic (mxd) is a modular diagnostic consisting of 34 tests that are executed as one utility. The diagnostic should be run while in System Maintenance mode.

To run mxd (all standard tests) on board 1, enter:

```
/etc/8x4/mxd
```

To run mxd on board 2, enter:

```
/etc/8x4/mxd -b 2
```

The following sections show how to run selected tests, nonstandard tests, and options for looping and modifying the test output.

9.1.1 Usage

Standard command line syntax for mxd is:

```
/etc/8x4/mxd -b n
/etc/8x4/mxd -T
/etc/8x4/mxd [-b n] [-QqLl] [-a x-y]
/etc/8x4/mxd [-b n] [-QqLl] [-a x-y] test ...
/etc/8x4/mxd [-b n] [-QqLl] [-a x-y] test -test ...
```

9.1.2 Options

-T	Print table of tests and usage. Overrides all other options and does not run any tests.
-b n	Specify Terminal Multiplexer board number n (1-4). The default is [illegible] if -b is not specified.
-Q	Run tests very quietly. The diagnostic does not generate any status or error messages.
-q	Run tests quietly. The diagnostic generates only error messages.
-L	Infinite loop on test. The diagnostic automatically repeats the sequence of tests specified. This is the preferred loop mode for normal use.
-l	Infinite loop on tests. A technician loop that repeats the inner loop of a single test.

-a x-y	Specify address range limits for tests that test memory (tests 5 through 8). Limits are specified in hexadecimal. The lower memory limit is x and the upper memory limit is y. The default is all 64K if the -a option is not specified. See the example that follows this list.
test	List of individual test numbers to run. If no test numbers are specified, then all standard tests are run. Standard tests are those listed with std in the right column when a test table (-T) is run.
test-test	Range or ranges of test numbers to run.

Example:

```
/etc/8x4/mxd -b 2 -a 0-ff 1-4 7
```

This example selects board 2 for the tests, sets the address range of any memory test to 0-ff, then runs tests 1,2,3,4,7. Tests 1-4 initialize the board.

9.1.3 Test Descriptions

Table 9–1 briefly describes each of the mxd tests.

Table 9–1 mxd Test Descriptions

No.	Name	Description
0	tech tests	The diagnostic enters a mode that accepts interactive commands to peek and poke into Terminal Multiplexer I/O and memory address space. For a detailed description of this command, see Section 9.1.4.
1	board reset	Reset 80188 8530s, 8237, and all board functions.
2	blink LED	Blink green LED for 1 to 2 seconds.
3	DMA reg I/O	Test 8237 register access from base CPU using rotating ones and rotating zeros patterns.
4	DMA reset	Reset 8237.
5	memory fill ones	Fill specified memory addresses (-a option) with all ones and verify.
6	memory fill zeros	Fill specified memory addresses (-a option) with all zeros and verify.

(continued on next page)

Table 9–1 (Cont.) mxd Test Descriptions

No.	Name	Description
7	memory walking ones	Test memory over the specified range (-a option) using a walking ones pattern. Note that this test will take a long time to run if the address range is large. This test is nonstandard and will run only if specified on the command line.
8	memory walking zeros	Test memory over the specified range (-a option) using a walking zeros pattern. This test will take a long time to run if the address range is large. This test is nonstandard and will run only if specified on the command line.
9	SCC A reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros patterns.
10	SCC B reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros patterns.
11	SCC C reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros patterns.
12	SCC D reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros patterns.
13	asynchronous internal loopback A	Test asynchronous serial data transfer on 8530 channel A using programmed I/O and internal loopback modes.
14	asynchronous internal loopback B	Test asynchronous serial data transfer on 8530 channel B using programmed I/O and internal loopback modes.
15	asynchronous internal loopback C	Test asynchronous serial data transfer on 8530 channel C using programmed I/O and internal loopback modes.
16	asynchronous internal loopback D	Test asynchronous serial data transfer on 8530 channel D using programmed I/O and internal loopback modes.
17	DMA asynchronous internal loopback A	Test asynchronous serial data transfer on 8530 channel A using DMA I/O and internal loopback modes.
18	DMA asynchronous internal loopback B	Test asynchronous serial data transfer on 8530 channel B using DMA I/O and internal loopback modes.

