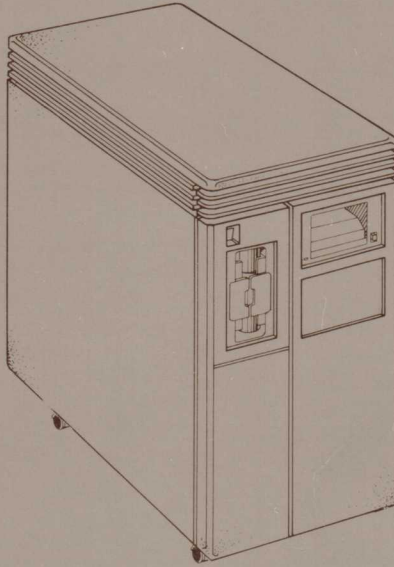


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# MicroVAX II 630QB Technical Manual

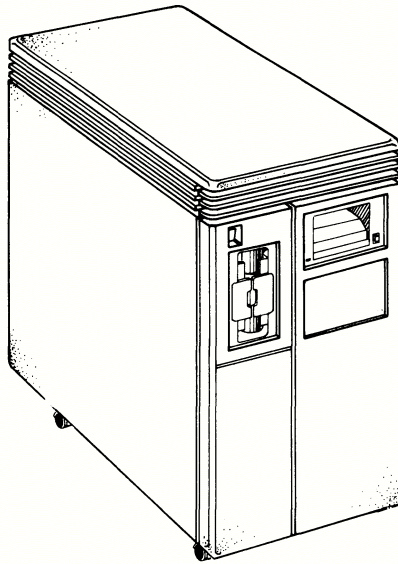
Technical Manual



**digital**™



# MicroVAX II 630QB Technical Manual



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Printed in U.S.A.

The manuscript for this book was created on a VAX-11/780 system and, via a translation program, was automatically typeset by Digital's DECset Integrated Publishing System. The book was produced by Educational Services Development and Publishing in Marlboro, MA.

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## Introduction

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This manual describes the MicroVAX II 630QB system. Housed in the BA123-A enclosure, this system uses standard Q22-Bus options and mass storage devices.

Chapter 1 describes the BA123-A enclosure, including the backplane, power supply, mass storage area, I/O distribution panel, and internal cabling.

Chapter 2 describes the MicroVAX II KA630-A CPU module, the CPU patch panel insert, and MS630 memory module.

Chapter 3 describes the communications, mass storage, and backup devices currently available as system options. The chapter provides configuration tables, cabinet kit information, and a brief description of each device.

Chapter 4 provides configuration information required for system expansion. Examples of typical systems are shown.

Chapter 5 describes the MicroVAX II power-up self-test and corresponding count-down error messages. The customer version of the MicroVAX Maintenance System and basic troubleshooting are also covered.

Chapter 6 lists the field replaceable units (FRUs) and provides appropriate removal and replacement procedures.

Appendix A provides information on MicroVAX II console commands.

Appendix B lists the console error messages produced by the KA630-A CPU, along with a brief explanation of each message.

### CONVENTIONS

Lower case **n** represents multiple numbers, where a specific designation is unnecessary or cumbersome (for example, RD5**n** instead of RD51, RD52, RD53). Similarly, a lowercase **x** represents multiple letters.

## NOTES, CAUTIONS, AND WARNINGS

Notes, cautions, and warnings appear throughout this manual and are defined as follows. A note contains general information. A caution contains information to prevent damage to equipment. A warning contains information to prevent personal injury.

## RELATED DOCUMENTS

The following is a list of related documents for the MicroVAX II systems.

<i>KA630-A CPU Module User's Guide</i>	BK-KA630-UG
<i>MicroVAX System Maintenance Guide</i>	AZ-GM3AA-MN
<i>DEQNA Ethernet User's Guide</i>	EK-DEQNA-UG
<i>DHV11 Technical Manual</i>	EK-DHV11-TM
<i>DLV11-J User's Guide</i>	EK-DLV1J-UG
<i>DMV11 Synchronous Controller Technical Manual</i>	EK-DMV11-TM
<i>DPV11 Synchronous Interface User's Manual</i>	EK-DPV11-UG
<i>DRV11-J Interface User's Manual</i>	EK-DRV1J-UG
<i>DZV11 Asynchronous Multiplexer Technical Manual</i>	EK-DZV11-TM
<i>RD52-D, -R Fixed Disk Drive Subsystem Owner's Manual</i>	EK-LEP03-OM
<i>RD53-D, -R Fixed Disk Drive Subsystem Owner's Manual</i>	EK-LEP06-OM
<i>RQDX2 Controller Module User's Guide</i>	EK-RQDX2-UG
<i>RQDX3 Controller Module User's Guide</i>	EK-RQDX3-UG
<i>RX50-AA Diskette Drive Subsystem Owner's Manual</i>	EK-RX50A-MM
<i>TK50 Tape Drive Subsystem User's Guide</i>	EK-LEP05-OM

You can order these documents from:

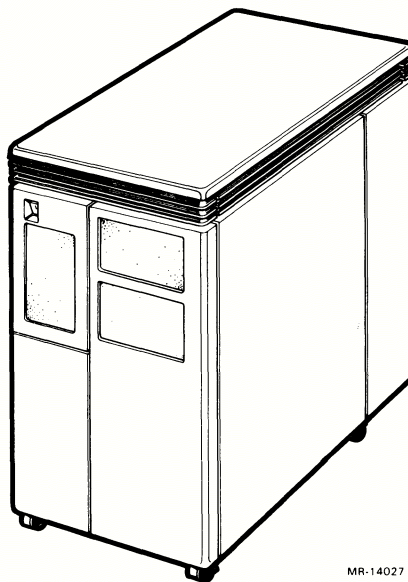
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## 1.1 INTRODUCTION

The BA123-A enclosure (Figure 1-1) is a floor stand unit for microcomputer systems. It can support a wide variety of hardware options. The air-cooled enclosure is designed to operate in an open office environment. It includes the following major components:

- Enclosure frame
- Control panel
- Mass storage area
- Backplane assembly
- Power supply
- I/O distribution panel



MR-14027

Figure 1-1 BA123-A Enclosure

## 1.2 ENCLOSURE FRAME

The BA123-A enclosure frame houses the power supply and the backplane assembly. It also provides mounting space for five 13.3 cm (5.25 in) mass storage devices. It is mounted on four shock-isolating casters and has the following dimensions:

**Height:** 62.2 cm (24.5 in)

**Width:** 33.0 cm (13.0 in)

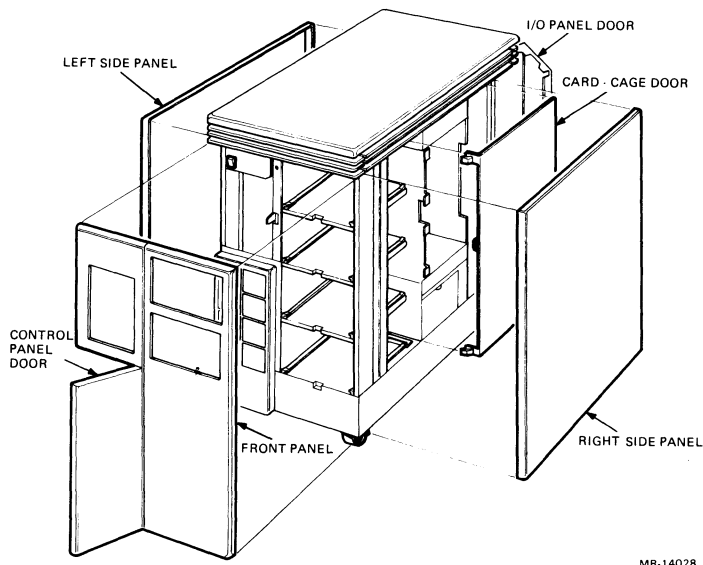
**Depth:** 70.0 cm (27.5 in)

The enclosure frame is covered by removable panels on the front, right, and left sides (Figure 1-2).

There are three doors: a control panel door on the front, an I/O panel door at the rear, and a card-cage door inside the right side panel.

### NOTE

**For panel removal procedures, see Section 6.2.**



MR-14028

Figure 1-2 BA123-A Removable Panels and Doors

Three fans in the BA123-A enclosure draw air into the top of the enclosure from the following areas (Figure 1-3):

- Below the module card cage
- Behind the control panel
- Inside the power supply

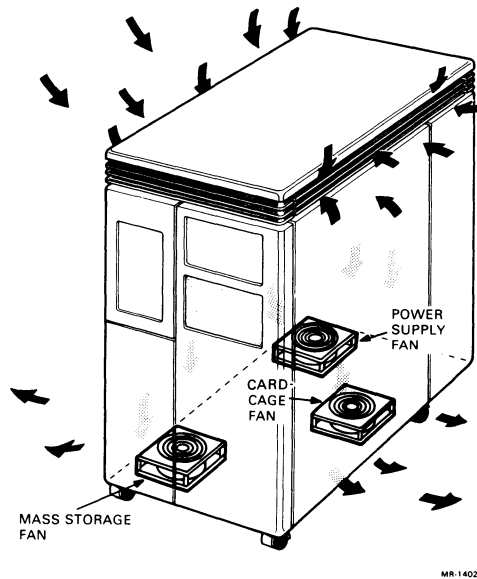
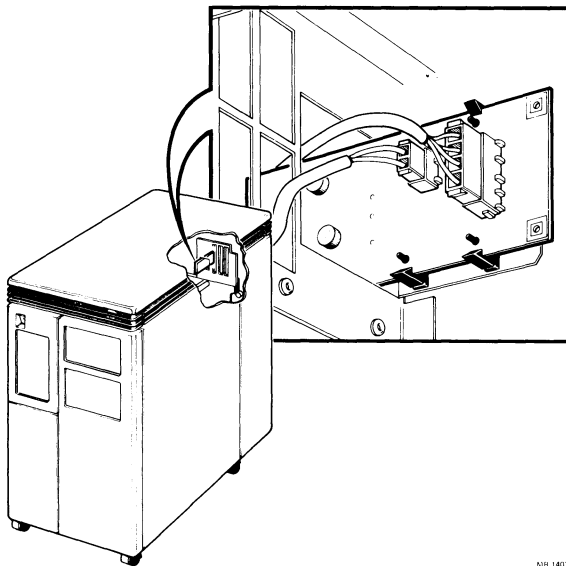


Figure 1-3 Air Flow

A printed circuit (PC) board above the card cage contains two temperature sensors (Figure 1-4). One sensor regulates the speed of the card-cage fan, keeping it at the minimum level required to maintain a constant temperature within the card cage. The other sensor shuts down the system at high temperature. The card-cage door encloses the area surrounding the modules. Removal of this door triggers an interlock switch, which increases the speed of the card-cage fan to maximum. If the proper temperature within the card cage cannot be maintained, even at maximum fan speed, the over-temperature sensor causes the system to shut down. The system also shuts down if the card-cage fan fails.



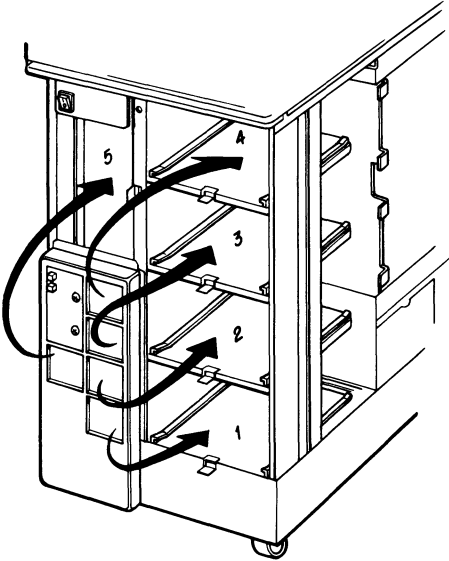
6/16 14030

Figure 1-4 Temperature Sensor PC Board



### 1.3 CONTROL PANEL

The control panel has six cutouts to provide space for control circuits. One cutout is used for a CPU console board. The other five cutouts provide space for mass storage console boards. Unused cutouts are covered with removable plates. Figure 1-5 shows the relationship between the cutouts and the mass storage shelves.



- LEGEND:
- |                 |                   |
|-----------------|-------------------|
| 1. DISK DRIVE 1 | 4. TAPE DRIVE     |
| 2. DISK DRIVE 2 | 5. DISKETTE DRIVE |
| 3. DISK DRIVE 3 |                   |

MR-15792

Figure 1-5 Mass Storage Shelves

#### 1.3.1 Mass Storage Shelves

The front panel covers five shelves used for mounting 13.3 cm (5.25 in) mass storage devices (Figure 1-5). The maximum recommended number of mass storage devices is four. These should be installed with two in shelves 1 and 2 and two in shelves 3, 4 or 5. Removable plates in front of shelves 3, 4 and 5 allow access to removable mass storage devices.

### 1.3.2 CPU Console Board

The CPU console board (Figure 1-6) is attached to the back of the control panel. It contains a DC OK indicator light, and two buttons that allow the user to halt or restart the system. A ribbon cable connects the CPU console board to the backplane. This cable provides the connection between the CPU and the CPU console board. The buttons and DC OK light provide the following functions:

- When the **Halt** button is depressed, the red LED in the **Halt** button lights. The system then enters console I/O mode (Section 2.2.1), providing halts are enabled by the switch on the CPU distribution panel at the rear of the system (Section 2.2.3).

#### **NOTE**

**If halts are disabled at the rear of the system, the LED in the Halt button still lights when the button is depressed, but the system is not halted.**

- When the DC OK light is ON, the system is receiving stable dc voltage from the power supply.
- When the **Restart** button is depressed, the system boots.

There are two LEDs on the CPU console board. These can be seen by removing the left side panel of the enclosure. If the DC OK light on the control panel is not lit, these two LEDs indicate which regulator supply to the backplane has failed:

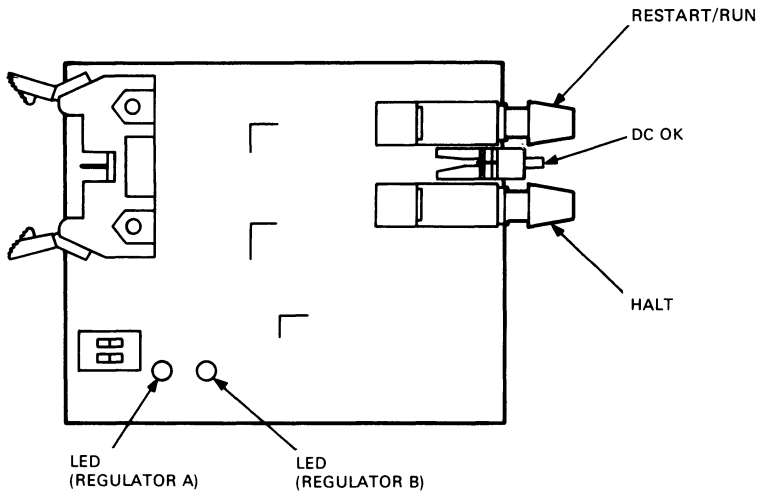
Left LED:     Regulator A  
Right LED:    Regulator B

When a LED is ON, +5 Vdc to the backplane is OK. When the LEDs are OFF, a regulator or connection to a regulator has failed.

**NOTE**

**There should be at least one module in both odd- and even-numbered backplane slots to draw enough current to start each regulator. See Section 1.6.**

There is a DIP switch pack to the left of the LEDs that contains two switches. Both switches are normally OFF and are unused in MicroVAX II systems.



MR-14187

Figure 1-6 CPU Console Board

### 1.4 SIGNAL DISTRIBUTION BOARD

The signal distribution board (M9058, Figure 1-7) is mounted in the bottom two (C and D) rows of backplane slot 13.

Up to four fixed disk drives, or an RX50 diskette drive and up to two fixed disk drives, can be connected to the signal distribution board (Figure 1-8). The signal distribution board is connected by a 50-conductor ribbon cable to an RQDXn mass storage controller module in the card cage. The signal distribution board is also connected to the RD console boards behind the control panel by a 40-conductor ribbon cable.

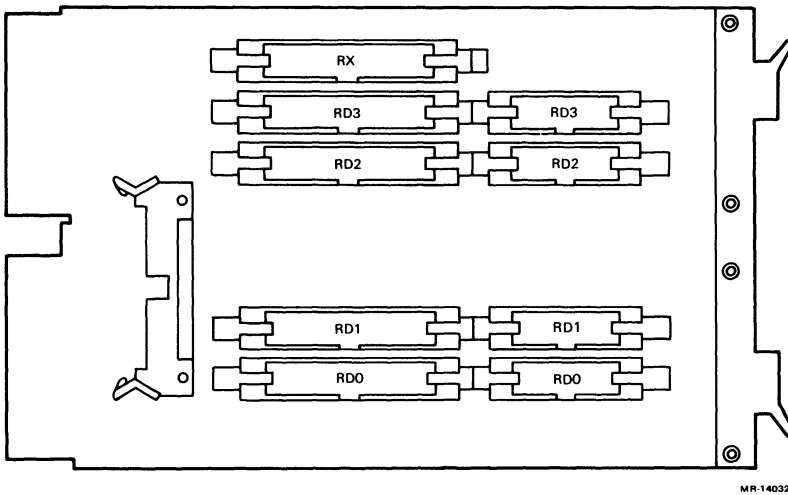
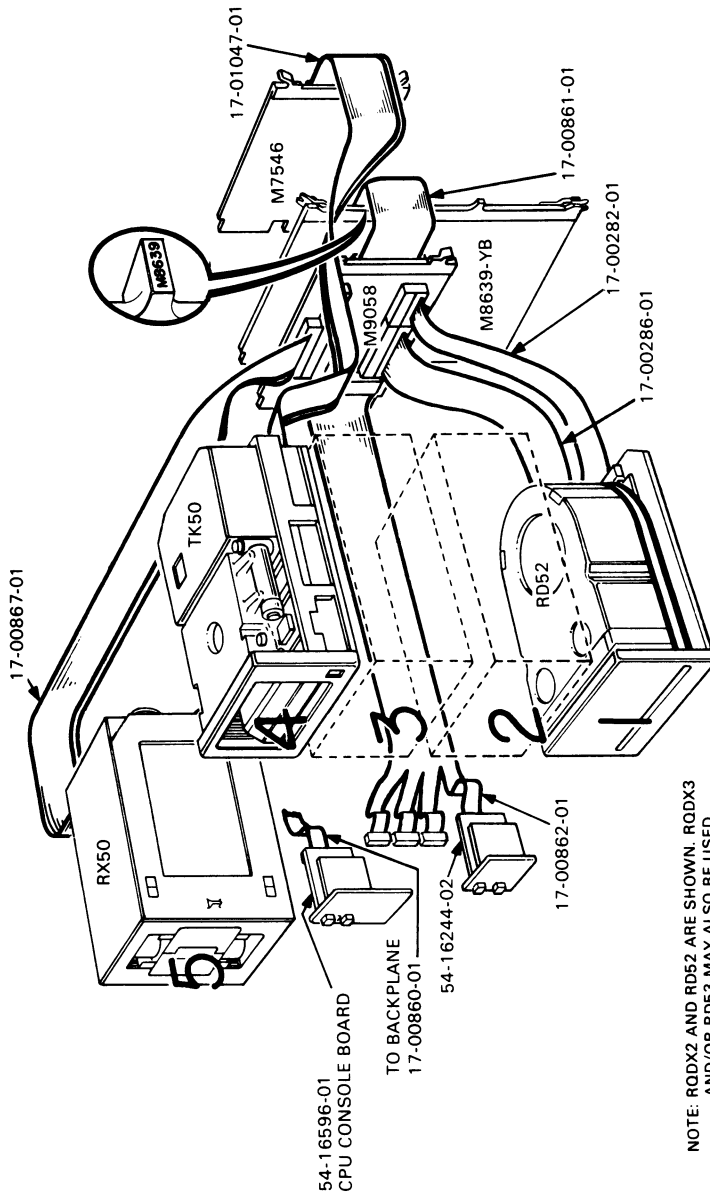


Figure 1-7 Signal Distribution Board



MR-14033

Figure 1-8 Signal Distribution Board Cabling

## 1.5 BACKPLANE

The BA123-A has a 4-row by 13-slot backplane that measures  $27.9 \times 19.9$  cm ( $11 \times 7.85$  in). The backplane implements the extended LSI-11 bus (or Q22-Bus), which uses 22-bit addressing.

The first 12 slots of the backplane provide space for dual- or quad-height modules that are compatible with the Q22-Bus.

- A dual-height module has connectors that fit into two rows of a backplane slot. Two dual-height modules can occupy one backplane slot.