(continued on next page)

Table 9–1 (Cont.) mxd Test Descriptions

No.	Name	Description
19	DMA asynchronous internal loopback C	Test asynchronous serial data transfer on 8530 channel C using DMA I/O and internal loopback modes.
20	DMA asynchronous internal loopback D	Test asynchronous serial data transfer on 8530 channel D using DMA I/O and internal loopback modes.
21	DMA asynchronous output A	Generate asynchronous data output on 8530 channel A using DMA I/O.
22	DMA asynchronous output B	Generate asynchronous data output on 8530 channel B using DMA I/O.
23	DMA asynchronous output C	Generate asynchronous data output on 8530 channel C using DMA I/O.
24	DMA asynchronous output D	Generate asynchronous data output on 8530 channel D using DMA I/O.
25	external loopback A <-> C	Sends characters between terminal concentrator ports A and C, using DMA I/O and asynchronous mode at 19.2K baud.
26	external loopback B <-> D	Sends characters between terminal concentrator ports B and D, using DMA I/O and asynchronous mode at 19.2K baud. This test requires that a standard Terminal Multiplexer mux-to-terminal concentrator cable be installed connecting ports B and D. This test also requires running test 4 prior to executing this test.
27	host interrupt self	Test the ability of the host adapter processor to interrupt the base CPU.
28	start loop	Start execution of the '188 in a very small loop at the start-up vector.
29	nop loop	Start execution of the '188 in a nop loop.
30	read/write loop	Start execution of the '188 in a memory read/write loop. The base CPU verifies the operation.
31	DMA io loop	Start execution of the '188 in an I/O loop referencing the 8237. The base CPU verifies the operation.
32	SCC io loop	Start execution of the '188 in an I/O loop referencing the 8530. The base CPU verifies the operation.

(continued on next page)

Table 9–1 (Cont.) mxd Test Descriptions

No.	Name	Description
33	interrupt	Test the ability of the base to interrupt the Terminal Multiplexer '188.
34	bus lock	Verify the proper operation of test, and set memory operations.

9.1.4 Tech Test Commands

Diagnostic test 0 enters a mode which provides interactive commands that allow peeking and poking into Terminal Multiplexer I/O and memory address space:

```
/etc/8x4/mxd -b n 0
```

where *n* is Terminal Multiplexer processor 1 to 4.

The * prompt is output to indicate tech test mode. All addresses specified are in hexadecimal and are relative to the particular module indicated.

In response to the prompt, you can select any of the following commands:

Command	Description
q	Quit the tech test mode
ib ioaddr	Input byte from ioaddr and print
ob ioaddr byte	Output byte to ioaddr
rb maddr	Read byte from maddr and print
wb maddr byte	Write byte to maddr
rw maddr	Read word from maddr and print
ww maddr byte	Write word (16-bits) to maddr
d maddr1 maddr2	Display (print) from maddr1 to maddr2
f maddr1 maddr2 byte	Fill from maddr1 to maddr2 with byte
L	Loop on next tech test command

where:

ioaddr is Terminal Multiplexer logical I/O address [0 thru 1F]

maddr is a Terminal Multiplexer memory address [0 thru FFFF]

byte is 8 bits of data [two hex characters]

word is 16 bits of data [four hex characters]

For example, to output the byte A to Terminal Multiplexer Control Register 1 (I/O location 15) on board 3, enter:

```
/etc/8x4/mxd -b 3 0
```

You will see the tech test prompt:

```
*
```

Now enter:

```
ob 10 0
```

As an example of looping, to continually read the byte of data from memory address A5:

```
* L
* rb a5
```

To exit this loop mode, use Ctrl/C.

9.2 PS1XG-AA Video Graphics Adapter Diagnostics

There is a bootable video graphics adapter diagnostic available for testing the VGA adapter. The bootable utility diskette ships with the adapter and contains a setup program, VSETUP, and a test program, VGATEST.

The VGATEST diagnostic should be used when the adapter produces a display but does not work properly. For example:

- The adapter does not display graphics.
- The display is missing characters.
- The display has no color.
- The adapter can display in some modes, but not others.

To use the diagnostics, place the diskette in Drive A (the 3.5-inch 1.44 MB is default drive A) and reset the system by pressing the reset switch, or by recycling power.

When the diskette boots, a menu appears which allows you to select either VSETUP or VGATEST. Select VGATEST.

The VGATEST menu displays the available tests. Select the "run all tests" option to completely test the module. You are also prompted for a time delay between the tests. By selecting a short amount of time, such as 5 seconds, you will be able to observe the results of each test before the program proceeds to the next test.

If all the screens in the VGATEST display properly, the VGA adapter is functional.

If any screens do not display correctly, exit VGATEST and select VSETUP to examine the current settings. The adapter has automatic monitor detection circuitry. If it is able to identify the monitor, it automatically configures itself for that monitor. If it is unable to identify the monitor, use VSETUP to select the proper monitor (a list of brand names is presented), or configure the adapter to match your monitor.

Digital Equipment Corporation monitors that are listed in the VSETUP selection include VRC16 and VRT13 monitors.

APPENDIX A

A Description of RRD Numbered Tests

A.1 Test 1 — Reset System Bus CPUs and Flush Bridge Cache (reset)

This test verifies that all processors can be reset and that the bridge cache can be flushed. The CPUs on the system bus all respond to slot 0xf, a nonexistent slot number. All CPUs are reset by sending a reset command to slot 0xf.

The bridge cache is flushed by first zeroing and then reading system bus RAM.

Caution

The first bridge cache flush following system powerup can destroy system bus memory contents.

A.2 Test 2 — Reset System Bus CPUs (creset)

This test verifies that all processors can be reset. As in Section A.1, this test resets all CPUs on the system bus by outputting a reset command to slot 0xf.

A.3 Test 3 — Poll System Bus Slots (carb)

This test polls system bus slots to determine whether a module is resident in each slot. Figure 2–1 illustrates the system bus and ISA bus slots. Table 2–1 lists configuration possibilities for each backplane slot.

A.4 Test 4 — Flush All System Bus CPUs (cflush)

This test verifies that the external caches of all CPUs on the system bus can be flushed. The caches are flushed in the following way:

Note

The first CPU cache flush following system powerup can destroy system bus memory contents.

A.5 Test 5 — Determine CPU Type (ctype)

This test determines the type and location of all additional processors in the system. It also sets up the configuration structure that is passed to the boot loader and the system exerciser.

The type and location of processors is tested as follows:

- CPU slots are polled
- If there is memory in the system, a server is started on the processor in question
- The processor determines whether each additional processor is a SCSI CPU or an SIO CPU

A.6 Test 6 — Bridge Cache Integrity (bflush)

This test verifies the integrity of the bridge cache RAMs. A walking ones pattern test is run over the first 16 bytes of RAM without causing a cache flush. The test then does an address inversions test over the first 64K of RAM without causing a cache flush. This test should be able to run with no system bus RAM installed. Since RRD and the local RAM are not cached, their use does not cause any cache lines to be flushed.

A.7 Test 7 — Memory Sizing (msize)

This test performs the following functions:

- Determines how many memory modules are installed
- Determines how much RAM is on each module

- Determines what kind of drams (1 Mb or 4 Mb) are on a module
- Assigns starting addresses for each module to make the maximum amount of contiguous memory available

This test sets up part of the configuration structure that is passed to the boot loader and the system exerciser.

A.8 Test 8 — Check Bits with Memory Fill Ones (mones)

This test verifies that each bit can be set by filling a range of addresses in memory with ones.