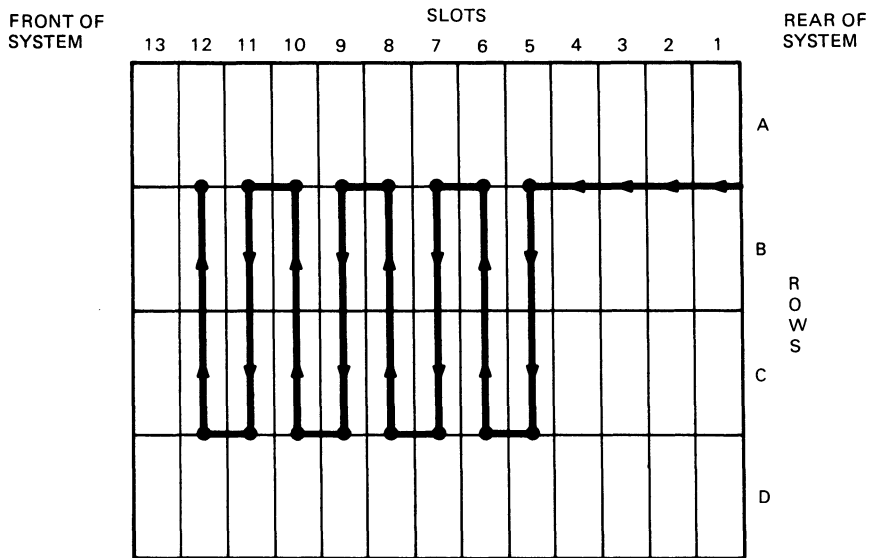
### NOTE

**Dual-height modules in slots 5–11 and rows C and D of slot 12 require another dual-height module or an M9047 grant card in the other two rows of the slot.**

- A quad-height module has connectors that fit into all four rows of a backplane slot. One quad-height module occupies one backplane slot.

Figure 1-9 shows the grant lines for the Q22-Bus interrupt and for direct memory access (DMA). The C and D rows of slots 1–4 implement a separate MicroVAX II local memory interconnect that is used to interface the system CPU and memory modules.





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Figure 1-9 Backplane Grant Continuity

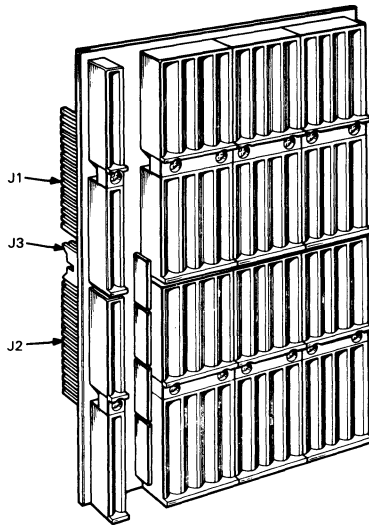
Four 120 ohm resistor packs between backplane slots 12 and 13 are used to terminate the Q22-Bus. The thirteenth slot of the backplane provides space for two dual-height modules (rows AB and CD). The Q22-Bus is not implemented in this slot. The CD rows are used for the signal distribution board. The AB rows can be used for a second signal distribution board. The thirteenth slot provides +5 Vdc, +12 Vdc, ground, and a signal (DC OK) that indicates dc voltage from the power supply is stable.

**NOTE**

**This backplane is a “bounded” system. That is, additional backplanes cannot be connected to the system.**

The backplane supports a maximum of 38 ac loads and 20 dc loads. The backplane balances the load on each of the power supply's two regulators. Figure 1-10 shows three J connectors on the backplane.

- J1 and J2 are 18-pin connectors that receive dc power and signals from two independent regulators in the power supply. J1 is connected to Regulator A, which supplies power to the odd-numbered slots. J2 is connected to Regulator B, which supplies power to the even-numbered slots.
- J3 is a 10-pin connector that connects a cable to the CPU console board.



MR 14234

Figure 1-10 Backplane Connectors

The backplane has an eight-layer PC board, which is arranged as follows:

layer	1	signal
	2	signal
	3	+5 Vdc from Regulator A
	4	ground
	5	ground
	6	+5 Vdc from Regulator B
	7	signal
	8	signal

Configuration rules for the backplane are listed in Chapter 4.

## 1.6 POWER SUPPLY

The power supply (Figure 1-11) is a 460 W unit consisting of two regulators. Each regulator supplies power to one-half of the slots in the backplane (see Section 1.5) and to mass storage devices inside the system.

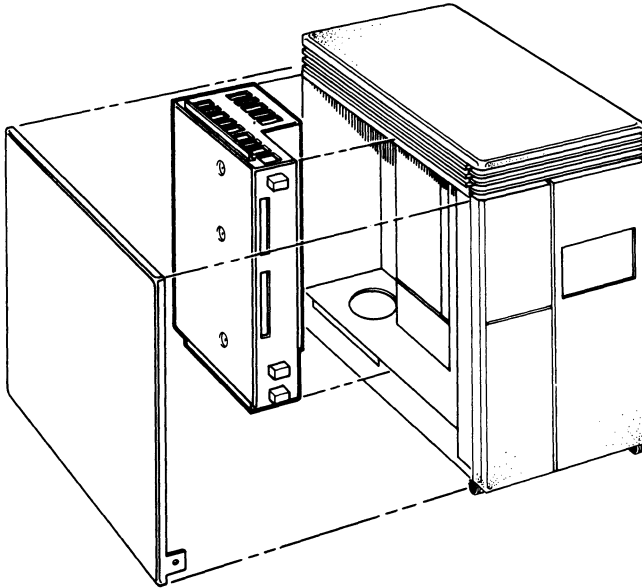
The power supply provides protection against excess voltage and current, and against temporary fluctuations in the ac supply. Table 1-1 lists the minimum and maximum currents supplied by each regulator.

**Table 1-1 Regulator A and B Current and Power**

Regulator	Maximum Power (in watts)	Current at +5 Vdc (in amps)		Current at +12 Vdc (in amps)	
		Minimum	Maximum	Minimum	Maximum
A	230	4.5	36.0	0.0	7.0
B	230	4.5	36.0	0.0	7.0

**NOTE**

**Total power used from each regulator must not exceed 230 W. This means that maximum current at +5 Vdc and +12 Vdc cannot be drawn at the same time. See Figure 4-1, a configuration worksheet, for further information.**



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Figure 1-11 Power Supply

The power supply also has two separate +12 Vdc outputs that are independent of the main 460 W output. These are used to drive the two fans that are external to the power supply, and to provide power to the temperature sensor above the card cage.

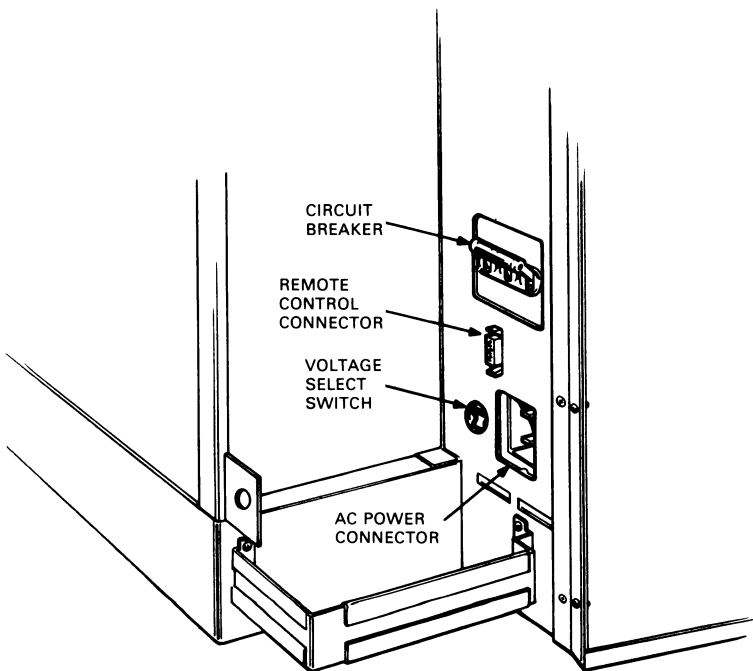
The power supply contains a connector at the back for remote control of power. The input power cable is protected by a circuit breaker (Figure 1-12). There is an International Electrical Commission (IEC) ac input connector for compatibility with international power cables.

Two voltage ranges can be selected:

120 V: 88–128 Vac  
240 V: 176–256 Vac

**NOTE**

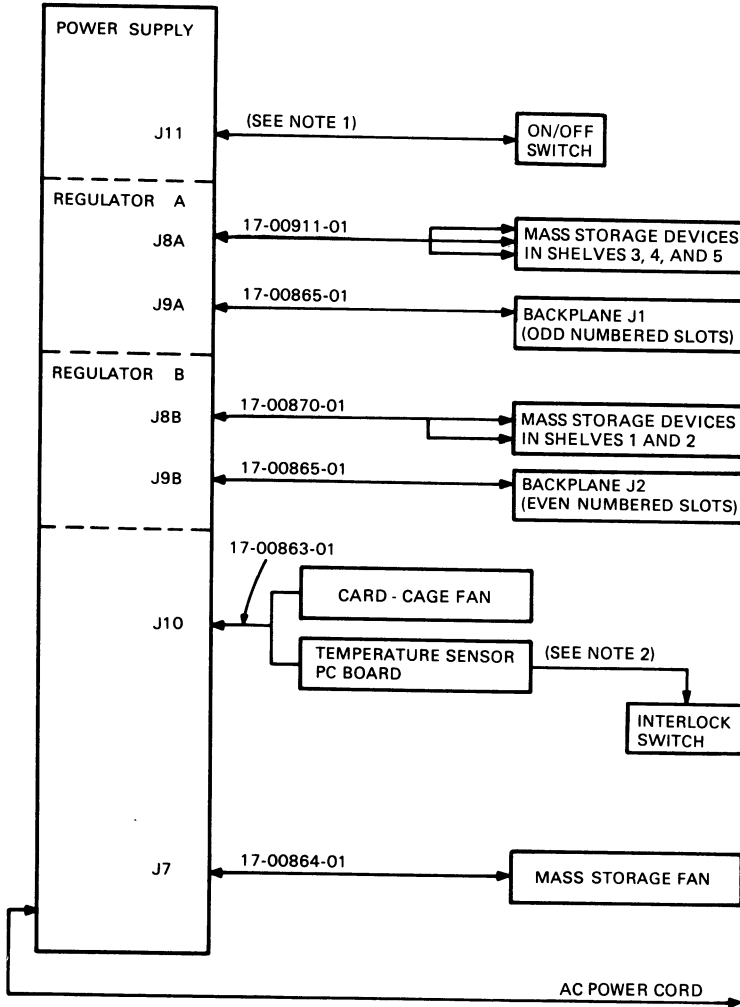
**In order to compensate for line cord voltage drop when the system is operating at maximum load, a minimum of 90 Vac (88–128 Vac setting) should be present at the outlet for low line operation.**



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Figure 1-12 Circuit Breaker, Voltage Select Switch, Connectors (Rear View)

Figure 1-13 shows the electrical power distribution of the enclosure. The part numbers of the power cables are also shown.



NOTES: 1. (INCLUDES THE ON/OFF SWITCH) 17-00859-01  
 2. (INCLUDES INTERLOCK SWITCH) 17-00942-01

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Figure 1-13 Electrical Distribution



## 1.7 I/O DISTRIBUTION PANEL

The I/O distribution panel is used for connecting the system to external devices. The rear door provides access to the I/O distribution panel (Figure 1-14).

Each module that connects to an external device requires an internal cable, a filter connector, and an insert panel. Together these three items are referred to as a cabinet kit.

Filter connectors are mounted in the insert panels. The insert panels are then mounted in cutouts in the I/O distribution panel, in the order shown in Figure 1-14. The CPU I/O distribution panel insert is typically mounted in cutout A. Unused cutouts are covered by removable plates.

### NOTE

**The phrase “type x filter connector” used in this manual refers to an insert panel and to a filter connector that has been mounted in the insert panel. This configuration is typical of what is contained in a cabinet kit.**

The I/O distribution panel has ten cutouts (Figure 1-14). Table 1-2 lists cutout and corresponding insert panel sizes.

**Table 1-2 Cutout and Insert Panel Sizes**

Cutout/Insert Panel	Dimensions	
	(in mm)	(in inches)
<b>Type A (4):</b>		
Cutout	15 × 81	0.6 × 3.2
Insert Panel	25 × 102	1.0 × 4.0
<b>Type B (6):</b>		
Cutout	57 × 81	2.25 × 3.2
Insert Panel	64 × 84	2.5 × 3.3

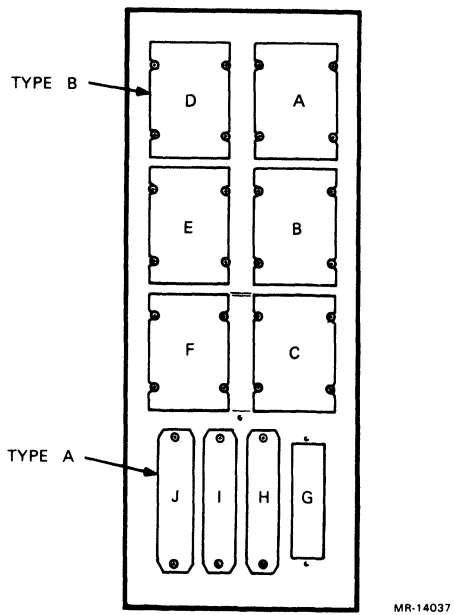


Figure 1-14 I/O Distribution Panel

In addition, a removable bracket between the bottom two type B cutouts allows for the addition of three more type A cutouts by installing an adapter plate (DIGITAL P.N. 74-27720-01).

Figure 1-15 shows typical type A and type B connectors and the adapter plate.

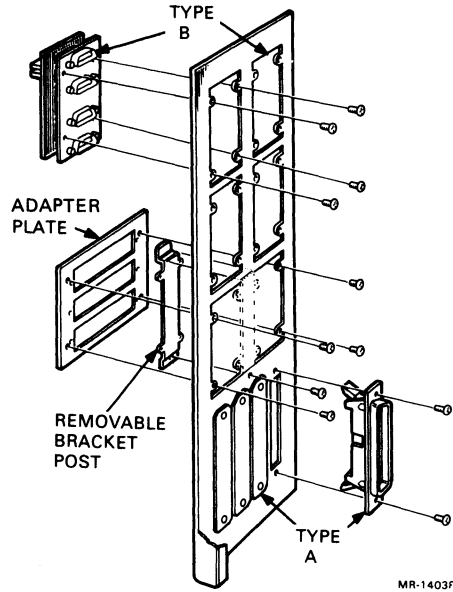


Figure 1-15 Filter Connectors and Adapter Plate



## 2.1 INTRODUCTION

A MicroVAX II base system includes a system enclosure, a KA630-A CPU module, and a CPU patch panel insert. The CPU module, which includes its own local memory, also supports one or two MS630 memory modules, adding up to 8 MByte of local memory.

## 2.2 KA630-A CPU

Two KA630-A CPU versions are available for MicroVAX II systems, the KA630-AA, with floating point, and the KA630-AB, without floating point. They include the following features:

- MicroVAX processor chip, which provides a subset of the VAX instruction set and data types, as well as full VAX memory management.
- 1 MByte of on-board memory, with support for up to two MS630 memory modules.
- Floating Point Processor (FPP) chip (KA630-AA only), which provides a subset of the VAX floating-point instruction set and data types. The FPP must be factory installed (surface mounted). It is not available as a field-upgrade part.
- Console Serial Line Unit (SLU) with externally selectable baud rate. The console SLU is accessed using four VAX Internal Processor Registers (IPRs).
- Interval timer, with 10 millisecond interrupts. Interrupts are enabled via an IPR.
- 64 KByte boot/diagnostic ROM, which provides power-up diagnostics, boot programs for standard devices, and a subset of the VAX console program.
- Q22-Bus map/interface, which provides Direct Memory Access (DMA) for all local memory. The KA630-A fields Q22-Bus interrupt requests BIRQ7 through 4.
- Virtual memory space of four gigabytes ( $2^{32}$ ).

The KA630-A supports the following VAX data types:

- Byte, word, longword, quadword
- Character string
- Variable length bit field
- F\_floating, d\_floating and g\_floating (KA630-AA only)

The remaining VAX data types are supported through software emulation.

The KA630-A implements the following subset of the VAX instruction set:

- Integer
- Address
- Variable length bit field
- Control and procedure call
- Queue
- MOVC3/MOVC5
- Floating point (KA630-AA only)

The remaining VAX instructions, including floating point for the KA630-AB version, are supported through software emulation.

The KA630-A CPU communicates with mass storage and peripheral devices via the Q22-Bus. The KA630-A communicates with MS630 memory modules through the MicroVAX local memory interconnect in the CD rows of backplane slots 1 through 3, and through a cable between the CPU and the MS630 memory module.

The KA630-A (Figure 2-1) CPU contains three connectors:

- J1, for a cable connecting to an MS630 memory module.
- J2, for a cable to the configuration and display connector on the CPU patch panel insert.
- J3, for a cable to the internal console SLU connector on the CPU patch panel insert.

**CAUTION**

The KA630-A CPU module can only be installed in a slot that contains the MicroVAX local memory interconnect. It is normally installed in slot 1. It must not be installed in slots 4-12.

Static electricity can damage integrated circuits in modules and mass storage devices. Always use a grounded wrist strap (DIGITAL P.N. 29-11762-00) and grounded work surface when accessing any internal part of a computer system.

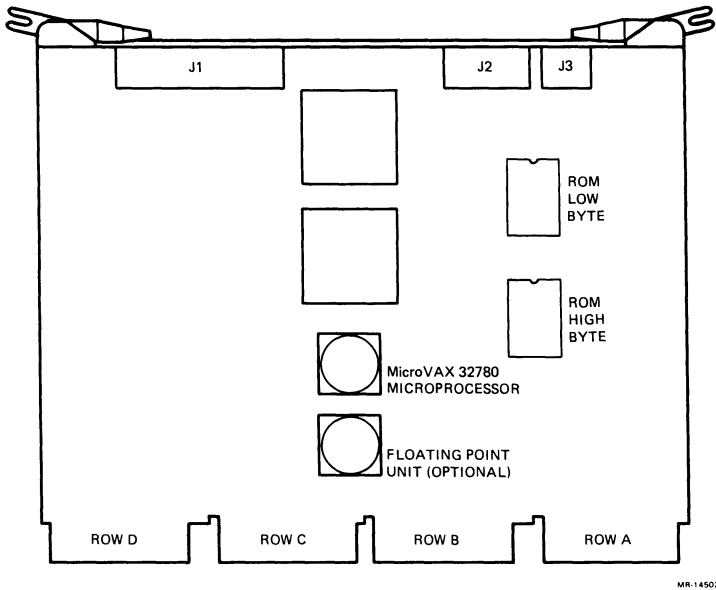


Figure 2-1 KA630-A CPU Module

### 2.2.1 Console Program

The console program, resident in two ROM chips on the module, receives control whenever the processor halts. For the KA630-A CPU, a halt means only that processor control has passed to the console program, not that instruction execution stops. The processor halts as a result of the following:

- System power-up or **Restart** button push
- External halt signal
- Execution of a halt instruction
- System error

At power-up, the system enters one of three power-up modes, which are set using a switch on the CPU patch panel insert (Section 2.2.3). The console program then determines console device type and console language.

If the console device supports the Multinational Character Set (MCS), then the console program can be run in any one of 11 languages. The language is chosen by setting the switch on the CPU patch panel insert to the Language Inquiry position and booting the system. A list of the 11 languages is then displayed and the user enters the number of the appropriate language. After the language is chosen, the switch on the CPU patch panel insert should be set to the Run position. The user language is then recorded in battery backed-up RAM (see Section 2.2.3) so that the preferred language is retained when the system is shut off.

If the console device does not support the MCS, no language prompt will occur and the console program will default to English.

Next, the message “Performing normal system tests” is displayed. A countdown of ongoing diagnostic tests is displayed on the console terminal, on the LED display on the CPU patch panel insert, and on the CPU module’s LEDs. These diagnostics test the CPU, the memory system and the Q22-Bus interface. The diagnostic test codes and corresponding tests, along with the FRUs most likely to be at fault, are described in Table 5-1.

If the halt has been caused by a condition other than power-up, the console program will branch directly to service the halt. The console program may branch to diagnostics, to a restart sequence, to a primary bootstrap routine, or to console I/O mode, depending on the nature of the halt.



If halts are enabled by the switch on the CPU patch panel insert (Section 2.2.3), the console program will enter console I/O mode in response to any halt condition, including system power-up. Console I/O mode allows the user to control the system through the console terminal using a console command language (described in Appendix A). The console I/O mode prompt is >>>.

### 2.2.2 Primary Bootstrap Program (VMB)

If halts are disabled by the CPU patch panel switch, and the diagnostic tests are completed successfully, the console program tries to load and start (bootstrap) an operating system. To do so, it searches for a 64 Kbyte segment of correctly functioning system memory. It then copies a primary bootstrap program, called VMB, from the console program ROM into the base address of the segment plus 512 bytes. The console program then branches to the VMB, which attempts to bootstrap an operating system from one of the devices listed in Table 2-1, in the order shown.

**Table 2-1 Console Program Boot Sequence**

Sequence	Controller Type	Controller	Device Name
1	MSCP (Disk)	RQDX	DUmn*
2	MSCP (Tape)	TQK50	MUmn
3	PROM	MRV11	PRmn
4	Ethernet adapter	DEQNA	XQmn

\* m = controller designator (A = first, B = second, etc.)  
n = unit number on specified controller

When VMB determines that a controller is present, it searches in order of increasing unit number for a bootable unit with a removable volume. If it finds none, it will repeat the search for a nonremovable volume.

In console mode the system can also be directed to boot a specific device. To do so, use the boot command followed by the device name (for example, B DUA0).

When the operating system is booted, the processor no longer executes instructions from the console program ROM. The processor is then in program I/O mode, in which terminal interaction is handled by the operating system.