A.9 Test 9 — Check Bits with Memory Fill Zeros (mzeros)

This test verifies that each bit can be cleared. It verifies a range of addresses in local RAM by filling the addresses with zeros.

A.10 Test 10 — Check Addresses (maddr)

This test verifies that each address is unique by filling each longword (32 bits) in a range of addresses in local RAM with its own physical address, then verifies the address.

A.11 Test 11 — Check Bits with Memory Walking Ones (mwones)

This test verifies that each bit is set individually and is not connected to any other bit. It verifies a range of addresses in local RAM by performing a walking ones memory test (march ones into a field of zeros), as follows:

- Memory is filled with zeros.
- Each bit is individually set (changed from 0 to 1).
- Each pass sets the next bit and verifies the previous pattern. In this way, the zeros are replaced by a series of marching ones.

A.12 Test 12 — Check Bits with Memory Walking Zeros (mwzeros)

This test verifies that each bit is cleared individually and is not connected to any other bit. The procedure is the same as Section A.11 except that the test verifies a range of addresses in memory by performing a walking zeros test (marching zeros into a field of ones).

A.13 Test 13 — Memory Inversions (minv)

This test verifies that data in a longword (32 bits) can be inverted without affecting other longwords in memory. The inversions algorithm performs a ones complement operation within a range of addresses in memory, and goes up and down memory to check that other longwords are not affected by the inversions.

The inversions algorithm makes six passes over the memory performing a read/write in the following way:

1. Fill a range of memory with a pattern of the letter *a* from low address to high address.
2. Invert the pattern (the letter *a* is inverted to become the number *5*) from high address to low address while verifying the previous pattern.
3. Invert the pattern from low address to high address while verifying the previous pattern.
4. Repeat step 3.
5. Repeat step 2 (except that the number *5* is inverted to become letter *a*).
6. Check for the original pattern from low address to high address.

A.14 Test 14 — Memory Inversions with Flush (minvf)

This test verifies that all data stored in cache is written to memory. The test performs the same memory inversions algorithm described in Section A.13, the memory inversions test. However, this test also forces every memory reference into system bus RAM by flushing the cache entry.

A.15 Test 15 — Memory Address Inversions (madrinv)

This test verifies that all data stored in cache is written to memory. It performs the memory inversions algorithm described in Section A.13, the memory inversions test, except that it uses the address of the memory as the data pattern.

A.16 Test 16 — Memory Address Inversions with Flush (madrinvf)

This test performs the memory inversions algorithm described in Section A.15, the memory address inversions test. However, it also forces every memory reference into system bus RAM by flushing the cache entry.

A.17 Test 17 — Memory Error Correcting Code (ECC)(memory ECC)

This test checks that the system bus RAM error correcting code (ECC) is working. The error correcting code corrects single bit errors and identifies double bit errors. It also verifies the following:

- Bits in *error address status* register
- Corrected data and address generation
- One-bit and two-bit error detection precedence

A.18 Test 18 — Reset DMA Controller and Initialize 8237 Registers (bdma reset)

This test resets the 8237 DMA controller on the base CPU and initializes the 8237 registers.

See Section A.42 for information about resetting the 8237 DMA controller on the CPU/SIO.

A.19 Test 19 — Verify Access to DMA Controller (bdma reg I/O)

This test verifies access to the 8237 register by writing a pattern to the address register and reading it.

A.20 Test 20 — Base to Base Interrupt (bintb)

This test verifies that the base can interrupt itself. Interrupts are generated by addressing the base interrupt location, which is located in memory-mapped system bus I/O.

A.21 Test 21 — CPU to Base Interrupt (cintb)

This test verifies that a slave processor can interrupt the base. A slave program is started on the slave processor, and the processor is directed to interrupt the base.

A.22 Test 22 — Base to CPU Interrupt (bintc)

This test verifies that the base can interrupt a slave processor. A slave program is started on the slave processor. The base interrupts the slave processor and then checks to see if the processor received the interrupt.

A.23 Test 23 — Verify Bridge Map RAM Register (bram)

This test verifies the bridge map RAM register by executing the following tests over the address range 0xfdf000 through 0xfdf1bd:

- A ones fill test
- An inversions test
- An address fill test
- A zeros fill test

A.24 Test 24 — Base CPU Blinks Bridge LED (bLEDb)

This test verifies that the base can control a slave processor. In this test, the base CPU blinks the bridge LED and verifies that the test was successful by watching the LED bit in the bridge status register.

A.25 Test 25 — Slave CPU Blinks Bridge LED (bLEDc)

This test verifies that one processor can control another processor. In this test a slave processor blinks the LED on the bridge module. A slave process is started on the slave processor, and it is directed by the base to blink the LED on the bridge.

A.26 Test 26 — Base CPU Blinks LED on Default CPU (cLEDc)

This test verifies that one processor can control another processor. In this test, the base CPU blinks the LED on the default CPU.

A.27 Test 27 — Start and Reset Default CPU (cnop)

This test verifies that the default CPU can be started and reset. The test procedure is as follows:

1. Poll the system bus CPU slots.
2. Place a short nop loop at the default CPU start vector.

3. Start the default CPU.
4. Reset the default CPU (after the nop delay, and only if the scopeloop flag is not enabled).

The base processor does not verify whether the default CPU executed the test correctly.

A.28 Test 28 — Read/Write by Default CPU (cr/w once)

This test verifies that the default CPU can move data from one address to another. The test procedure is as follows:

1. Poll the system bus CPU slots.
2. Load test code into system bus memory.
3. Start the default CPU; the default CPU begins executing the code.
4. Read and verify bytes and words from one memory address to another through the default CPU.
5. Halt the default CPU.
6. Verify through the base CPU that the data was correctly moved.

A.29 Test 29 — Read/Write in a Loop by Default CPU (cr/w)

This test verifies that the default CPU can move data from one address to another. The test operation is the same as Section A.28, (Read/write by default CPU) except that the test code uses a rotating ones pattern in a loop. This allows the base to vary the data.

A.30 Test 30 — Check Multiplication (cfloat)

This test verifies that the 80486 chip on the default CPU can perform multiplication. If the processor is an 80386, an 80387 floating chip must be installed on the default CPU module.

The test procedure is as follows:

1. Poll the system bus slots.
2. Load the test code into system bus memory.
3. Start the default CPU and begin executing the code.

4. The test code initializes the floating-point chip, reads two multiplication operands from memory, multiplies them using the floating-point chip, stores the product in another memory location, and loops.
5. The base CPU uses several test numbers and verifies the correct result.

A.31 Test 31 — Check Locking Mechanism (cxch)

This test verifies that different CPUs honor each other's locking mechanism during a read/write cycle by the base CPU and the default CPU.

The test procedure is as follows:

1. Poll the system bus slots.
2. Load the test code into system bus memory.
3. Start the default CPU and begin executing the code.
4. Two memory locations are used, one as a lock and the other as data. The CPU code attempts to gain control of the data by locking the lock byte. When the default CPU gets control, it puts a unique value in the data byte. (The base CPU simultaneously attempts to gain control of the data.) The exchange instructions, which cause locked bus cycles, are used to perform the test-and-set lock functions. Each CPU verifies that there is no corruption of the data while it has control of the lock.

   In addition, the CPUs use a variety of back-to-back exchanges, and exchanges separated by various numbers of nops to vary the timing and to increase the number and variety of locked bus cycles.

A.32 Test 32 — Check Slave CPUs and Blink Base LED (cminv cLED)

This test verifies that each slave processor can do a memory inversions test without interfering with the memory space of the other CPUs. Each CPU is assigned a unique 128K region of memory and each slave processor executes the test code. The test procedure is as follows:

1. Poll the system bus slots.
2. Load memory inversions test code into system bus memory.
3. Start all CPUs.

4. The slave CPUs execute the memory inversions code, which performs a memory inversions test of 128K of system bus memory.
5. The base CPU verifies the correct operation of all CPUs and executes a loop which turns on its own LED and the LEDs of all the slave processors.