### 2.2.3 CPU Patch Panel Insert

The CPU patch panel insert (Figures 2-2 and 2-3) is mounted in the I/O distribution panel of the BA123-A enclosure.

The CPU patch panel insert contains the following:

- 3 switches
- 1 LED display
- 1 external connector
- 2 internal connectors
- 1 battery backup unit (BBU)

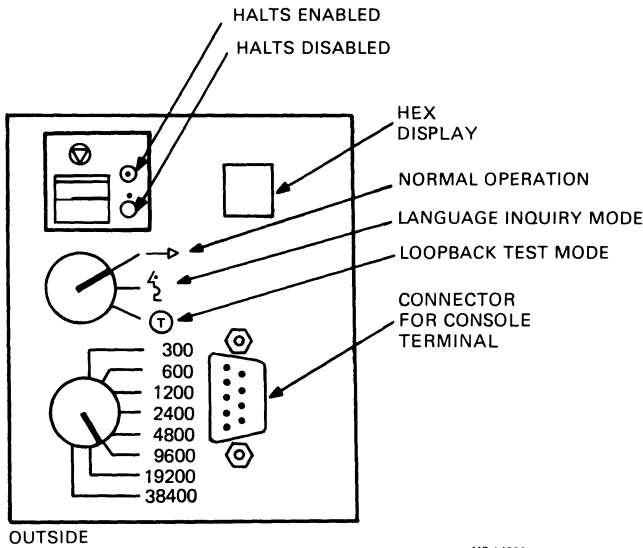
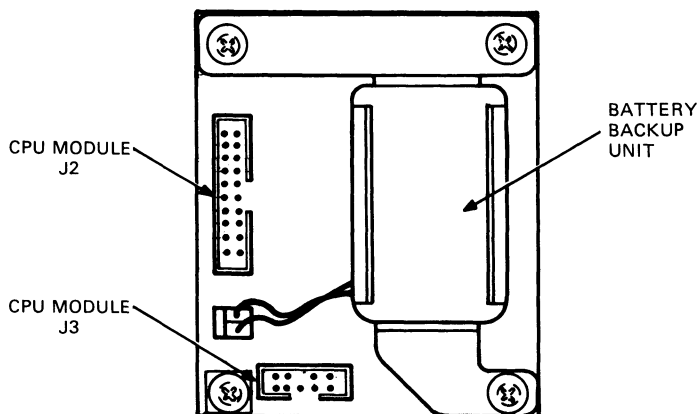


Figure 2-2 CPU Patch Panel Insert (Front View)



MR-14504

Figure 2-3 CPU Patch Panel Insert (Rear View)

## Switches

The three switches on the CPU patch panel insert provide the following functions:

### Halt Enable Switch – (2-position toggle)

#### Position

Down  
(dot outside circle)

#### Function

Halts are disabled (factory setting). On power-up or restart, system attempts to load software from one of the boot devices at the completion of start-up diagnostics.

Up  
(dot inside circle)

Halts are enabled. On power-up or restart, system enters console I/O mode at the completion of start-up diagnostics and the console I/O mode prompt (>>>) appears.

### **Power-Up Mode Select Switch – (3-position rotary)**

<b>Position</b>	<b>Function</b>
0 (arrow)	Run (factory setting). If the console terminal supports the MCS, the user is prompted for language only if the battery backup has failed. Full start-up diagnostics are run.
1 (face)	Language inquiry. If the console terminal supports MCS, the user is prompted for language on every power-up and restart. Full start-up diagnostics are run.
2 (T in a circle)	Test. ROM programs run wrap-around serial line unit (SLU) tests.

### **Baud Rate Select Switch – (8-position rotary)**

Sets the baud rate of the console terminal serial line. The factory setting is 4800 baud. The baud rate of this switch must match the baud rate of the console terminal.

### **LED Display**

Displays numbers of on-going steps of power-up tests and booting procedures. If a failure occurs, the LED display stops at a non-zero hex value. Table 5-1 lists the tests corresponding to those values, and the FRUs most likely to be at fault when the test fails.

### **Console SLU Connector – (external)**

9-pin connector for a cable to the console terminal.

### **Console SLU Connector – (internal)**

9-pin connector for a cable to connector J3 of the KA630-A CPU.

### **Configuration and Display Connector – (internal)**

20-pin connector for a cable to connector J2 of the KA630-A CPU. Connects the three switches and the LED display to the CPU.

### **Battery Backup Unit (BBU) – (internal)**

Provides power to the time-of-year (TOY) clock chip on the KA630-A CPU when the system is off. The code for the user's language is stored in RAM on this chip and is lost if the BBU fails.

For further information, refer to the *MicroVAX 630 CPU Module User's Guide* (EK-KA630-UG).

### 2.3 MS630 MEMORY MODULE

The MS630 memory module provides memory expansion for the KA630-A CPU module. It is available in three versions (Table 2-2), all populated with 256 K RAM chips.

**Table 2-2 MS630 Memory Module Versions**

<b>Version</b>	<b>Size (Mbyte)</b>	<b>Module Height</b>	<b>Module Number</b>
MS630-AA	1	Dual	M7607-AA
MS630-BA	2	Quad	M7608-AA
MS630-BB	4	Quad	M7608-BA

One or two MS630 modules can be used in the MicroVAX system. The MS630 modules interface with the KA630-A CPU through the MicroVAX local memory interconnect in the CD rows of slots 1 through 3 of the backplane, and through a 50-conductor cable. This cable is installed between J1 of the KA630-A CPU and the corresponding J connector on one or both MS630 modules.

No jumper or switch configuration is required for MS630 modules.

**CAUTION**

**MS630-BA and -BB modules can only be installed in slots 2 and 3 of the backplane. The MS630-AA module can only be installed in the CD rows of slots 2 and 3.**



### 3.1 INTRODUCTION

This chapter describes the options currently supported by the MicroVAX II 630QB system. These options, as well as commonly used peripheral devices, are broken down into the following categories:

- Communications
- Disk Storage
- Tape Storage

Each section includes configuration tables and a description of the cabinet kit required for installation. Detailed documentation for each device is also listed.

#### **NOTE**

**Current, power and bus loads for the following options are listed in Table 4-1.**

#### 3.1.1 Ordering Options

Two items, a base module and a cabinet kit, must be ordered to get all the parts necessary for an option. For example,

- DEQNA-M Base module
- CK-DEQNA-KA Cabinet kit

### 3.1.2 Module Configuration

Each module in a system has a device address, commonly referred to as a control and status register (CSR) address, and an interrupt vector, which must be set when the module is installed. The CSR address and interrupt vector are either fixed or floating.

A fixed address or vector means that there is a standard location reserved in memory for the address or vector of that particular module. Modules with fixed addresses and vectors are usually shipped to match the standard locations. If two modules of the same type are used, the address and vector settings of the second module must be changed.

A floating address or vector is assigned a location within an octal range. The exact address or vector within the range depends on what other modules are in the system. The ranges are as follows:

- Floating CSR address: (1776)0010–(1776)3776
- Floating interrupt vector: (00000)300–(00000)774

Chapter 4 provides guidelines for determining floating CSR address and interrupt vector settings.

The address and vector settings are usually configured by means of switches or jumpers on the module. For example, the 22-bit setting for a CSR address of 17761540 is as follows:

A21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0
—	△	△	—	△	△	—	△	△	—	△	△	—	△	△	—	△	△	—	△	△	—
1	7	7	6	1	5	4	0														



It is not necessary to change bits 21–13, because all possible fixed and floating addresses begin with either 1777 or 1776. It is only necessary to be able to change bits A12–A3 (or A2) to set the CSR address. A typical switch setting would only show the following switches:

Switch	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits
Setting →	0	0	0	1	1	0	1	1	0	0	
	△	△	△		△	△		△	△		
	6*	1		5			4				

\* If A12 were set to a 1, this would be a 7.

Similarly, an interrupt vector of 320 is typically configured using only the following bits:

Switch	V8	V7	V6	V5	V4	V3	← Vector Bits
Setting →	0	1	1	0	1	0	
	△	△		△	△		
	3			2			

#### NOTE

**The switch layout for different modules varies. The line below the switch setting for each module shows the octal boundaries.**

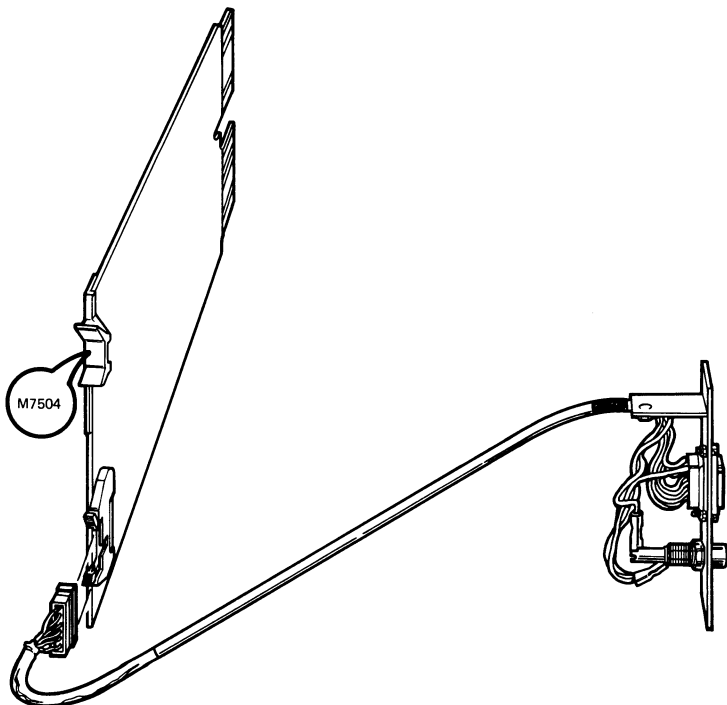


**Table 3-1 DEQNA CSR Address and Interrupt Vector**

Module	CSR Address	Interrupt Vector
1	17774440	120
2	17774460	Floating

Jumper W2 is normally removed. This provides fair access to all Q22-Bus DMA devices by causing the DEQNA to wait 5 microseconds before re-requesting the bus. Jumper W3 is normally installed. When installed, it disables a sanity timer at initialization. Figure 3-2 shows the internal cabling for the DEQNA.

For further information, refer to the *DEQNA User's Guide* (EK-DEQNA-UG).



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Figure 3-2 DEQNA Internal Cabling

### 3.2.2 DHV11 Asynchronous Multiplexer (Eight Lines)

Order:	DHV11-M	Base module
	CK-DHV11-AA	Cabinet kit (two type B filter connectors, 2 internal cables)

Module Number: M3104

The DHV11 (Figure 3-3) is an asynchronous multiplexer that provides support for up to eight serial lines for data communications. It is a quad-height module with the following features:

- Full modem control
- DMA or silo output
- Silo input buffering
- Split speed

The DHV11 is compatible with the following modems:

- Digital modems: DF01, DF02, DF03, and DF112
- Bell modems: 103, 113, 203C, 202D, and 212

The CSR address and interrupt vector of the module are set using two DIP switches, E58 and E43 (Figure 3-3). The CSR address and interrupt vector are floating. Tables 3-2 and 3-3 show the factory and common settings.

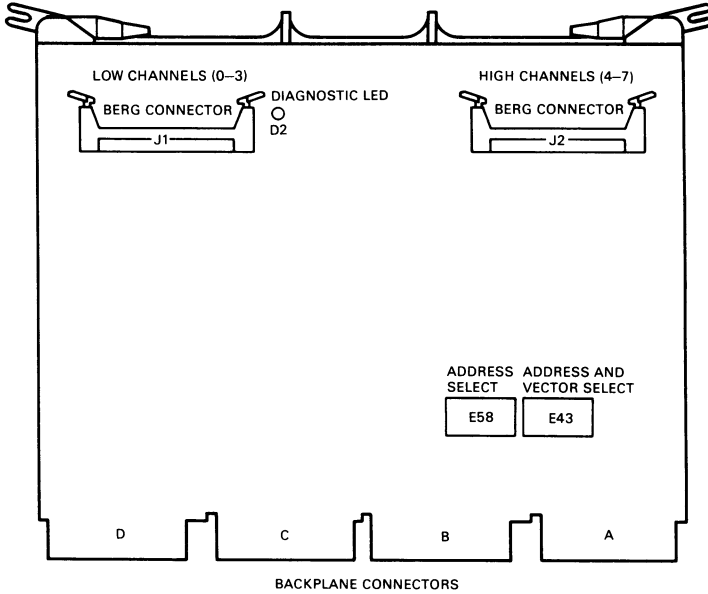


Figure 3-3 DHV11 Module Layout

Table 3-2 DHV11 CSR Address

CSR Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	← Add. Bits
	E58								E43	← Switches
	1	2	3	4	5	6	7	8	1	
17760460	0	0	0	0	1	0	0	1	1	(Factory)
17760440	0	0	0	0	1	0	0	1	0	
17760500	0	△	0	0	△	1	0	1	△	0

1 = Switch on  
0 = Switch off

Table 3-3 DHV11 Interrupt Vector

Setting	V8	V7	V6	V5	V4	V3	← Switch*
	E43-3	4	5	6	7	8	
300	0	1	1	0	0	0	(Factory)
310	0	1	1	△	0	0	1

1 = Switch on  
0 = Switch off  
\* E43 switch 2 is not used.

**NOTE**

**The actual address and vector of the DHV11 depend on what other modules are installed in the system. Refer to Section 4.1.5 for guidelines for setting the address and vector.**

Figure 3-4 shows the internal cabling for the DHV11. The internal cables should be installed with the red stripe side connected to pin A (pin 1) of the DHV11 connectors. The other end of the cables should then be installed with the red stripe aligned with the small arrow (pin 1) on the filter connector.

For further information, refer to the *DHV11 Technical Manual (EK-DHV11-TM)*.

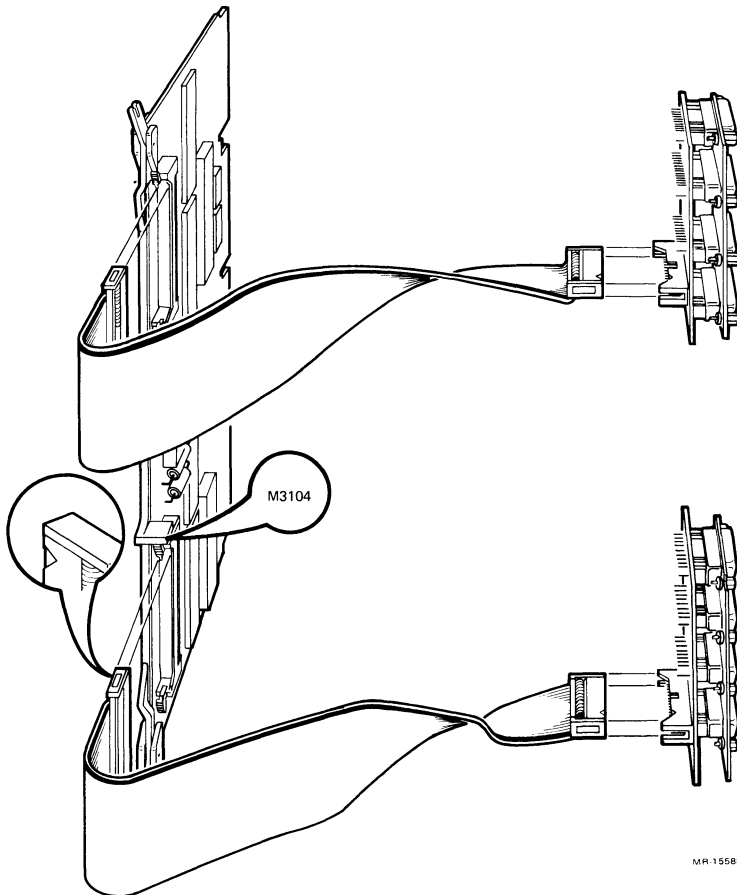


Figure 3-4 DHV11 Internal Cabling

### 3.2.3 DHV11 Remote Distribution Cabinet Kit (CK-DHV11-VA)

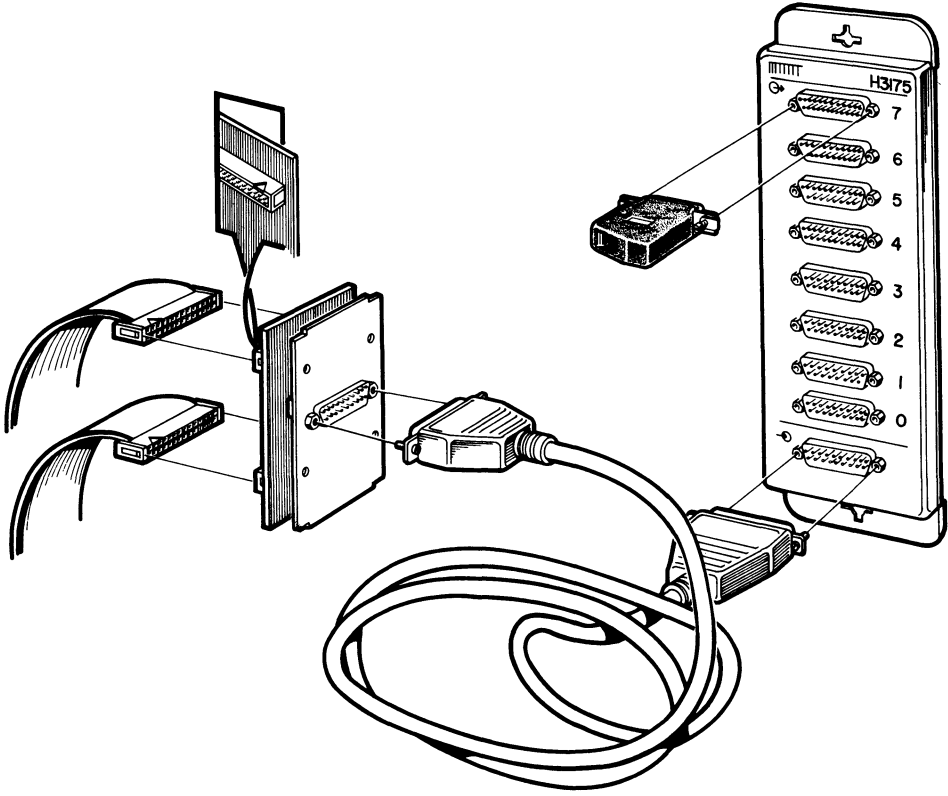
The DHV11 Remote Distribution Cabinet Kit (Figure 3-5) distributes eight data-only serial lines from one type B filter connector using a remote distribution panel.

The DHV11 Remote Distribution Cabinet Kit contains the following:

- H3176 Bulkhead panel (fits into one type B I/O panel cutout)
- H3175 Remote distribution panel (contains eight 25-pin D subconnectors)
- BC22H-10 A 10 ft cable (connects the remote distribution panel to the bulkhead panel)
- BC05L-1K Two 21-inch cables (connect the DHV11 to the bulkhead panel)

The H3176 bulkhead panel consists of two 40-pin headers and a fully filtered female 25-pin D subconnector. It is connected to a DHV11 by two BC05L-1K cables, which supply eight pairs of data signals (transmit/receive) plus signal ground for each pair.

The H3175 remote distribution panel distributes the eight pairs of data signals plus signal ground for each pair to eight male 25-pin D subconnectors. The connection to the H3176 is made by the BC22H-10 cable. The H3175 has teardrop cutouts on both ends, and can be mounted vertically or horizontally on a wall or floor. The H3175 dimensions are 279 × 86 × 17.7 mm (11 × 3.4 × 0.7 in).



MR-16246

Figure 3-5 DHV11 Remote Distribution Cabinet Kit



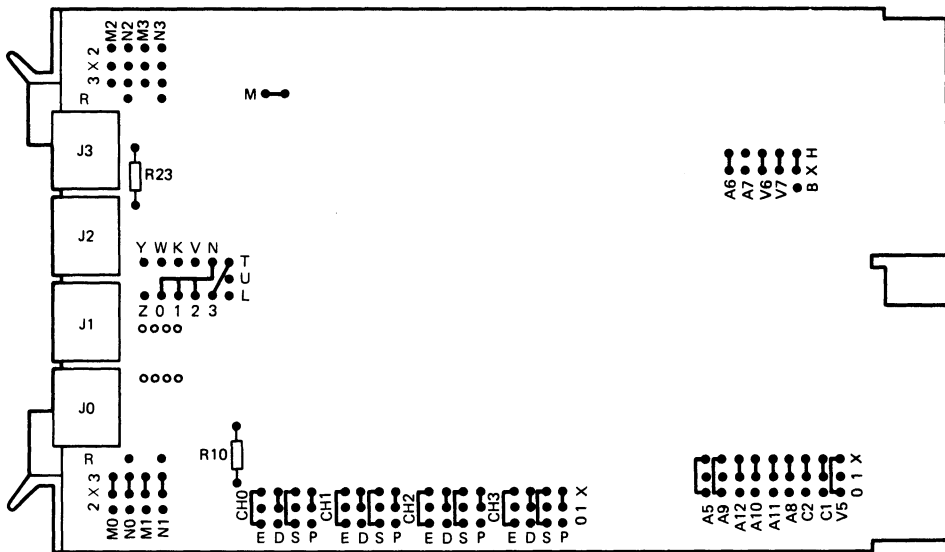


The interrupt vector is floating and is configured using wire-wrap pins. The interrupt vector of channel 0 can only be set at **x00** or **x40**. The interrupt vector of the remaining channels is then 10 (octal) greater. For example, if the module is set at 300, the interrupt vector of CH-1 is 310, CH-2 is 320, etc. The factory configuration is shown in Table 3-5.

**Table 3-5 DLVJ1 Interrupt Vector**

Settings	V8	V7	V6	V5	V4	V3	←	Vector Bits
300	-	x-h	x-h	R-x	-	-		(Factory)
340	-	x-h	x-h	1-x	-	-		

R = No wire wrap on pins = 0  
 x-h = Wire wrap on pins x and h = 1  
 1-x = Wire wrap on pins 1 and x = 1



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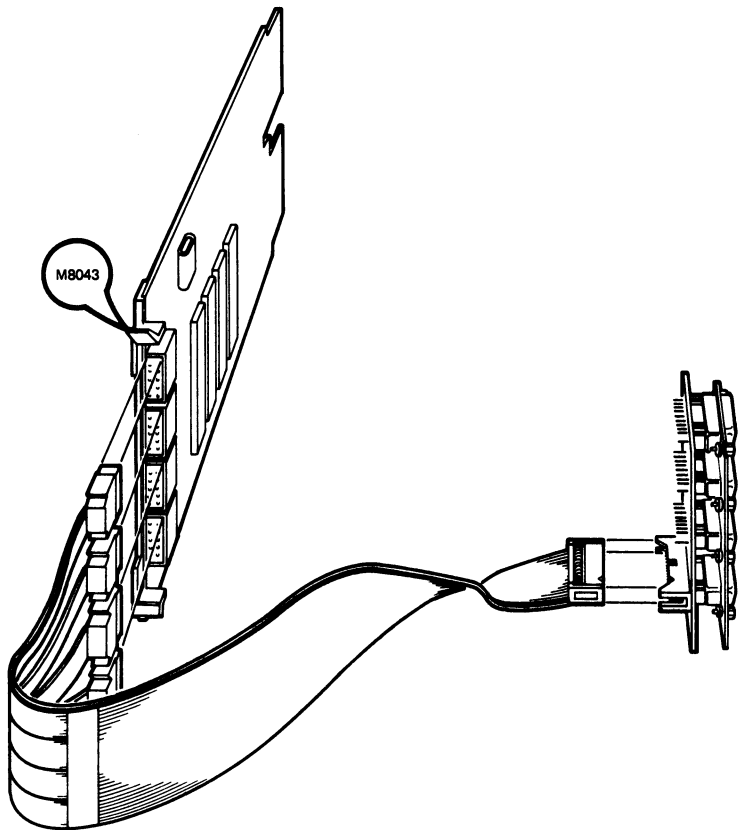
Figure 3-6 DLVJ1 Module Layout

**NOTE**

The actual interrupt vector of the DLVJ1 depends on the other modules in the system. Section 4.1.5 provides guidelines for determining the interrupt vector.

Figure 3-7 shows the internal cable setup for the DLVJ1.

For further information, refer to the *DLV11-J User's Guide* (EK-DLVIJ-UG).



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Figure 3-7 DLVJ1 Internal Cabling

### 3.2.5 DMV11 Synchronous Controller

The DMV11 is a quad-height module that supports:

- Full-duplex or half-duplex operations
- DMA
- Point-to-point communications
- Multipoint communications

It is available in four system options. The option is determined by the interface requirements of your system. Table 3-6 lists the four system options and their corresponding upgrade components. Table 3-7 lists the interface for each system option and the appropriate external cable.

**Table 3-6 DMV11 Versions**

<b>Order (Base Module + Cabinet Kit)</b>	<b>Module Number</b>	<b>Module Connector</b>	<b>I/O Panel Insert Type</b>
DMV11-M + CK-DMV11-AA	M8053	J2 (of 2)	B
DMV11-M + CK-DMV11-BA	M8053	J1 (of 2)	A
DMV11-N + CK-DMV11-CA	M8064	J1 (of 1)	B
DMV11-M + CK-DMV11-FA	M8053	J2 (of 2)	B

**Table 3-7 DMV11 Interfaces**

<b>Order (Base Module + Cabinet Kit)</b>	<b>Interface</b>	<b>External Cable</b>
DMV11-M + CK-DMV11-AA	EIA RS232-C/CCITT V.28	BC22E or BC22F
DMV11-M + CK-DMV11-BA	CCITT V.35/DDS	BC17E*
DMV11-N + CK-DMV11-CA	Integral modem	BC55S or BC55T
DMV11-M + CK-DMV11-FA	EIA RS423-A/CCITT V.24	BC55D

\* Cable included in the -BA cabinet kit.

The CSR address and interrupt vector of the DMV11 are configured by means of DIP switches (Figures 3-8 and 3-9). The CSR address and interrupt vector are both floating. Tables 3-8 and 3-9 show the factory settings and other common settings.

**Table 3-8 DMV11 CSR Address**

	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits	
	E53 (M8053)						E54 (M8053)					
	E58 (M8064)						E59 (M8064)					
CSR											← Switches	
Address	8	7	6	5	4	3	2	1	2	1		
17760320	0	0	0	0	0	1	1	0	1	0		
17760340	0	0	0	0	0	1	1	1	0	0	(Factory)	
17760360	0	△	0	0	△	0	1	1	△	1	0	△

1 = On = Closed  
 0 = Off = Open

**Table 3-9 DMV11 Interrupt Vector**

	V8	V7	V6	V5	V4	V3	← Vector Bits
	E54 (M8053)			E59 (M8064)			
Interrupt							← Switches
Vector	8	7	6	5	4	3	
300	0	1	1	0	0	0	(Factory)
310	0	1	1	△	0	1	

1 = On = Closed  
 0 = Off = Open

**NOTE**

The actual settings depend on the other modules in the system. Section 4.1.5 provides guidelines for setting the CSR address and interrupt vector.

Another DIP switch on the DMV11 controls selectable features. Table 3-10 shows the function of this switch and a common setting.

**Table 3-10 DMV11 Switch Selectable Settings**

<b>E107 (M8064)</b>									
<b>E101 (M8053)</b>									
<b>10</b>	<b>9</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
off	off	on	on	on	on	on	on	on	on

On = function disabled = 0

Notes:

Switch 10 is unused on M8064. Switch 10 is in OFF position for EIA interface, ON for V.35.

Switch 9 must be OFF for integral modem (M8064) or when running above 19.2 K baud.

Switches 8, 7 and 6 set mode of operation when switch 1 is OFF.

Switch 5 OFF enables Remote Load Detect.

Switch 4 OFF enables Power On Boot.

Switch 3 OFF enables Auto Answer.

Switch 2 determines unit number for booting (ON = first DMV11, OFF = second DMV11).

Switch 1 OFF enables switches 8, 7 and 6 to determine mode of operation. Switch 1 ON = mode of operation determined by software.

A DIP switch (E119 on M8064, E113 on M8053) determines the Digital Data Communications Message Protocol (DDCMP) address register tributary/password. This must be set to a unique site address. For further information, refer to the *DMV11 Synchronous Controller User's Guide* (EK-DMV11-UG).

Figures 3-8 and 3-9 show the location of the DIP switches on the two DMV11 modules. Figures 3-10 and 3-11 show the internal cabling for the four DMV11 interfaces.

For further information, refer to the *DMV11 Synchronous Controller Technical Manual* (EK-DMV11-TM).

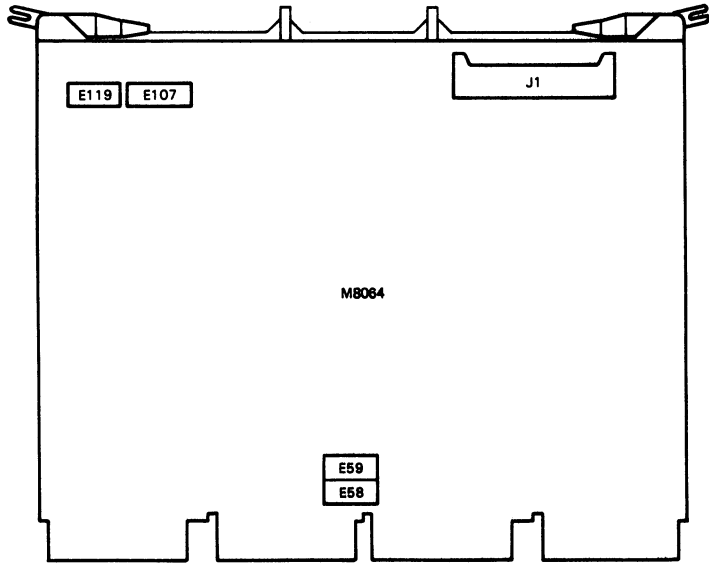


Figure 3-8 DMV11 (M8053) Module Layout

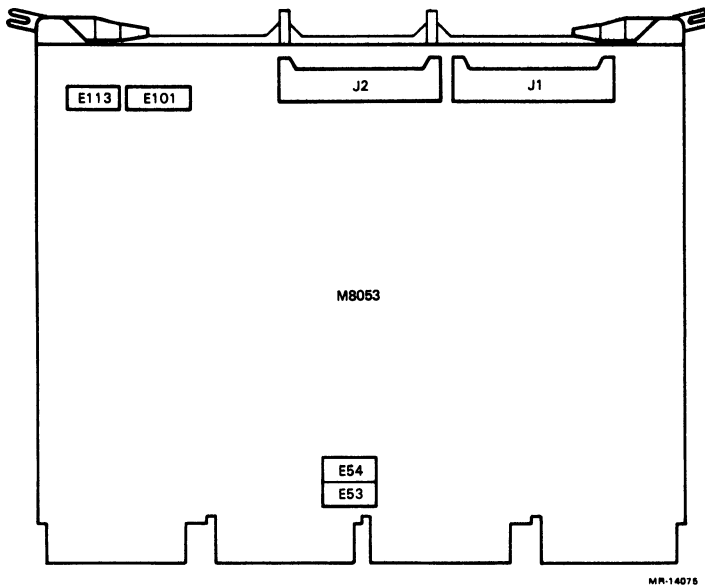


Figure 3-9 DMV11 (M8064) Module Layout

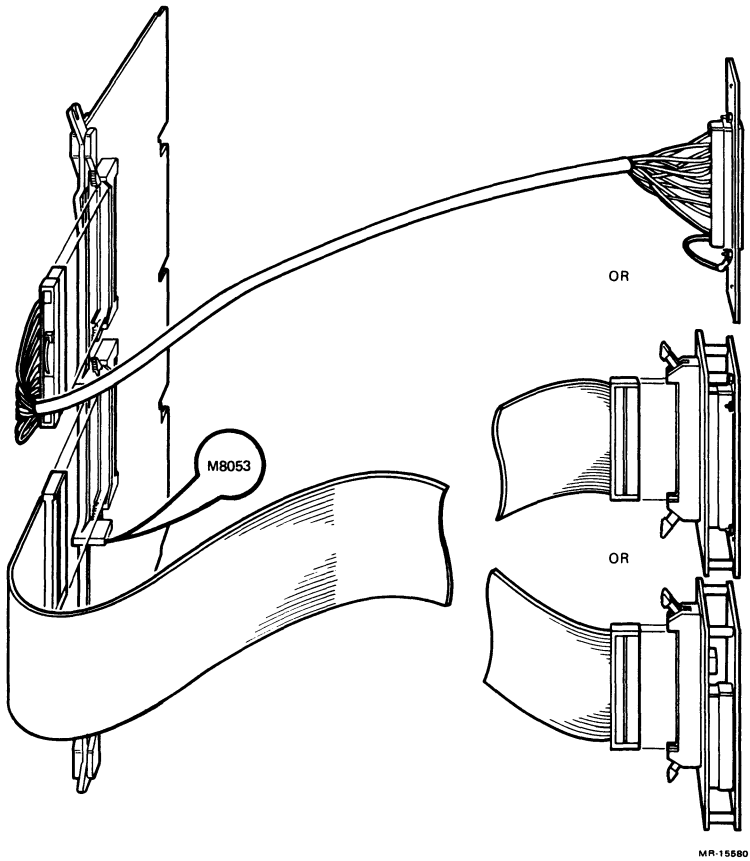
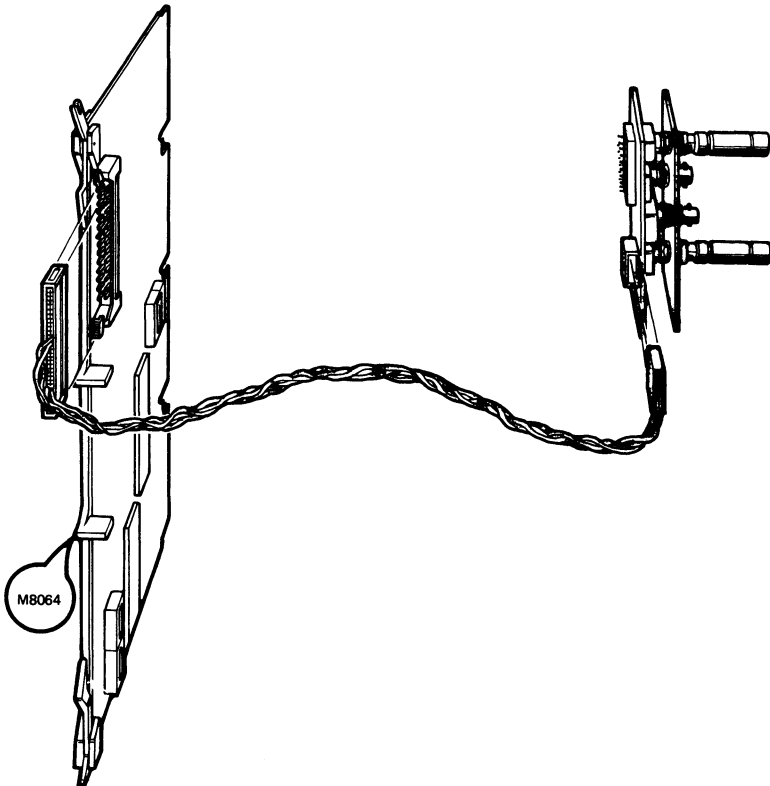


Figure 3-10 M8053 Internal Cabling





MR-15585

Figure 3-11 M8064 Internal Cabling

### 3.2.6 DPV11 Synchronous Interface

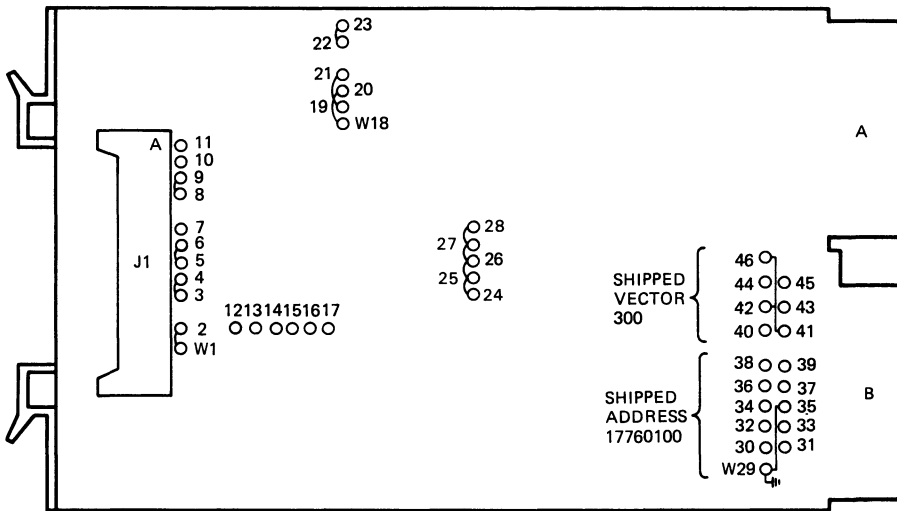
Order: DPV11-M Base module  
CK-DPV11-AA Cabinet kit (type A filter connector and internal cable)

Module Number: M8020

The DPV11 is a dual-height module that connects the Q-Bus to a modem, using a synchronous serial line. The serial line conforms to the following RS-232-C, RS-423-A, and RS-422-A EIA standards.

EIA compatibility is provided solely for use in local communications (timing and data leads only). The DPV11 is intended for character-oriented protocols, such as DDCMP, or communication protocols that are bit-oriented, such as Synchronous Data-Link Control (SDLC).

The CSR address and interrupt vector of the DPV11 are configured by means of jumpers (Figure 3-12).



MR-14236

Figure 3-12 DPV11 Module Layout

The CSR address and interrupt vector are both floating. Tables 3-11 and 3-12 show factory and common settings.

**Table 3-11 DPV11 CSR Address**

Setting	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits
	W31	W30	W36	W33	W32	W39	W38	W37	W34	W35	← Pin
17760010	0	0	0	0	0	0	0	0	0	1	(Factory)
17760270	0	0	0	0	0	1	0	1	1	1	
17760310	0	△	0	0	△	0	1	1	△	0	1

1 = Jumper inserted between pin Wxx and pin 29 (ground)

0 = Jumper removed

**Table 3-12 DPV11 Interrupt Vector**

Interrupt Vector	V8	V7	V6	V5	V4	V3	← Vector Bits
	W34	W42	W41	W40	W44	W45	← Pin
300	0	1	1	0	0	0	(Factory)
310	0	1	1	△	0	0	1

1 = Jumper inserted between pin Wxx and pin 46 (ground)

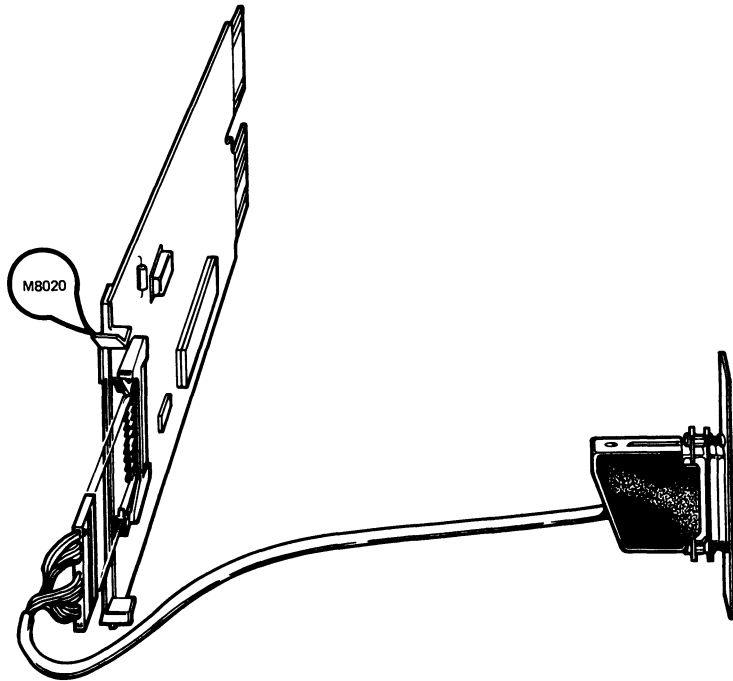
0 = Jumper removed

**NOTE**

The actual settings of the DPV11 depend on the other modules in the system. Section 4.1.5 provides guidelines for setting the CSR address and interrupt vector.

Figure 3-13 shows the internal cabling of the DPV11. The DPV11 cabinet kit should be installed in cutout J or I of the I/O distribution panel (see Figure 1-14). The cable must be installed from the inside of the I/O distribution panel, as follows:

1. Unscrew the filter connector from the black cable terminator.
2. Connect the cable to the DPV11 module.
3. Place the black cable terminator inside the J or I cutout.
4. Reconnect the filter connector to the cable terminator from the outside of the I/O distribution panel.
5. Tighten the two screws that secure the cable terminator to the filter connector from the inside of the I/O distribution panel.
6. Tighten the two screws that secure the filter connector to the I/O panel from the outside of the I/O distribution panel.



MR-15582

Figure 3-13 DPV11 Internal Cabling

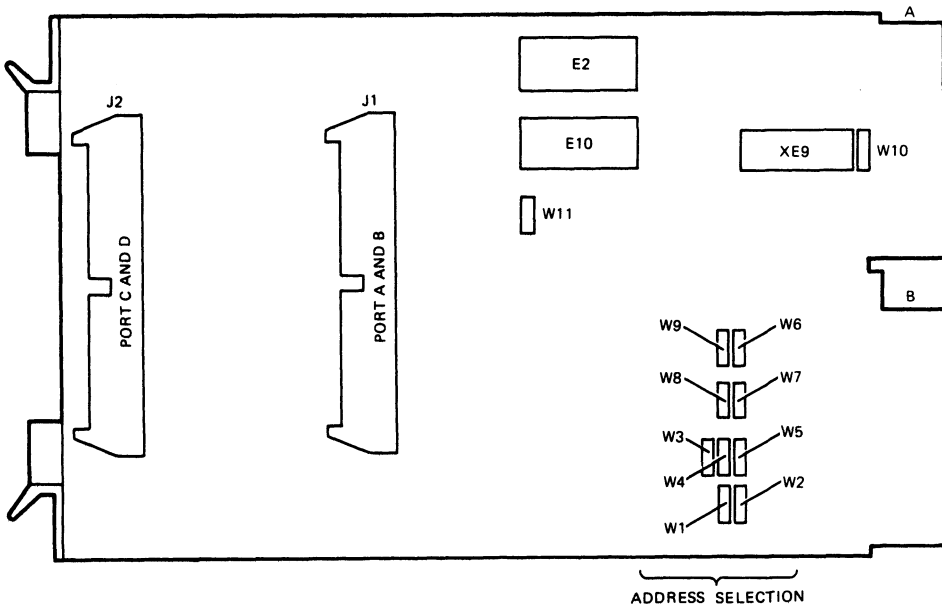
For further information, refer to the *DPV11 Synchronous Interface User's Manual* (EK-DPV11-UG).