See Section A.13, Memory Inversions Test, for a description of the algorithm used to check that data can be inverted without affecting other longwords.

See Section A.38, Memory Inversions on Slave Processor, for a description of the same test except that the CPUs run concurrently instead of serially, and the test code performs a memory inversions test over all available system bus memory, rather than only 128K of memory.

A.33 Test 33 — Check Slave CPUs and Blink Bridge LED (cminv bLED)

This test is the same as Section A.32, Check Slave CPUs and Blink Base LED, except that the bridge LED, rather than the base LED, is blinked.

A.34 Test 34 — Check Slave CPUs and Run Data Inversions (cminv bminv)

This test is the same as Section A.32, Check Slave CPUs and Blink Base LED. It also verifies that each slave processor can do a memory inversions test without interfering with the memory space of the other CPUs. However, instead of blinking the LED, it executes a memory inversions test over a unique 128K region of memory.

A.35 Test 35 — Check Slave CPUs and Operation of All CPUs (cminv bck)

This test is the same as Section A.32, Check Slave CPUs and Blink Base LED. It also verifies that each slave processor can do a memory inversions test without interfering with the memory space of the other CPUs. However, instead of blinking the LED, the base verifies the operation of the CPUs.

A.36 Test 36 — Check Slave CPUs and Run Address Inversions (cmadrinv bck)

This test is the same as Section A.35. It verifies that each slave processor can do a memory inversions test without interfering with the memory space of the other CPUs. However, the CPUs execute address inversions instead of the normal inversions test.

A.37 Test 37 — Verify Memory (cminv ml/O)

This test verifies memory while it is being used by a slave processor. It uses AT addresses to access system bus memory.

The test procedure is as follows:

1. Read a cache entry.
2. Read the memory control register.
3. Write the memory control register while doing a memory inversions test on the slave.

A.38 Test 38 — Check Slave CPUs and Run Memory Inversions (mult cpu mchk)

This test verifies that each slave processor can do a memory inversions test without interfering with the memory space of the other CPUs. This test divides system bus memory between all slave processors and runs an inversions test for each slave processor in the area of memory allocated to it. This test code performs the memory inversions test over all available system bus memory. See Section A.13, Memory Inversions Test, for a description of the inversions algorithm.

The base CPU performs a locked OR with every byte in memory and blinks the LEDs on the slave processors, while it checks the status of each CPU.

See Section A.32 for a description of a similar test in which the CPUs run serially instead of concurrently.

A.39 Test 39 — Run Memory Inversions on Slave Processor with Flush (mult cpu mchkf)

This test is the same as Section A.38 except that every memory reference is forced into system bus RAM by flushing the cache entry.

A.40 Test 40 — Reset SIO DMA Controller Using Zero Fill (dzero)

This test validates the 32K of DMA RAM that is private to the 386/486 SIO processors. The DMA RAM occupies addresses 0x80000 thru 0x87fff in the address space of the SIO CPU. Direct access by the base CPU is not possible. To execute this test, the SIO CPU runs a slave executive which allows the base to have indirect access. Only the DMA RAM on the default (currently selected) SIO CPU is tested.

The test procedure is as follows:

1. Poll the system bus slots.
2. Load the slave code into system bus memory.
3. If the default CPU is an SIO, execute the code "slave start".
4. Perform a zero fill memory test over the DMA RAM address range as the slave code is instructed by the base CPU.

A.41 Test 41 — Reset SIO DMA Controller Using Ones Fill (dones)

This test is the same as Section A.40, except that the memory test is a ones fill rather than a zero fill.

A.42 Test 42 — Reset SIO DMA Controller/Initialize 8237 Registers (dr)

This test does a reset of the 8237 DMA controller on the SIO CPU and initializes the 8237 registers. Access to the 8237 is through private memory mapped I/O, and is not directly accessible by the base CPU. The 8237 occupies addresses 0xc0000 thru 0xc000f in the address space of the SIO CPU. The CPU that controls the 8237 runs the slave executive and allows the base indirect access to the 8237.