### 3.2.7 DRV11-J High Density Parallel Interface (Four Lines)

Order:                DRV11-J                Base module  
                      CK-DRV1J-KB        Cabinet kit (two type A filter connectors,  
  two internal cables)

Module Number:    M8049

The DRV11-J (Figure 3-14) is a dual-height module that connects a Q-Bus to 64 I/O lines. These lines are organized as four 16-bit ports, A through D. Data line direction is selectable under program control for each 16-bit port.



MR-14797

Figure 3-14 DRV11-J Module Layout

The interrupt vector is set under program control, eliminating the need for jumper-defined vectors. The CSR address of the module is fixed and is set with jumpers W1 through W9. Table 3-13 lists the factory configuration.

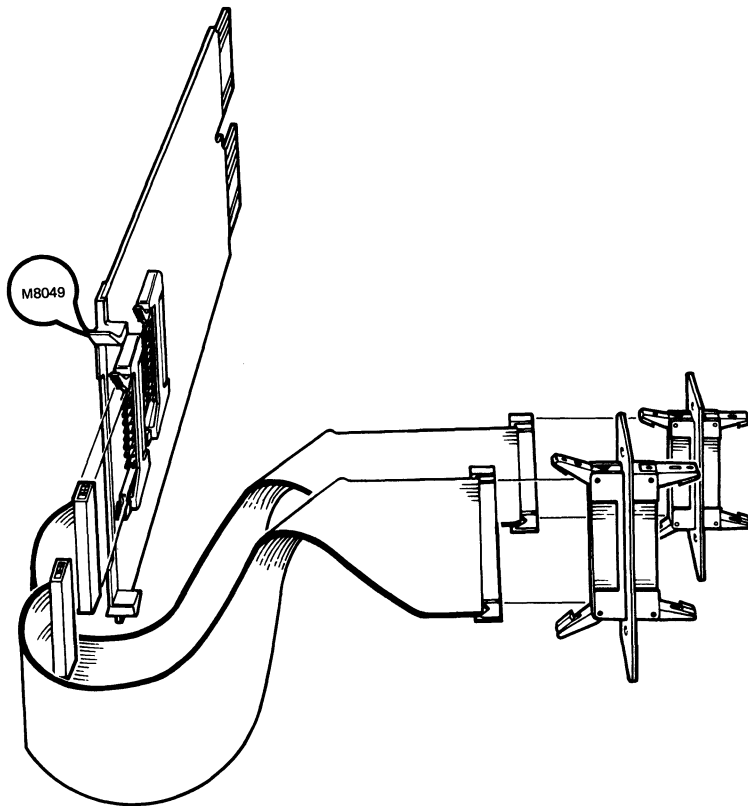
**Table 3-13 DRV11-J CSR Address**

Module	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	← Add. Bits ← Jumpers
		W1	W2	W3	W4	W5	W6	W7	W8	W9	
1	17764160	0	1	0	0	0	0	1	1	1	(Factory)
2	17764140	0	1	0	0	0	0	1	1	0	

1 = Installed  
0 = Removed

Figure 3-15 shows the internal cabling for the DRV11-J.

For further information, refer to the *DRV11-J Interface User's Manual* (EK-DRV1J-UG).



MR-15581

Figure 3-15 DRV11-J Internal Cabling

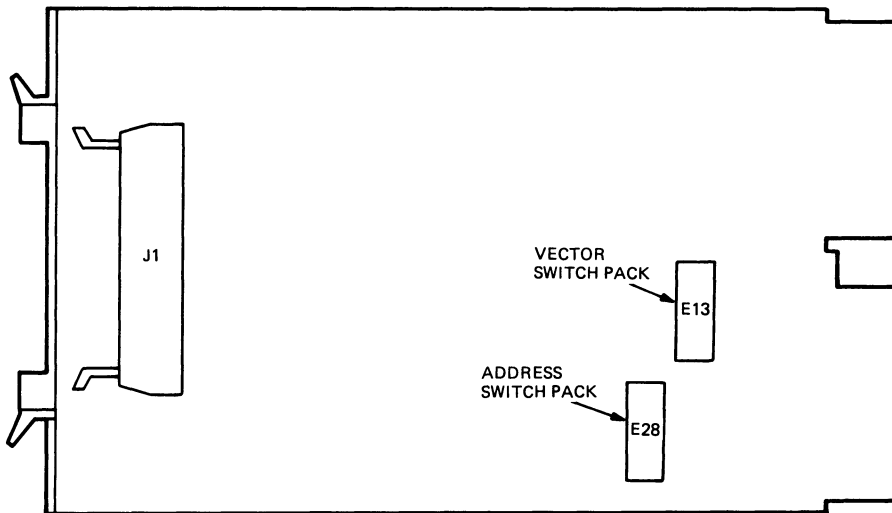
### 3.2.8 DZQ11 Asynchronous Multiplexer (Four Lines)

Order:               DZQ11-M               Base module  
                      CK-DZQ11-DA       Cabinet kit (type B filter connector,  
  internal cable)

Module Number:    M3106

The DZQ11 is a dual-height module that connects the Q22-Bus to up to four asynchronous serial lines. It conforms to the RS-232-C and RS-423-A interface standards. The DZQ11 permits dial-up (auto-answer) operation with modems using full-duplex operations such as Bell models 103, 113, 212 or equivalent.

The CSR address and interrupt vector of the module are set using two DIP switches, E28 and E13 (Figure 3-16). The CSR and interrupt vector are floating. Tables 3-14 and 3-15 show the factory and common settings.



MR-15244

Figure 3-16 DZQ11 Module Layout



**Table 3-14 DZQ11 CSR Address**

CSR Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Switches		
	E28												
	1	2	3	4	5	6	7	8	9	10			
17760010	0	0	0	0	0	0	0	0	0	1	(Factory)		
17760100	0	△	0	0	0	△	0	0	1	△	0	0	△

0 = Switch open

1 = Switch closed

**Table 3-15 DZQ11 Interrupt Vector**

Interrupt Vector	V8	V7	V6	V5	V4	V3	← Switches
	E13						
	1	2	3	4	5	6	
300	0	1	1	0	0	0	(Factory)
310	0	1	1	△	0	0	1

0 = Switch open

1 = Switch closed

Notes:

Switch 7 of the E13 DIP switch is not used.

For normal operation switch 8 must be ON and switches 9 and 10 must be OFF.

Figure 3-17 shows the internal cabling for the DZQ11.

For further information, refer to the *DZQ11 Asynchronous Multiplexer User's Guide* (EK-DZQ11-UG).

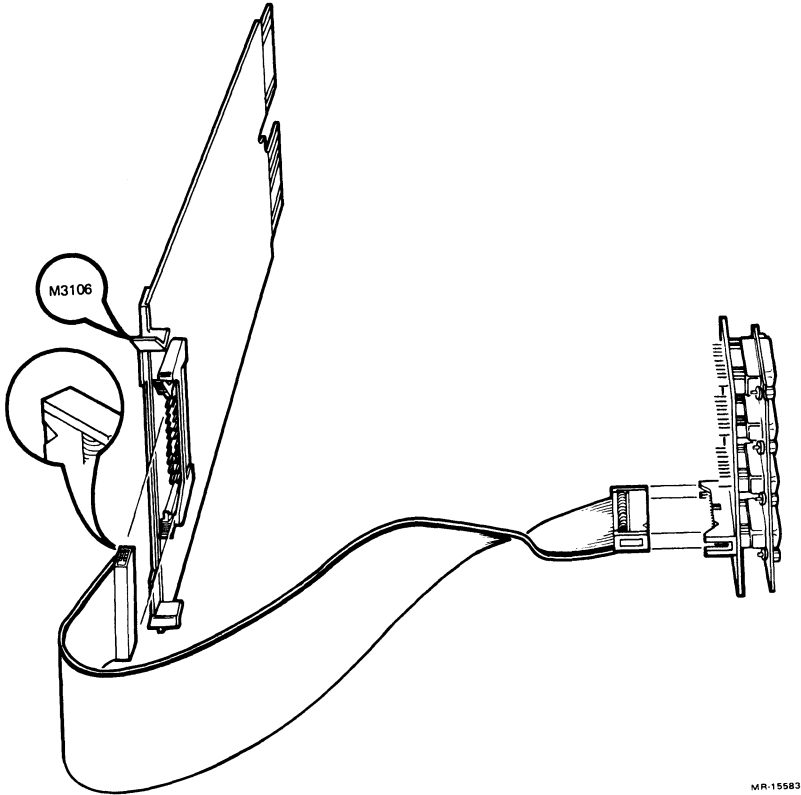


Figure 3-17 DZQ11 Internal Cabling



The DZV11 is configured using 16 jumpers and 2 DIP switches. The CSR address and interrupt vector of the DZV11 are both floating. Tables 3-16 and 3-17 list the factory settings.

**Table 3-16 DZV11 CSR Address**

CRS Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits	
	E30	1	2	3	4	5	6	7	8	9	10	← Switches
17760010	0	0	0	0	0	0	0	0	0	0	1	(Factory)
17760100	0	△	0	0	△	0	0	1	△	0	0	0

1 = Switch closed  
 0 = Switch open

**Table 3-17 DZV11 Interrupt Vector**

Interrupt Vector	V8	V7	V6	V5	V4	V3	← Vector Bits
	E2	1	2	3	4	5	6
300	0	1	1	0	0	0	(Factory)
310	0	1	1	△	0	0	1

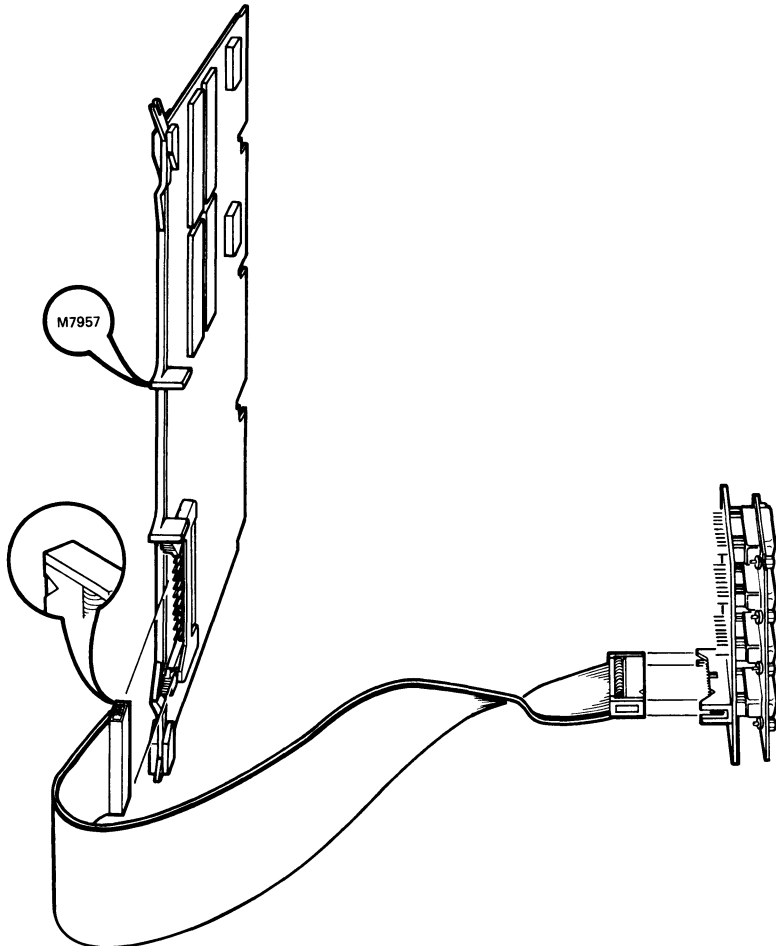
1 = Switch closed  
 0 = Switch open

**NOTE**

**The actual settings of the DZV11 depend on the other modules in the system. Section 4.1.5 provides guidelines for setting the CSR address and interrupt vector.**

Figure 3-19 shows the internal cabling layout.

For further information, refer to the *DZV11 Asynchronous Multiplexer Technical Manual* (EK-DZV11-TM).



MR-15586

Figure 3-19 DZV11 Internal Cabling

**3.2.10 LPV11 Interface Module (For LP25 System Printer)**

Order:                   LPV11-AD           LP25-DA printer and LPV11 controller for 64/96 US character set  
                           CK-LPV1A-KB       Cabinet kit (type A filter connector and internal cable)

Module Number: M8027

The LPV11 is a dual-height module that controls the flow of data between the Q22-Bus and a line printer. It is configured using jumpers (Figure 3-20).

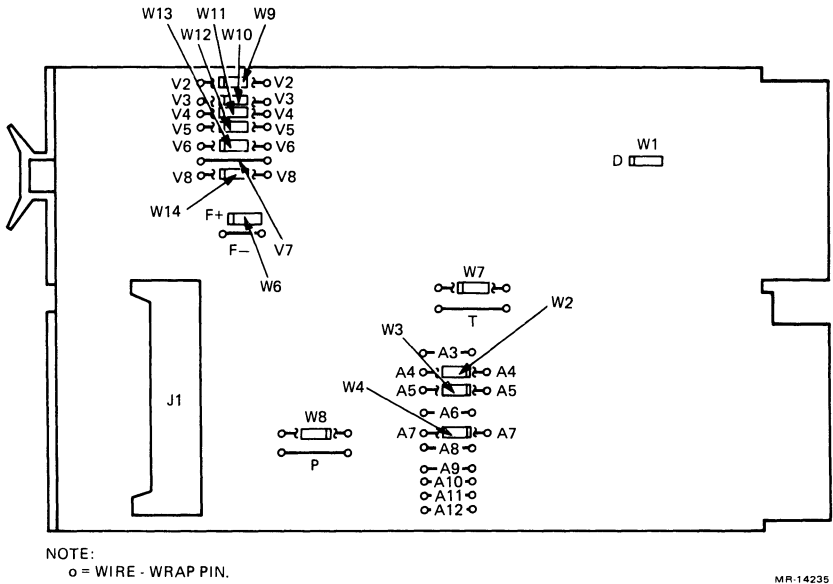


Figure 3-20 LPV11 Module Layout

The CSR address and interrupt are both fixed. Tables 3-18 and 3-19 show the factory configuration. Figure 3-21 shows the internal cabling setup.

**Table 3-18 LPV11 CSR Address**

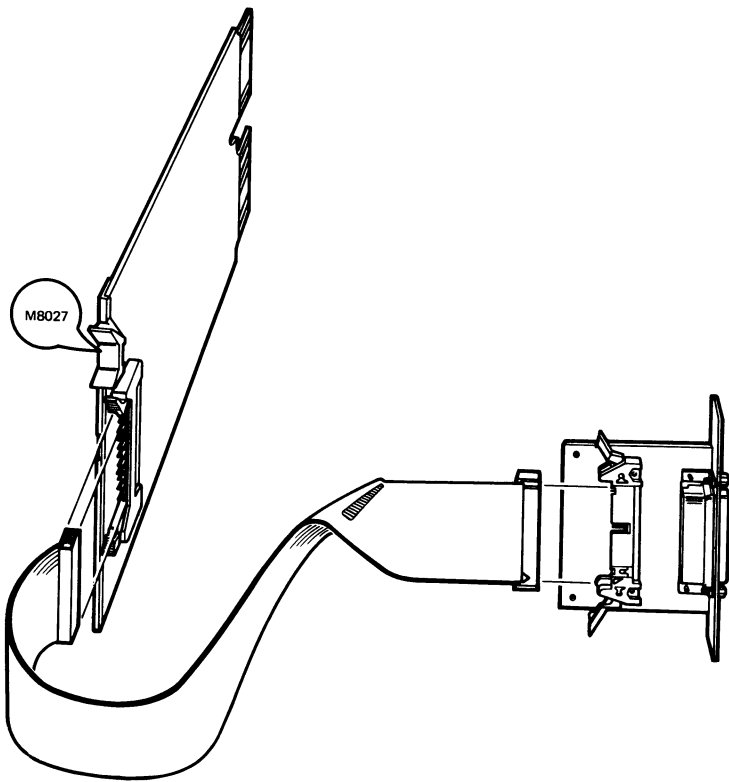
CSR Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits (Jumpers)
17777514	1	1	1	1	1	0	1	0	0	1	(Factory)

0 = Installed  
 1 = Removed

**Table 3-19 LPV11 Interrupt Vector**

Interrupt Vector	V8 W14	V7 V7 W7	V6 W13	V5 W12	V4 W11	V3 W10	V2 W9	← Vector Bits ← Jumper
200	0	1	0	0	0	0	0	(Factory)

0 = Installed  
1 = Removed



MR-15587

Figure 3-21 LPV11 Internal Cabling

### 3.3 DISK STORAGE

#### 3.3.1 RQDX2, RQDX3 Disk Controllers

Order:                    RQDXn-BA                    Controller kit for BA123-A enclosure  
                              (n = 2 or 3)

Module Number:    M8639-YB (RQDX2)  
                              M7555 (RQDX3)

An RQDXn-BA kit includes the following:

1. RQDXn: Controller module
2. M9058: Signal distribution board
3. 17-00861-01: 50-pin cable, RQDX to M9058
4. 17-00862-01: 40-pin cable, M9058 to four RD console boards

RQDX2 and RQDX3 are intelligent controllers with on-board microprocessors, used to interface fixed disk drives and diskette drives to the Q22-Bus. Data is transferred using DMA. Programs in the host system communicate with the controller and drives using the Mass Storage Control Protocol (MSCP).

The RQDX2 and RQDX3 can control a maximum of four drives. Each fixed disk counts as one drive. Each RX50 counts as two drives. Figure 3-22 shows the jumper and LED locations for the RQDX2, while Figure 3-23 shows the jumper and LED locations for the RQDX3.



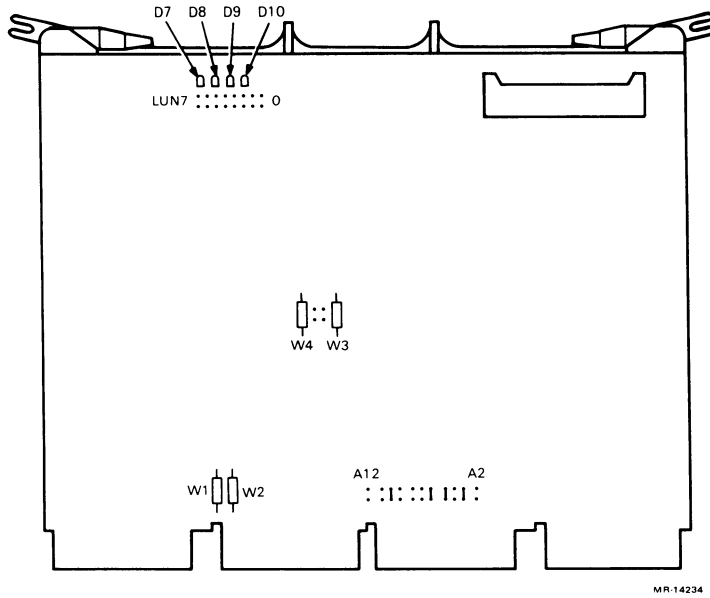


Figure 3-22 RQDX2 Module Layout

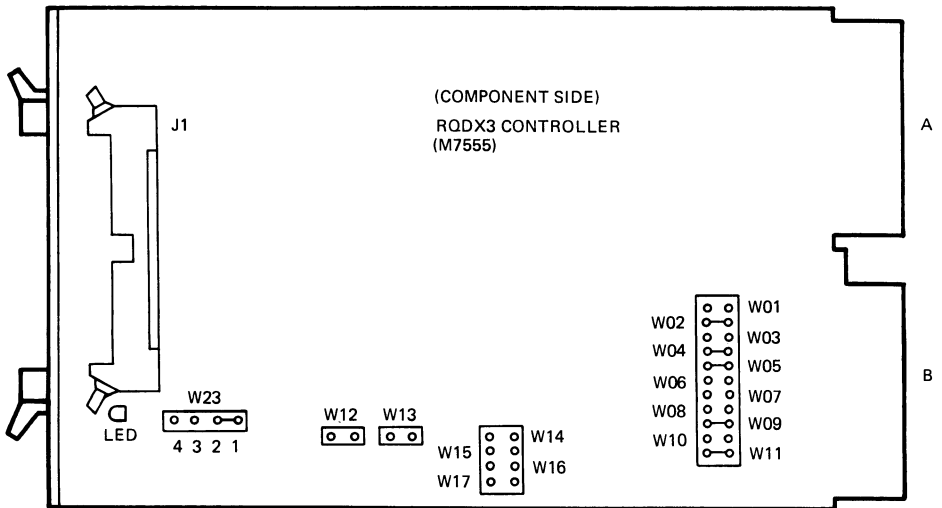


Figure 3-23 RQDX3 Module Layout

MR-16713

The CSR address of the first MSCP controller is fixed. If a second controller is installed, its CSR address is floating. Table 3-20 lists the factory setting and common settings for a second MSCP controller.

**Table 3-20 RQDX2/RQDX3 CSR Address**

Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	← Add. Bits (Jumpers)
17772150	1	0	1	0	0	0	1	1	0	1	0	← (Factory)
<b>Possible settings for a second controller:</b>												
17760334	0	0	0	0	0	1	1	0	1	1	1	
17760354	0	0	0	0	0	1	1	1	0	1	1	
17760374	0	△	0	0	△	0	1	1	△	1	1	△

1 = Installed  
 0 = Removed

The interrupt vector for the RQDX2 and RQDX3 controllers is set under program control. The first controller is assigned a fixed interrupt vector of 154. If a second one is installed, its interrupt vector is floating.

**NOTE**

**RQDX2 and RQDX3 controllers are MSCP devices. The first MSCP device in a system is assigned a CSR address of 17772150. If more than one MSCP device is installed, the CSR address of the second device must be set within the floating range. See Section 4.1.5 to determine the floating CSR address.**

**In MicroVAX II systems, Logical Unit Number (LUN) jumpers should not be installed on the RQDX2 or RQDX3 modules.**

For further information, refer to the *RQDX2 Controller Module User's Guide* (EK-RQDX2-UG), or the *RQDX3 Controller Module User's Guide* (EK-RQDX3-UG).

### 3.3.2 RD52, RD53 Disk Drives

Order:                   RD5nA-BA                   Disk kit  
                              (n = 2 or 3)

An RD5nA-BA kit includes the following:

1. RD5n-A: Disk drive
2. 17-00282-01: 20-pin cable to signal distribution board
3. 17-00286-01: 34-pin cable to signal distribution board
4. 70-22393-01: Control panel assembly

The RD52 and RD53 are fixed disk drives with formatted storage capacities of 31 and 71 Mbytes, respectively.

In addition to the cables listed above, a cable from the power supply must be connected to each RD drive in the system (see Section 1.6).

**3.3.2.1 Factory Configuration** – The RD52 read/write printed circuit board (PCB) has five pairs of drive select pins (Figure 3-24). One (any one) of the four pairs of pins on the left must be connected with a jumper. The RD53 read/write PCB has four drive select switches at the rear of the drive's read/write board. One (any one) of the four switches must be depressed.

In the BA123-A enclosure, a drive is selected by the position of its signal cables in the M9058 signal distribution board, not by the drive select pins. See Figure 1-8 for the correct cabling.

**3.3.2.2 Disk Formatting** – If an RD52 or RD53 drive is added to the system, it must be formatted. The formatting utility is available in the maintenance version of the MicroVAX II Diagnostics Kit.

For further information, refer to *RD52-D, -R Fixed Disk Drive Subsystem Owner's Manual* (EK-LEP04-OM-001) and *11C23-UE/11C23-UC RD52 Installation Guide* (EK-RD52U-IN).

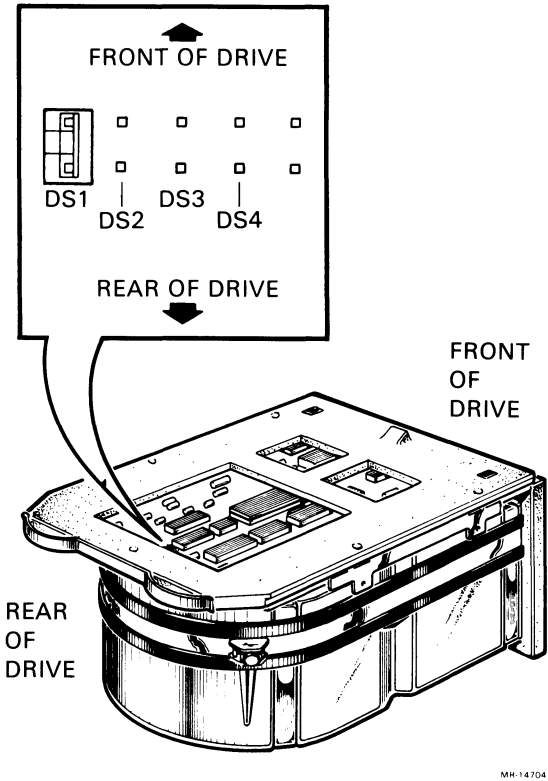


Figure 3-24 RD52 Disk Drive and Shunt Jumper

### 3.3.3 RX50 Diskette Drive

Order:                   RX50A-BA                   Diskette kit

The RX50A-BA kit includes the following:

1. RX50-AA: Diskette drive
2. 17-00867-01: 34-pin cable, RX50 to signal distribution board

The RX50 (Figure 3-25) is a random access, dual-diskette storage device that uses two single-sided 13.3 cm (5.25 in) RX50K diskettes. It has a total formatted capacity of 818 Kbytes (409 per diskette). The RX50 has two access doors and slots for diskette insertion. A light next to each slot indicates when the system is reading or writing to the diskette in that slot.

The RX50 is installed in mass storage shelf 5. A cable connects the RX50 to the power supply.

**NOTE**

**Only one RX50 drive can be used with one RQDX2 controller module.**

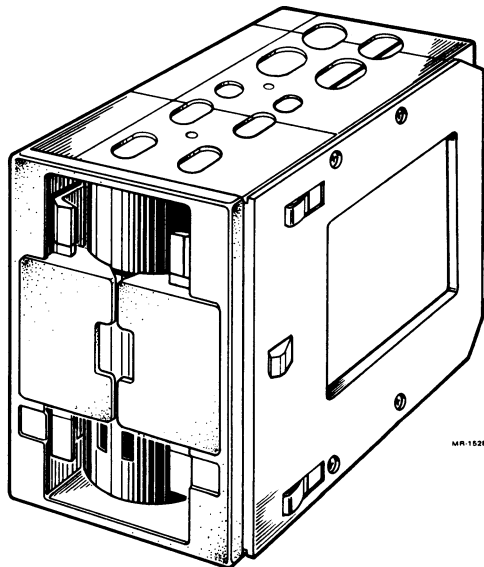


Figure 3-25 RX50 Diskette Drive

### 3.4 TAPE STORAGE

#### 3.4.1 TK50 Tape Drive Subsystem

Order: TK50-AA                   Tape drive and cartridge  
      TQK50-BA                  Controller module and signal cable

The TK50 is a streaming tape drive subsystem that provides 95 Mbytes of backup data storage. The media used are magnetic tape cartridges.

The TK50 tape drive subsystem (Figure 3-26) consists of two major components:

- TK50-AA tape drive and cartridge, installed in enclosure shelf 4
- TQK50-BA (M7546) controller module and 76.2 cm (30 in) signal cable

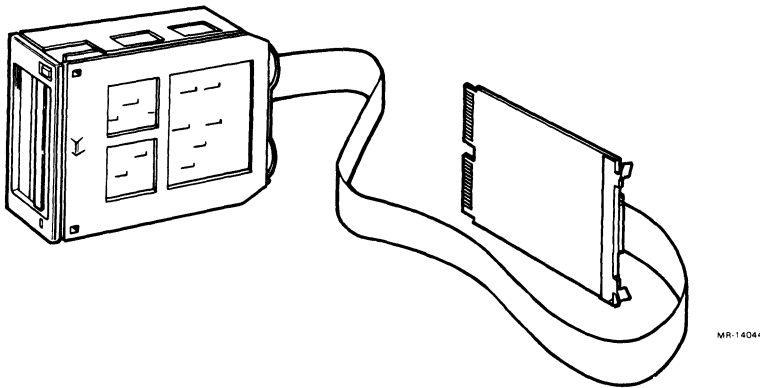
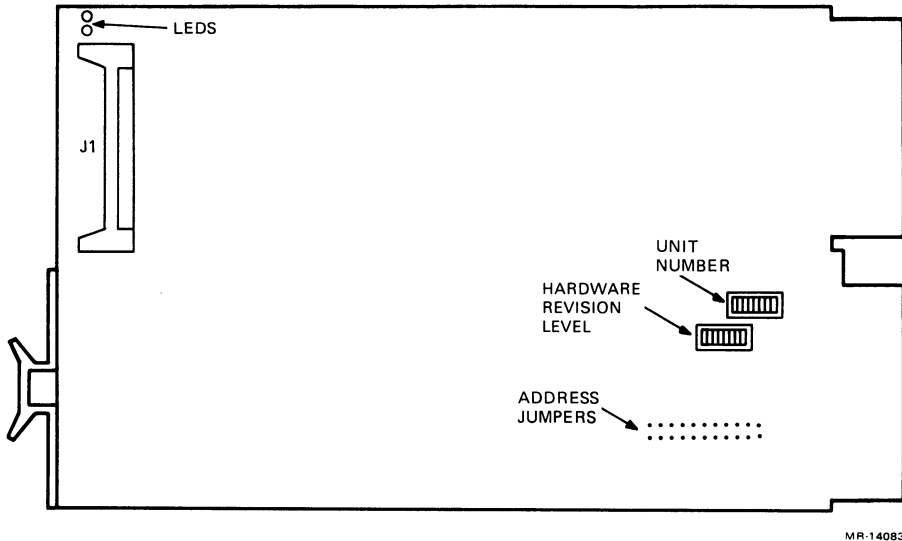


Figure 3-26 TK50 Tape Drive Subsystem

The M7546 controller module provides the interface between the TK50-AA tape drive and the Q22-Bus. The signal cable connects the module to the drive.

Figure 3-27 shows the location of two DIP switches on the controller module, which are used to configure the following:

- Hardware revision level (set at the factory)
- Unit number



MR-14083

Figure 3-27 M7546 Module Layout

The hardware revision level DIP switch is set to match the module revision level stamped on the back of the module. The eight switches in this DIP switch represent a binary weighted value, as shown in Table 3-21.

**Table 3-21 Revision Level Switch Settings**

Revision Level	Switches		
	1	2	3-8*
0	0	0	0-0
1 (A)	1	0	0-0
2 (B)	0	1	0-0
3 (C)	1	1	0-0
etc.			

0 = Open

1 = Closed

\* Switch 8 is nearest module edge.

The unit number may be specified using the unit number DIP switch as shown in Table 3-22. It is not necessary to change this switch from the factory setting if the MicroVMS operating system is installed.

**Table 3-22 Unit Number Settings**

Unit Number	Switches		
	1	2	3-8*
0	0	0	0-0 (Factory)
1	1	0	0-0
2	0	1	0-0
3	1	1	0-0
etc.			

0 = Open

1 = Closed

\* Switch 8 is nearest module edge.

The CSR address for the first M7546 controller module is fixed at 17774500 and is set using jumpers (Figure 3-27). If an additional M7546 controller module is installed, its CSR address is floating (see Table 4-3). Table 3-23 lists the factory setting for the first M7546 and possible settings for a second M7546.

**Table 3-23 M7546 Controller Module CSR Address**

CSR Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	← Add. Bits (Jumpers)*
17774500	1	1	0	0	1	0	1	0	0	0	0	(Factory)
<b>Common settings for a second M7546 controller:</b>												
17760404	0	0	0	0	1	0	0	0	0	0	1	
17760444	0	△	0	0	△	1	0	0	△	1	0	△

1 = Jumper installed

0 = Jumper removed

\* A2 is the jumper nearest the module edge.

The interrupt vector is fixed at 260 for the first and is floating for a second M7546 controller. The interrupt vector is set under program control.

For further information, refer to the *TK50 Tape Drive Subsystem Owner's Manual* (EK-LEP05-OM).



## 4.1 CONFIGURATION RULES

There are several factors to consider when configuring a MicroVAX system in a BA123-A enclosure:

- Module physical priority
- Backplane and I/O distribution panel expansion space
- Power requirements
- Module CSR addresses and interrupt vectors

### 4.1.1 Module Physical Priority

The order in which options are placed in the backplane affects system performance. Modules should be installed according to the following rules.

1. The KA630-A CPU is installed in slot 1.
2. MS630-B memory modules are installed in slots 2 and 3.
3. The MS630-AA memory module must be placed in the CD rows of slot 2 or 3.
4. With the exception of the MS630-AA memory module, dual-height modules installed in slots 2–4 must be placed in the AB rows. No grant continuity card is necessary in the CD rows.

#### **NOTE**

**If slots 2 and 3 (or slot 3) are not used for MS630 memory modules, and are not required for Q22-Bus options, it is recommended that they be reserved for future memory expansion with M9047 grant continuity cards placed in the AB rows.**

5. Dual-height modules installed in slots 5–12 can be located in either the AB or CD rows. The opposite rows must contain either another dual-height module or an M9047 grant continuity card.

The following list shows the recommended sequence of modules:

1. CPU  
KA630-A
2. Local Memory Modules (no more than two):  
MS630-BB  
MS630-BA  
MS630-AA
3. Q22-Bus Memory Modules  
MRV11 M8047
4. Synchronous Communications Modules – No Silos  
DPV11 M8020
5. General Purpose I/O Ports  
DRV11-J M8049
6. Line Printer Interface  
LPV11 M8027
7. Asynchronous Communications Module – No Silos  
DLVJ1 M8043
8. Asynchronous Communications Modules – With Silos  
DZV11 M7957  
DZQ11 M3106
9. Synchronous Communications Modules – DMA  
DMV11-M M8053  
DMV11-N M8064
10. Ethernet Communications Module  
DEQNA M7504
11. Asynchronous Communications Module – With Silos/DMA  
DHV11 M3104

## 12. Streaming Tape Controller (Smart DMA)

TQK50 M7546

## 13. Mass Storage Controller (Smart DMA)

RQDX3 M7555

RQDX2 M8639-YB

The relative priority of these options is based on their preferred interrupt and DMA priority. The location of the MRV11 has no effect on interrupt and DMA priorities; its location may be changed to facilitate cable distribution, etc.

### 4.1.2 Expansion Space

**4.1.2.1 Backplane** – There are twelve backplane slots available for Q22-Bus compatible modules. The configuration examples in this chapter show the slots occupied by modules and the number of open slots that remain.

**4.1.2.2 I/O Distribution Panel Insert Space** – There are four type A (1 × 4) and six type B (2 × 3) cutouts available for mounting I/O distribution panel inserts on the back panel. The bottom two type B cutouts can be converted to provide three additional type A cutouts. Table 4-1 lists the type of inserts used for each module. The configuration worksheet (Figure 4-1) tracks inserts used.

### 4.1.3 Power Requirement

The configuration worksheet (Figure 4-1) is used to keep track of current at +5 V and +12 V, and power. The total current drawn and power used by system modules and mass storage devices in the enclosure must not exceed the following limits for each regulator:

Current: at +5 Vdc = 36 A  
          +12 Vdc = 7 A

Power: 230 W from each regulator

# Configuration

ADD THESE COLUMNS

SLOT	MODULE	REGULATOR A			REGULATOR B			I/O INSERTS	
		CURRENT +5 VDC	(AMPS) +12 VDC	POWER (WATTS)	CURRENT +5 VDC	(AMPS) +12 VDC	POWER (WATTS)	(2 X 3) B	(1 X 4) A
1	AB								
	CD								
2	AB								
	CD								
3	AB								
	CD								
4	AB								
	CD								
5	AB								
	CD								
6	AB								
	CD								
7	AB								
	CD								
8	AB								
	CD								
9	AB								
	CD								
10	AB								
	CD								
11	AB								
	CD								
12	AB								
	CD								
13	AB	SIGNAL							
	CD	DIST.	.52						
				2.60					
	MASS STORAGE SHELF	DEVICE							
5*									
4									
3									
2									
1									
TOTAL THESE COLUMNS:		—	—	—	—	—	—	—	—
MUST NOT EXCEED:		36 A	7 A	230 W	36 A	7 A	230 W	6	4**

\*RECOMMENDED FOUR DRIVES MAXIMUM – TWO IN SHELVES 1 AND 2, TWO IN 3, 4, OR 5.  
 \*\*IF MORE THAN FOUR 1 X 4 I/O PANELS ARE REQUIRED, AN ADAPTER TEMPLATE MAY BE USED.

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Figure 4-1 Configuration Worksheet

Table 4-1 lists the current drawn by the Q22-Bus options.

**Table 4-1 Power Requirements, Bus Loads, I/O Inserts**

Option	Module	Current (in amps)			Power (in watts)	Bus Loads		I/O Inserts
		+5 V	+12 V	ac		dc	A = 1 × 4 B = 2 × 3	
KA630-AA	M7606	6.2	0.14	32.7	2.7	1.0	B	
KA630-AB	M7606	5.9	0.14	31.1	2.7	1.0	B	
MS630-AA	M7607	1.0	0.0	5.0	-	-		
MS630-BA	M7608	1.3	0.0	6.5	-	-		
MS630-BB	M7608	1.8	0.0	9.0	-	-		
MRV11-AA	M7942	2.8	0.0	14.0	1.8	1.0		
DPV11-DP	M8020	1.2	0.3	9.6	1.0	1.0	A	
DRV11-JP	M8049	1.8	0.0	9.0	2.0	1.0	A (2)	
LPV11-XP	M8027	0.8	0.0	4.0	1.4	1.0	A	
DLVJ1-LP	M8043	1.0	0.25	8.0	1.0	1.0	B	
DZV11-DP	M7957	1.2	0.39	10.7	3.9	1.0	B	
DZQ11	M3106	1.0	0.36	9.32	1.5	1.0	B	
DMV11-AP	M8053-MA	3.4	0.4	21.8	2.0	1.0	B	
DMV11-BP	M8053-MA	3.4	0.4	21.8	2.0	1.0	A	
DMV11-CP	M8064-MA	3.4	0.4	21.8	2.0	1.0	B	
DMV11-FP	M8053-MA	3.4	0.38	21.56	2.0	1.0	B	
DHV11-AP	M3104	4.5	0.55	29.1	2.9	0.5	B (2)	
DEQNA-KP	M7504	3.5	0.5	23.5	2.8	0.5	A	
RLV12-AP	M8061	5.0	0.10	26.2	2.7	1.0	A	
TQK50	M7546	2.9	0.0	14.5	2.0	1.0		
RQDX2	M8639-YB	6.4	0.1	33.2	2.0	1.0		
RQDX3	M7555	2.48	.06	13.12	1.0	1.0	B	
RX50-AA		0.85	1.8	25.9	-	-		
RD51-A		1.0	1.6	24.2	-	-		
RD52-A		1.0	2.5	35.0	-	-		
RD53-A		0.9	2.5	34.5	-	-		
TK50-AA		1.35	2.4	33.55	-	-		

#### 4.1.4 Bus Loads

Bus loads must not exceed 38 ac or 20 dc. These limits are not exceeded using standard Q22-Bus options, but bus loads for each option are included in Table 4-1 in case a nonstandard module is installed. In such a case, the total bus loads of installed modules should be checked to be sure the total does not exceed these limits.

#### 4.1.5 Module CSR Addresses and Interrupt Vectors

Modules must be set to the correct CSR address and interrupt vector. Use Table 4-2 to determine the correct settings. The following rules must be observed:

1. Check off all the devices that will be installed in the system.
2. If there is an F in the vector column, the device has a floating interrupt vector. Assign a vector to each device checked, starting at (octal) 300 and continuing as follows:

DLVJ1 (increment of 40 to next device)

DRV11 (increments of 10 for subsequent devices)

DZV/Q

DPV11

DMV11

2nd MSCP (first is fixed at 154)

2nd TQK50 (first is fixed at 260)

DHV11

2nd DEQNA (first is fixed at 120)

For example, from the list of devices above, systems containing the following modules would be assigned as shown:

##### Example 1

DLVJ1	300
DZV11	340
DMV11	350
2nd MSCP	360
DHV11	370

##### Example 2

DZQ11	300
2nd MSCP	310
DHV11	320
2nd DEQNA	330

The floating vector of a 2nd MSCP or TQK50 is program-set, not configured using jumpers or switches. If there is a second MSCP or TQK50 in your system, you must still determine what the vector is, because it will determine the vector of devices after it.

3. If there is an F in the address column, the device has a floating CSR address. Use Table 4-3 to determine the correct addresses for these devices. If a module has a floating vector and CSR address, additional modules of the same type will also have a floating vector and CSR address.

**Table 4-2 Address/Vector Worksheet**

Option	Module	Unit No.	Check if in System	Vector	CSR Address (N = 177)
KA630-A	M7606	-	-	-	-
MS630-A	M760x	-	-	-	-
DPV11	M8020	1		F	F
DRV11-JP	M8049	1		F	N64120
DRV11-JP	M8049	2		F	N64140
LPV11	M8027	1		200	N77514
DLVJ1	M8043	1		F*	N76500
DLVJ1	M8043	2		F	N76510
DZV11	M7957	1		F	F
DZQ11	M3106	1		F	F
DHV11	M3104	1		F	F
DEQNA	M7504	1		120	N74440
DMV11	M8053	1		F	F
DMV11-CP	M8064	1		F	F
TQK50	M7546	1		260	N74500
RQDX2	M8639	1		154	N72150
RQDX3	M7555	1		154	N72150

\* The DLVJ1 vector can only be configured at 300, 340, 400, 440 etc. If the first available floating vector is 310, 320, or 330, the DLVJ1 should be set to 340 and the next device set to 400.