See Section A.42 for information about resetting the 8237 DMA controller on the base CPU.

A.43 Test 43 — Check SIO DMA Controller (DsrI/O)

This test verifies access to the 8237 register by writing a pattern to the address register and reading it back.

A.44 Test 44 — Check SIO DMA Controller with Rotating Pattern (DrI/O)

This test verifies access to the 8237 register in the same way as Section A.43, except that all address and count registers are tested with a rotating ones and rotating zeros pattern.

A.45 Test 45 — Check SCC Controller on SIO Module (Srl/O)

This test verifies access to both of the 8530 Serial Communications Controllers (SCC) on the default SIO CPU. The test performs a rotating ones and rotating zeros in the time constant registers for each of the four 8530 channels.

Access to the 8530 is through private memory mapped I/O, and is not directly accessible by the base CPU. The two 8530s occupy addresses 0xc0018 thru 0xc001f in the address space of the SIO CPU. The CPU that controls the 8530s runs the slave executive and allows the base indirect access to the 8530 channels.

A.46 Test 46 — Check SCC Controller on SIO Module (SDasync)

This test sets up a continuous output stream from the 8530 channel A, using 8237 DMA. No verification of operation is possible.

A.47 Test 47 — Test Channel A of SCC Controller (Sasyncloop)

This test checks the SCC controller using a rotating bit pattern.

This test sets Channel A of the 8530 to async loopback mode. Data is transmitted, and the received data is verified.

A.48 Test 48 — Test the 8530 Using 8237 Controller (SDasyncloop)

This test is the same as Section A.46, except that the 8237 DMA controller is used.

A.49 Test 49 — Test Channels A and C of 8530 (A–C)

This test sets channels A and C of the 8530 into DMA async mode; it requires a cable to be connected between channels A and C. Data is transmitted on A, and the received data from C is verified. Data is transmitted on C, and the received data from A is verified. A rotating bit pattern is used.

A.50 Test 50 — Test Channels B and D of 8530 (B–D)

This test is the same as Section A.49, except that Channels B and D are used.

A.51 Test 51 — Check FIFO and Configuration Registers in SCSI I/O Controller (SCSI I/O reg)

This test verifies that the FIFO and configuration registers in the 53C90 SCSI I/O controller can be addressed, written to, and read from. This test uses a walking ones and walking zeros pattern.

A.52 Test 52 — Check the 486 SCSI Module DMA Transmit Buffer (SCSI tr buf)

This test verifies that the DMA control logic can transfer data from main memory to the SCSI Module DMA transmit buffer.

The test procedure is as follows:

1. Use the page map to assign a start location in main memory or cache.
2. Allocate and fill 1024 bytes at the location specified by the page map. (The data used to fill the memory is the address of the data.)
3. Enable DMA to copy data from main memory to the SCSI module DMA transmit buffer.
4. Read and verify the data in the SCSI transmit buffer. (The data is not transmitted across the SCSI bus.)
5. Repeat this loop twice, once in burst mode and once in nonburst mode. In burst mode, the data is transmitted 16 bytes at a time. In nonburst mode, the data is transmitted 4 bytes (doublewords) at a time.

A.53 Test 53 — Check 486 SCSI Module DMA Receive Buffer (SCSI rcv buf)

This tests the ability of the DMA control logic to transfer data from the SCSI Module DMA receive buffer to main memory.

The test procedure is as follows:

1. Use the page map to get a start location in main memory or cache.
2. Allocate and fill 1024 bytes at the location specified by the page map. (The data used to fill the memory is zeros.)

3. Enable DMA to copy data from the receive buffer to main memory.
4. Load the SCSI module DMA receive buffer with a test pattern.
5. Read the data in main memory to verify that the DMA logic transferred the data from the SCSI module DMA receive buffer.
6. Repeat this loop twice, once in burst mode and once in nonburst mode. In burst mode, the data is transmitted 16 bytes at a time. In nonburst mode, the data is transmitted 4 bytes (double-words) at a time.