Table 4-3 lists the floating CSR addresses for common combinations of devices requiring configuration. These settings are only valid for the devices listed. They may change if other devices with floating CSR addresses are installed.

**Table 4-3 Floating CSR Addresses**

Device	Substitute the Numbers Below for the nnn in 17760nnn									
DZQ/V 1				100	100	100	100	100	100	100
DZQ/V 2				110*	110*	110	110*	110	110*	110*
DZQ/V 3				120*		120		120		
DPV11	270*	270*	270*		310*	330*	310*	330*	310*	310*
DMV11				320			340	360	340	
2nd MSCP		334	354*		354*	374	374	414*		
2nd TK50	404*	444*	444*	444*		504*	504*	504	444*	
DHV11 1	440	500	500	500	500	540	540		500	
DHV11 2	460	520	520	520	520				520	

\* Device may be installed or not. Go DOWN through the columns in the table to find the column that matches your configuration. Any device added to or removed from the list does not affect the addresses of devices above it.

**Example 1:**

1 DHV11 only: 17760440  
 (derived from the first column)

**Example 2:**

DZQ11: 17760100  
 DPV11: 17760310  
 DHV11: 17760500  
 (derived from the fifth column)



## 4.2 CONFIGURATION EXAMPLES

The BA123-A enclosure can be used in a variety of configurations. Figure 4-2 shows possible module utilizations for MicroVAX II systems.

### NOTE

Refer to Figure 1-9 to review the bus grant continuity before configuring a system.

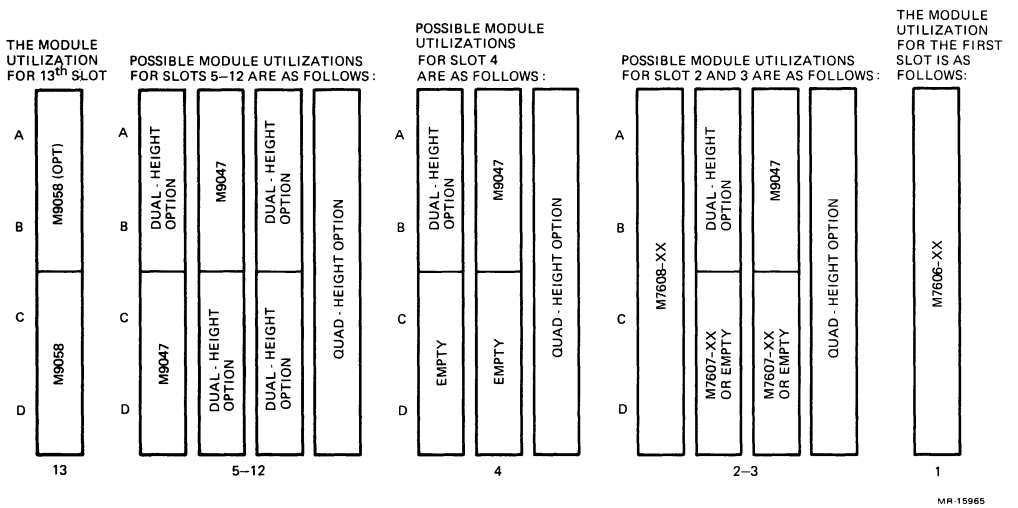


Figure 4-2 Module Utilizations

Figure 4-3 shows the backplane setup for a base system that can be expanded at a later time. It includes the following features:

- 2 Mbytes of main memory
- 1 RD52 fixed disk drive, providing 31 Mbytes of mass storage
- 1 RX50 dual-diskette drive for system loading and backup
- 1 eight-line asynchronous multiplexer, providing ports for 8 serial devices

Figure 4-4 shows the expandability of a MicroVAX II system in the BA123-A enclosure. It includes the following features:

- 9 Mbytes of main memory
- 2 RD53 fixed disk drives, providing 142 Mbytes of mass storage
- 2 eight-line asynchronous multiplexers, providing ports for 16 serial devices
- DEQNA module to connect to Ethernet
- DPV11 module to connect to a modem
- LPV11 module for an LP25 printer
- TK50-AA tape drive for system loading and backup

MASS STORAGE DEVICE: RX50  
RD52

BACKPLANE SLOT NO.	BACKPLANE ROW				I/O CUTOUTS (STANDARD I/O)	
	A	B	C	D	(1 × 4) 4	(2 × 3) 6
1	KA630-AB (QUAD) CPU					1
2	M9047 GRANT CARD		MS630-AA MEMORY			
3	M9047 GRANT CARD		EMPTY			
4	DHV11 (QUAD) 8-LINE MULTIPLEXER					2
5	RQDX2 (QUAD) RD/RX CONTROLLER					
6						
7						
8						
9						
10						
11						
12						

TOTAL USED:	0	3
AVAILABLE:	4	3

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Figure 4-3 Base System

# Configuration

---

MASS STORAGE DEVICE: RX50  
 RD53  
 RD53  
 BACKUP DEVICE: TK50-AA

BACKPLANE SLOT NO.	BACKPLANE ROW				I/O CUTOUTS (STANDARD I/O)	
	A	B	C	D	(1 × 4) 4	(2 × 3) 6
1	KA630-AA (QUAD) 1 MBYTE MEMORY + FPP					1
2	MS630-BB (QUAD) 4 MBYTE MEMORY					
3	MS630-BB (QUAD) 4 MBYTE MEMORY					
4	DPV11 (DUAL)		EMPTY		1	
5	LPV11 (DUAL)		DEQNA (DUAL)		2	
6	DHV11 (QUAD) 8-LINE MULTIPLEXER					2
7	DHV11 (QUAD) 8-LINE MULTIPLEXER					2
8	M9047 GRANT CARD		TQK50 (DUAL)			
9	RQDX2 (QUAD) RD/RX CONTROLLER					
10						
11						
12						

TOTAL USED:      3      5

AVAILABLE:      1      1

MR-16400

Figure 4-4 Advanced System

## 5.1 INTRODUCTION

This chapter performs two basic functions. It provides:

- An overview of the diagnostic and maintenance tools available for use with the MicroVAX II
- A roadmap for the diagnosis and repair of failures

## 5.2 KA630-A BOOT AND DIAGNOSTIC ROM

The MicroVAX II boot and diagnostic ROM tests the basic functionality of the KA630-A module. Testing can occur in either of two modes:

- Power-up Mode
- Console I/O Mode

### 5.2.1 Power-up Mode

In power-up mode the ROM diagnostics, in conjunction with the boot programs, test the KA630-A module's ability to load and run an operating system, the MicroVAX Maintenance System, or other diagnostic software.

Table 5-1 provides a description of each test located in the ROM diagnostic, and the LED value displayed on the MicroVAX II CPU I/O distribution insert as the system counts down through each test. The LED value is also displayed in binary form by a series of red LEDs on the KA630-A module (Figure 5-1), and, for values of 7 or less, on the console terminal.

Table 5-1 also lists the field replaceable units (FRUs) most commonly at fault if the countdown stops at a particular nonzero value. Their numbering indicates their probability of fault (i.e., 1 is most likely).

**Table 5-1 LED Status and Countdown Error Messages**

---

**Value Countdown Tests/Probable FRU Failures**

---

<b>F</b>	<b>WAITING FOR DC OK</b> <ol style="list-style-type: none"><li>1. KA630-A module (does not recognize DC OK assertion)</li><li>2. Power supply (negating DC OK on bus)</li><li>3. A Q22-Bus device (negating DC OK on bus)</li><li>4. Backplane (DC OK shorted to another signal)</li><li>5. Power supply cable (defective or not properly connected)</li></ol>
<b>E</b>	<b>WAITING FOR P OK</b> <ol style="list-style-type: none"><li>1. KA630-A module (does not recognize P OK assertion)</li><li>2. Power supply (negating P OK on bus)</li><li>3. A Q22-Bus device (negating P OK on bus)</li><li>4. Backplane (P OK shorted to another signal)</li></ol>
<b>D</b>	<b>RUNNING CHECKSUM TEST ON CPU ROM</b> <ol style="list-style-type: none"><li>1. KA630-A module</li></ol>
<b>C</b>	<b>SEARCHING FOR RAM MEMORY REQUIRED FOR CPU ROM PROGRAMS</b> <ol style="list-style-type: none"><li>1. KA630-A module</li><li>2. MS630 module or modules</li><li>3. KA630-A/MS630 interconnect cable (short- or open-circuited)</li></ol>
<b>B</b>	<b>READING KA630-A IPCR REGISTER (accesses Q22-Bus)</b> <ol style="list-style-type: none"><li>1. KA630-A module</li><li>2. A Q22-Bus device (preventing the CPU from acquiring the bus)</li><li>3. Backplane (preventing the CPU from acquiring the bus)</li></ol>
<b>A</b>	<b>TESTING VCB01 VIDEO CONSOLE DISPLAY (if present)</b> <ol style="list-style-type: none"><li>1. Keyboard for VCB01 (defective or not connected)</li><li>2. Video display for VCB01 (defective or not connected)</li><li>3. VCB01 module</li><li>4. KA630-A module (can't read or write Q22-Bus; may be shorting Q22-Bus)</li><li>5. A Q22-Bus device (preventing the CPU from acquiring the bus)</li><li>6. Backplane (preventing the CPU from acquiring the bus)</li><li>7. VCB01 distribution insert</li></ol>

---

**Table 5-1 LED Status and Countdown Error Messages (Cont)****Value Countdown Tests/Probable FRU Failures**

---

9	IDENTIFYING CONSOLE TERMINAL
	1. KA630-A module (if console does not respond within 6 seconds, CPU proceeds to 7)
8*	LANGUAGE INQUIRY OR CPU HALTED†
	1. KA630-A module (probably console interface)
	2. Console cables (defective or not connected)
	3. Console baud rate (mismatched)
	4. Console terminal (power-off or broken)
	5. Console distribution insert
7	RUNNING DATA TESTS ON RAM MEMORY
	1. KA630-A module (RAM memory failure)
	2. MS630 module
	3. Backplane (CD interconnect short- or open-circuited)
	4. KA630-A/MS630 interconnect cable (short- or open-circuited)
6	RUNNING ADDRESS TESTS ON RAM MEMORY
	1. MS630 module
	2. Backplane (CD interconnect short- or open-circuited)
	3. KA630-A/MS630 interconnect cable (short- or open-circuited)
5	RUNNING TESTS THAT USE Q22-BUS MAP TO ACCESS LOCAL MEMORY
	1. KA630-A module
	2. Q22-Bus device (preventing the CPU from acquiring the bus)
	3. Backplane (preventing the CPU from acquiring the bus)
4	CPU INSTRUCTION AND REGISTER TESTS
	1. KA630-A module

---

**Table 5-1 LED Status and Countdown Error Messages (Cont)**

---

<b>Value</b>	<b>Countdown Tests/Probable FRU Failures</b>
3	<b>RUNNING INTERRUPT TESTS</b> <ol style="list-style-type: none"><li>1. KA630-A module</li><li>2. Q22-Bus device (incorrectly requesting interrupt)</li><li>3. Backplane (Q22-Bus BR line shorted)</li></ol>
2	<b>SEARCHING FOR BOOTSTRAP DEVICE†</b> <ol style="list-style-type: none"><li>1. RQDX controller, RD5n drive, RX50 drive, or interconnect cable (defective or not properly connected)</li><li>2. TQK50 controller, TK50 drive, or interconnect cable (defective or not properly connected)</li><li>3. MRV11D module</li><li>4. DEQNA module</li><li>5. KA630-A module</li></ol>
1	<b>BOOTSTRAP DEVICE FOUND</b> <ol style="list-style-type: none"><li>1. Q22-Bus bootstrap device</li><li>2. Signal cable to bootstrap device (defective or not connected)</li><li>3. Power cable to bootstrap device (defective or not connected)</li><li>4. KA630-A module</li></ol>
0	<b>TESTING COMPLETED</b>

---

\* Before the console reaches 8, a heading should appear that reports the version of CPU installed in the system, as well as other system information. If the LED reaches 8 or less and the console terminal doesn't display a heading, then the five FRUs listed should be suspected.

† When the LED is stopped at 8, the system is A) preparing to ask the user to supply the selected language to be used, B) informing the user that the CPU is halted, or C) actually indicating a failure. If the system is not indicating a halt, but waiting for a language to be entered, time out occurs and testing continues within two to six minutes.

‡ Be sure to try the troubleshooting remedies in the *MicroVAX II 630QB Owner's Manual* before exploring these possibilities. Check signal and power cables before assuming drives or controllers to be defective. Once cables have been checked, examine power-up LEDs on individual devices and refer to Section 5.3 of this manual.



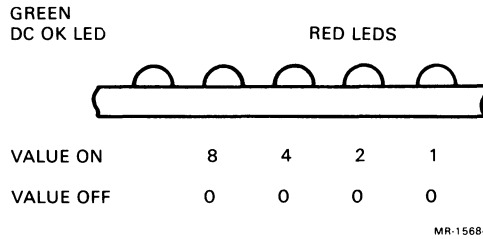


Figure 5-1 KA630-A CPU Module LEDs

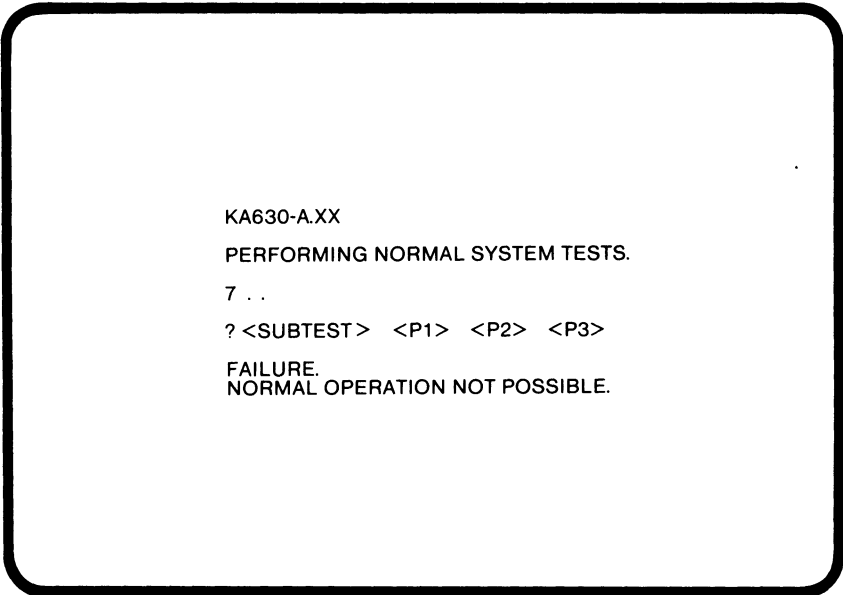
The sum of values of all LEDs ON (when translated to hexadecimal) corresponds to the hexadecimal values listed in Table 5-1.

### 5.2.2 Console Mode

In the console I/O mode, one of the ROM tests may be selected using the TEST command. In addition, the EXAMINE command lets the user examine the contents of registers and memory, and the BOOT command, when combined with the appropriate qualifier, selects the boot device. Further details on console commands are given in Appendix A.

### 5.2.3 Console Terminal Error Messages

Error messages reported on the console terminal are formatted as shown in Figure 5-2. An explanation of the numbered messages follows the figure.



```
1.      KA630-A.XX
2.      PERFORMING NORMAL SYSTEM TESTS.
3.      7 . .
4.      ? <SUBTEST> <P1> <P2> <P3>
5.      FAILURE.
        NORMAL OPERATION NOT POSSIBLE.
```

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Figure 5-2 Example of a Console Terminal Error Message

1. Identifies the processor and the version number of the console program ROM.
2. Explains that the system is performing normal system tests as programmed on the ROM.
3. Begins a countdown sequence to show that the system is progressing through its tests. The numbers displayed have the same meaning as the numbers displayed on the I/O distribution panel insert.
4. Indicates that the countdown sequence has been interrupted. Displays a diagnostic message that includes the question mark, a subtest code number and up to three parameters.
5. Indicates that the test has failed and that the console program has stopped executing.

### 5.3 POWER-UP LEDS ON MASS STORAGE, BACKUP, AND COMMUNICATIONS DEVICES

Several of the supported options (modules) for MicroVAX II have LEDs which provide information on device-level power-up testing. Figures 5-3 through 5-5 show the orientation of LEDs on these modules. Tables 5-2 through 5-4 explain the LED readings and list the field replaceable units (FRUs) most likely to be at fault. Their numbering indicates their probability of fault (i.e., 1 is most likely).

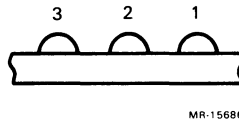


Figure 5-3 LED Orientation on the DEQNA Module

**Table 5-2 DEQNA Module LED Indications**

LEDs			Definition/FRU
3	2	1	
ON	ON	ON	Performing DEQNA station address PROM test 1. DEQNA module 2. KA630-A module 3. Q22-Bus device 4. Backplane
ON	ON	OFF	Performing DEQNA internal loopback test 1. DEQNA module
ON	OFF	OFF	Performing DEQNA external loopback test 1. DEQNA module 2. Cabling (short- or open-circuited, or not connected) 3. Fuse in distribution insert
OFF	OFF	OFF	DEQNA has passed all power-up tests

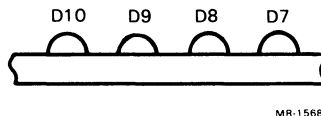


Figure 5-4 LED Orientation on the RQDX2 Module

**Table 5-3 RQDX2 Module LED Indications**

---

<b>LEDs</b>				<b>Definition/FRU</b>
<b>D10</b>	<b>D9</b>	<b>D8</b>	<b>D7</b>	
ON	ON	ON	ON	Beginning power-up testing 1. RQDX2 Module
OFF	OFF	OFF	ON	Performing T11 processor test 1. RQDX2 Module
OFF	OFF	ON	OFF	Performing T11 timer/counter/address generator test 1. RQDX2 Module
OFF	OFF	ON	ON	Performing Q22-Bus timer/counter/address generator test 1. RQDX2 Module
OFF	ON	OFF	OFF	Performing Serializer/Deserializer test 1. RQDX2 Module
OFF	ON	OFF	ON	Performing CRC generator test 1. RQDX2 Module
OFF	ON	ON	OFF	Performing hardware version test 1. RQDX2 Module
OFF	ON	ON	ON	Performing ROM checksum test 1. RQDX2 Module
ON	OFF	OFF	OFF	Performing RAM test 1. RQDX2 Module
ON	OFF	OFF	ON	Performing diagnostic interrupt test 1. RQDX2 Module
ON	OFF	ON	OFF	Performing shuffle oscillator test 1. RQDX2 Module
ON	OFF	ON	ON	Performing valid configuration test 1. RQDX2 Module
ON	ON	OFF	OFF	NOT USED
ON	ON	OFF	ON	NOT USED
ON	ON	ON	OFF	NOT USED
OFF	OFF	OFF	OFF	Testing completed

---



Figure 5-5 LED Orientation on the TQK50 Module

**Table 5-4 TQK50 Module LED Indications**

LEDs		
2	1	Definition RU
ON	ON	Failed to pass power-up test 1. M7546 module
OFF	ON	Failed U/Q port initialization 1. M7546 module 2. Interconnect cable 3. TK50 drive
BLINKING	BLINKING	Fatal error detected by controller 1. Interconnect cable (improperly keyed) 2. M7546 module 3. TK50 drive
OFF	OFF	Normal operation

The following supported options for the MicroVAX II system have a single LED that (when ON) indicates proper operation of that option:

- DRV11
- DHV11

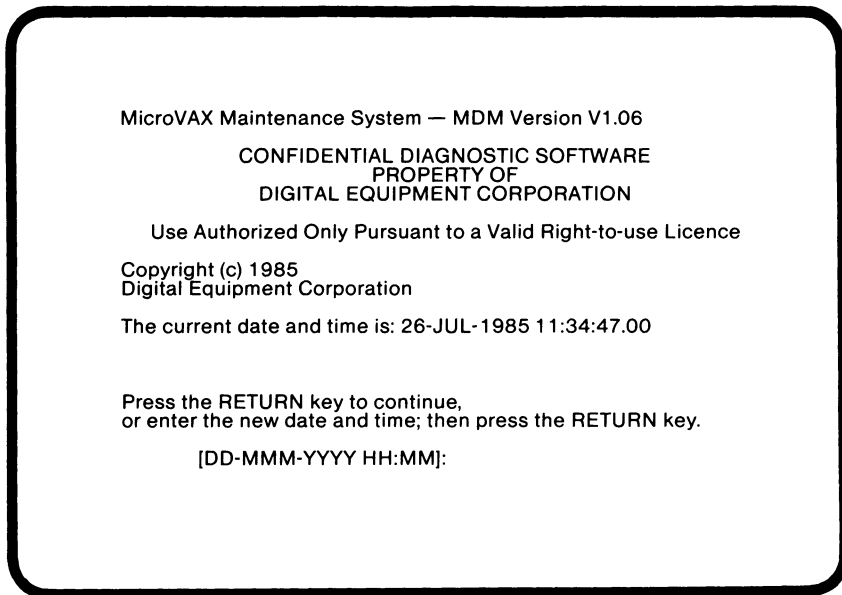
The RQDX3 module has a single LED that indicates a failure when ON.