A.54 Test 54 — Verify Entries in DMA Page Map (SCSI DMA map)

This test verifies that all entries in DMA page map can address main memory correctly.

The test procedure is as follows:

1. Use the page map to assign a start location in main memory or cache.
2. Allocate and fill 1024 bytes at the location specified by the page map. (The data used to fill the memory is the address of the data.)
3. Enable DMA to copy 16 bytes of data from main memory to the SCSI module DMA transmit buffer.
4. Read and verify the 16 bytes of data copied to the SCSI transmit buffer. (The data is not transmitted across the SCSI bus.)
5. Repeat the above steps 256 times, going from low address to high address.
6. Repeat the above steps 256 times, this time going from high address to low address. (This loop is repeated 256 times to account for each map register in the DMA page map.) This test is performed in nonburst mode. The data is transmitted 4 bytes (doublewords) at a time.

A.55 Test 55 — Check Page Index Counter (SCSI pg ndx cntr)

This test verifies that the page index counter can start at any of the 256 possible start addresses.

The procedure is as follows:

1. Use the page map to assign a start location in main memory or cache.
2. Allocate and fill 1024 bytes at the location specified by the page map. (The data used to fill the memory is the address of the data.)

3. Enable DMA to copy 16 bytes of data from main memory to the SCSI module DMA transmit buffer.
4. Read and verify the 16 bytes of data copied to the SCSI transmit buffer. (The data is not transmitted across the SCSI bus.)
5. Repeat this loop 256 times, once for each increment of the page index counter. This test is performed in nonburst mode. The data is transmitted 4 bytes (doublewords) at a time.

A.56 Test 56 — Check DMA Control Logic — Main Memory to FIFO (SCSI tr DMA)

This tests the ability of the DMA control logic to transfer data from main memory to the 53C90 SCSI I/O controller's 16-byte FIFO.

The test procedure is as follows:

1. Use the page map to assign a start location in main memory or cache.
2. Allocate and fill 1024 bytes at the location specified by the page map. (The data used to fill the memory is the address of the data.)
3. Enable DMA to copy data from main memory to the SCSI module 53C90 SCSI I/O controller's FIFO buffer.
4. Read and verify the data in the SCSI FIFO buffer. (The data is not transmitted across the SCSI bus.) This test is performed in nonburst mode. The data is transmitted 4 bytes (doublewords) at a time.

This test might require an external jumper from REQ to ACK.

A.57 Test 57 — Check DMA Control Logic — FIFO to Main Memory (SCSI rcv DMA)

This tests the ability of the DMA control logic to transfer data from the 53C90 SCSI I/O controller's 16-byte FIFO to main memory.

The test procedure is as follows:

1. Use the page map to get a start location in main memory or cache.
2. Allocate and fill 1024 bytes at the location specified by the page map. (The data used to fill the memory is the address itself.)
3. Load the 53C90 SCSI I/O controller's 16-byte FIFO buffer.

4. Enable DMA to copy data from the FIFO buffer to main memory.
5. Read and verify the data in main memory.

This test might require an external jumper from REQ to ACK.

A.58 Test 58 — DMA Control Logic — Misaligned Byte Boundary (SCSI rcv odd)

This test verifies that the DMA control logic can handle data starting on a misaligned byte boundary. The test procedure is as follows:

- Use the page map to get a start location in main memory or cache.
- Allocate and fill 1024 bytes at the location specified by the page map. (The data used to fill the memory is the address itself.)
- Misalign the data by performing three processor writes on the receive buffer.
- Load the 53C90 SCSI I/O controller's 16 byte FIFO buffer.
- Enable DMA to copy data from the FIFO buffer to main memory.
- Verify three processor writes were discarded.
- Read and verify that the 16 bytes in main memory are correct.

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