### 5.4 MicroVAX MAINTENANCE SYSTEM

The MicroVAX Maintenance System (MMS) is a combination diagnostic/maintenance operating system. The system is available in two versions: 1) the installation version provided with each MicroVAX II, and 2) the service version shipped with the MicroVAX II Maintenance kit. The installation version is documented here, while the service version is documented in the *MicroVAX System Maintenance Guide*. The installation version provides:

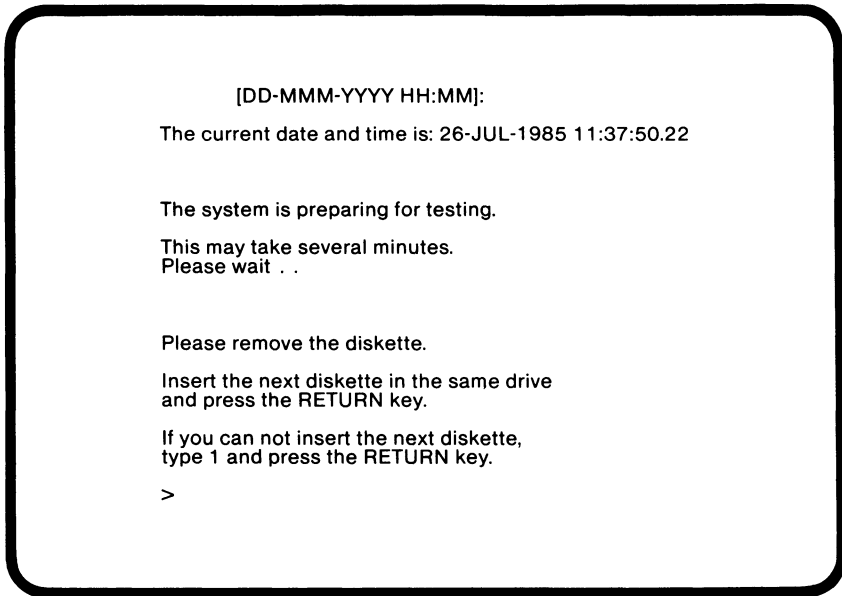
- Configuration verification
- System level testing

MMS is menu driven and can be loaded into any MicroVAX II system via tape or diskette. Figure 5-6 shows the disclaimer screen when the first tape cartridge or diskette is loaded into a system. After entering the date, if necessary, and pressing the **Return** key, a screen similar to Figure 5-7 appears, requesting that the next diskette be loaded (if diskettes are used). This screen is repeated until all necessary diagnostics have been loaded. Once this has been accomplished, pressing the **Return** key accesses the MMS Main Menu as seen in Figure 5-8.



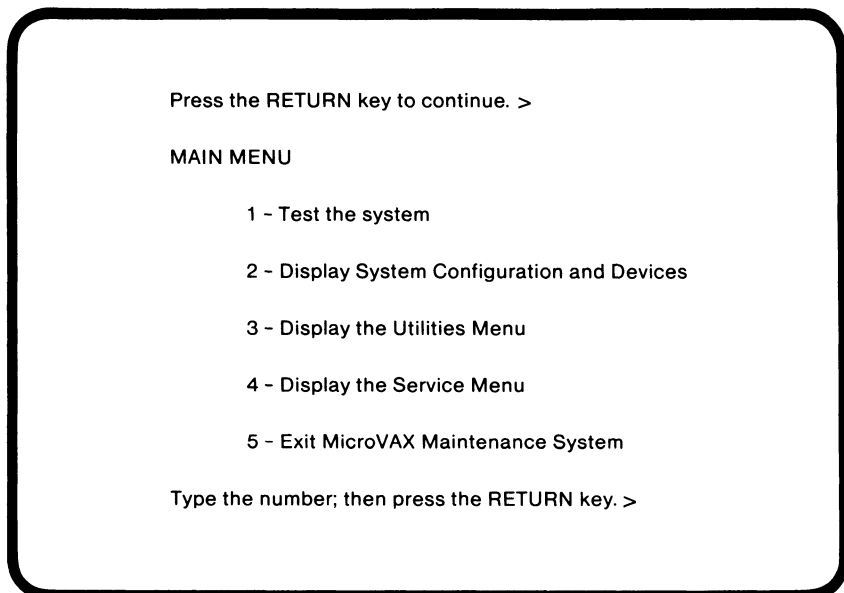
MR-16211

Figure 5-6 Disclaimer Screen



MR-16212

Figure 5-7 Load Additional Media Screen



MR-16213

Figure 5-8 Maintenance System Main Menu

#### **5.4.1 Test the System (Menu Item #1)**

System functional and exerciser tests are run by MMS. System tests are run on all recognized devices, and can be run by any user at any time without jeopardizing data.

#### **5.4.2 Display System Configuration and Devices (Menu Item #2)**

MMS provides verification of system installation by determining and displaying recognized system configuration. A problem or incorrect installation is evident when any device known to be physically installed is missing from the terminal display.

##### **NOTE**

**It is often useful to use the Display System Configuration and Devices selection before using the Test the System selection. It provides a quick check on what the system “sees” as available for testing.**

#### **5.4.3 Display the Utilities Menu (Menu Item #3)**

This selection is not used by the installation version of MMS. It is reserved for further development under the service version of MMS.

#### **5.4.4 Display the Service Menu (Menu Item #4)**

This selection is not used by the installation version of MMS. It is used by the service version, available in the MicroVAX Maintenance Kit, and documented by the *MicroVAX System Maintenance Guide*.

#### **5.4.5 Exit the MicroVAX Maintenance System (Menu Item #5)**

This selection performs an orderly exit from the MicroVAX Maintenance System.



## 5.5 TROUBLESHOOTING

When the MicroVAX II system or a supported option fails or exhibits erratic behavior, the problem may be diagnosed using:

- Front panel indicators and lights
- Power-up self-tests
- *MicroVAX II 630QB Owner's Manual*
- *MicroVAX II 630QB Technical Manual* (this manual)
- MicroVAX Maintenance System – installation version
- *MicroVAX System Maintenance Guide*
- MicroVAX Maintenance System – service version

### NOTE

**Before using the Troubleshooting section of this manual, please read the Problem/Solution section of the *MicroVAX II 630QB Owner's Manual*.**

Most problems exhibited by a MicroVAX II system fall under one of the following categories:

- Unknown system level problems (system fails to boot)
- Suspected device level problems (system can boot, problem may be intermittent and is very often a CPU, memory, mass storage, or communications problem)

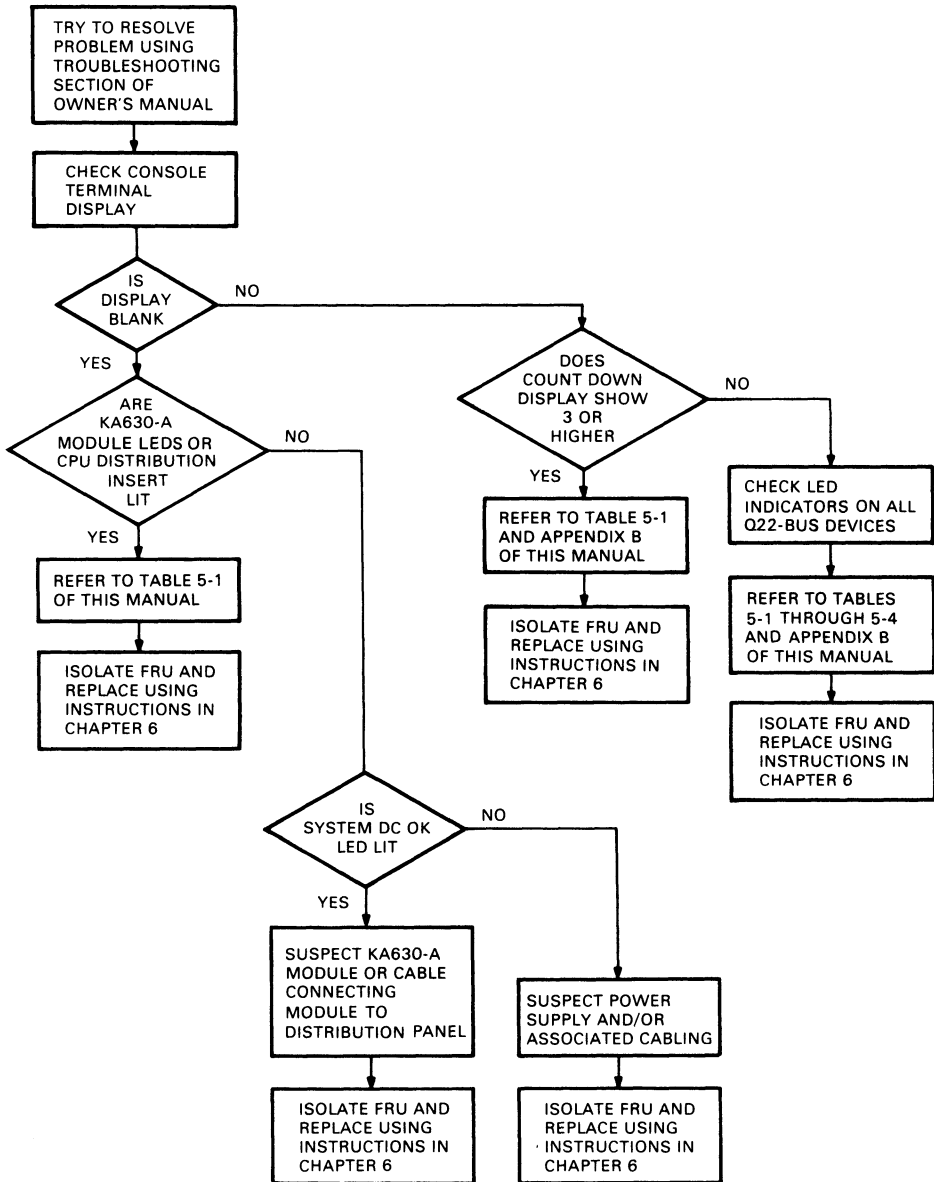
The following sections give a suggested method of troubleshooting each family of problems.

### 5.5.1 Unknown System Level Problems (System Fails to Boot)

Figure 5-9 outlines the general procedure for troubleshooting the system when either an operating system or the MicroVAX Maintenance System fails to boot.

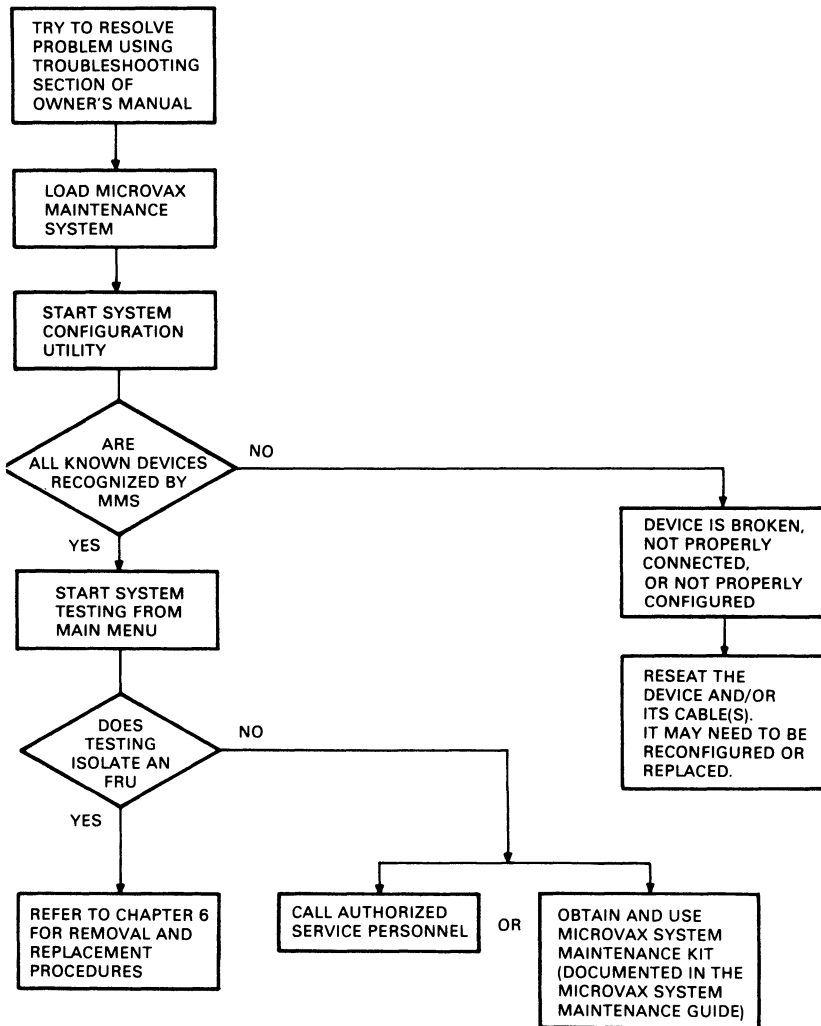
### 5.5.2 Device-Specific Problems

Figure 5-10 outlines the general troubleshooting procedure when the system can boot the MicroVAX Maintenance System, but a problem with a specific device is suspected.



MR-15690

Figure 5-9 Troubleshooting Flowchart for Fail-to-Boot Problems



MR-15691

Figure 5-10 Troubleshooting Flowchart for Device-Specific Problems



## FRU Removal and Replacement Procedures **6**

### 6.1 INTRODUCTION

This chapter describes the removal and replacement procedures for the field replaceable units (FRUs) in the BA123-A enclosure (Table 6-1, Figure 6-1).

**Table 6-1 BA123-A FRUs**

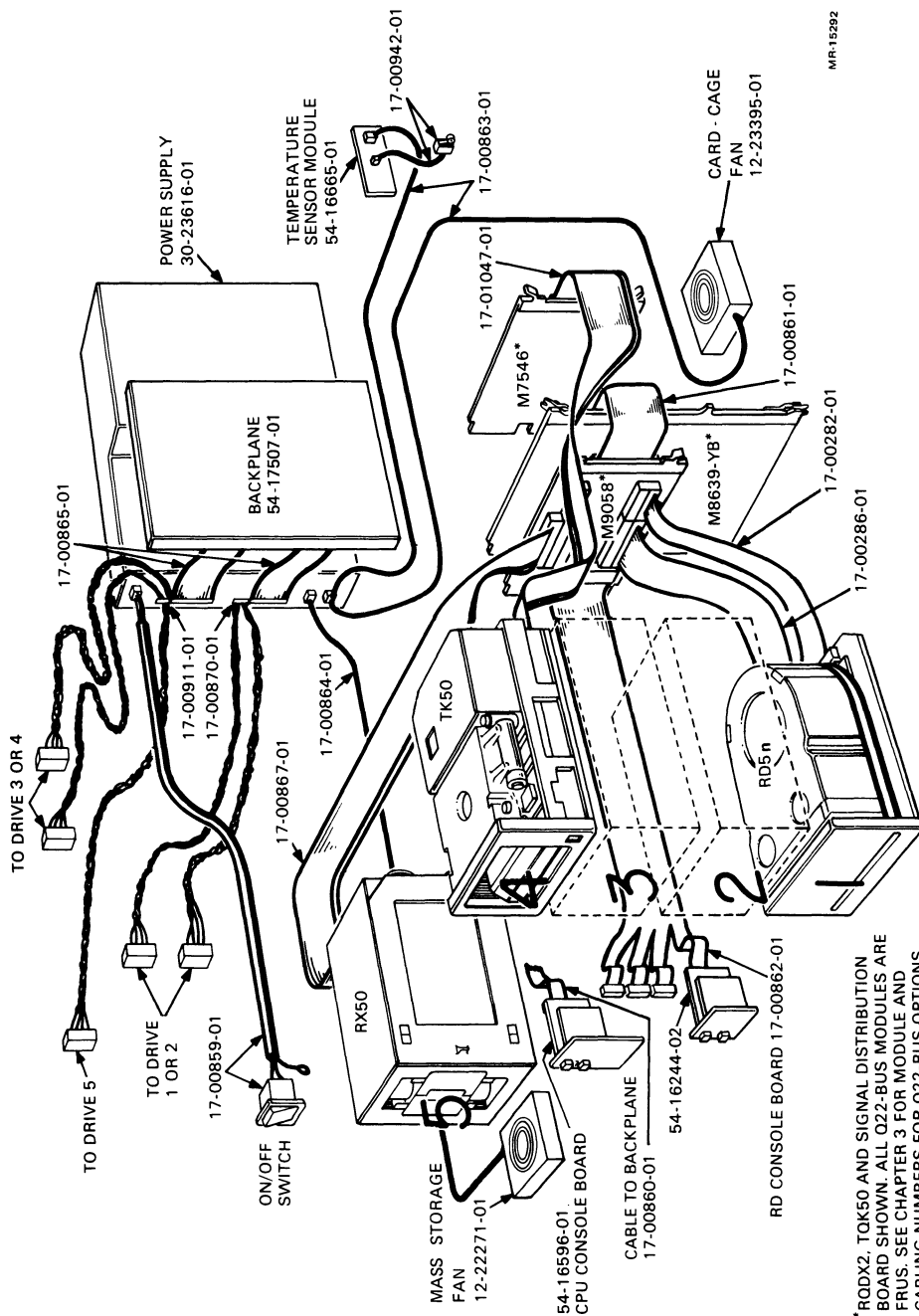
<b>Part Number</b>	<b>Description</b>
17-00859-01	Switch, ac power to power supply, and cable from switch to power supply
17-00860-01	Cable, backplane to CPU console board
54-16596-01	CPU console board
17-00862-01	Cable, signal distribution board to 4 RD consoles
17-00282-01	Cable, 20-conductor RD drive
17-00286-01	Cable, 40-conductor RD drive
54-16244-02	RD52 console
17-00861-01	Cable, 50-conductor, RQDX to signal distribution board
17-00867-01	Cable, signal distribution board to RX50
17-01047-01	Cable, TK50-A/TQK50 interconnect
M9058	Signal distribution board
12-23395-01	Fan, 12.7 cm (5 in) card-cage
12-22271-01	Fan, 11.4 cm (4.5 in) mass storage
17-00942-01	Switch, door interlock, and cable from switch to temperature sensor board
54-16665-01	Temperature sensor board

**Table 6-1 BA123-A FRUs (Cont)**

<b>Part Number</b>	<b>Description</b>
17-00863-01	Cable, power supply to card-cage fan and temperature sensor
17-00864-01	Cable, power supply to mass storage fan
17-00865-01	Cable, Regulator A to backplane
17-00865-01	Cable, Regulator B to backplane
17-00870-01	Cable, Regulator A to 2 drives via 2 plugs
17-00911-01	Cable, Regulator B to 3 drives via 3 plugs
30-23616-01	Power supply
54-17507-01	Q22-Bus backplane, 13-slot, quad-height
12-23985-01	Castors, shock isolating, fixed (2)
12-23985-02	Castors, shock isolating, swivel (2)
54-16744-01	CPU distribution insert

**NOTE**

**Unless otherwise specified, FRUs are replaced by reversing the order of the removal procedures.**



MR-15292

Figure 6-1 BA123-A FRUs

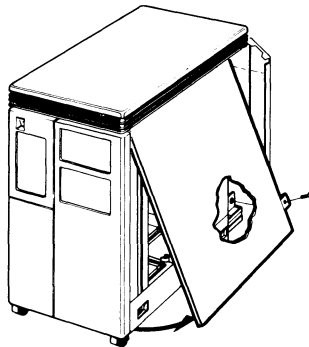
\*RD5X2, TK50 AND SIGNAL DISTRIBUTION BOARD SHOWN. ALL Q22-BUS MODULES ARE FRUs. SEE CHAPTER 3 FOR MODULE AND CABLING NUMBERS FOR Q22-BUS OPTIONS.

## 6.2 REMOVAL OF THE EXTERIOR PANELS

The exterior panels must be taken off before beginning most removal and replacement procedures. The following two sequences will be referenced in the subsequent procedures.

### 6.2.1 Removal of the Right Side Panel

1. Turn the system off and unplug the ac power cord from the wall socket.
2. Open the rear door.
3. Loosen the captive screw that connects the right side panel to the rear of the enclosure frame (Figure 6-2).
4. The panel is attached to the bottom of the enclosure frame by two snap fasteners. Pull the bottom of the panel out until the panel detaches from the bottom of the enclosure.
5. Lift the panel slightly to release it from the lip at the top of the frame and remove the panel (Figure 6-3).



MR-14045

Figure 6-2 Unhooking the Right Side Panel



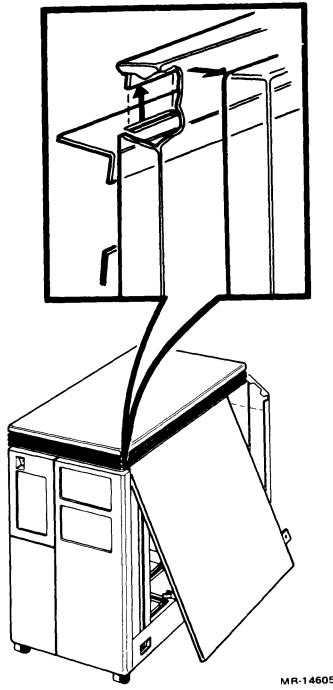


Figure 6-3 Removing the Right Side Panel

### 6.2.2 Removal of the Left Side Panel

1. Turn the system off and unplug the ac power cord from the wall socket.
2. Open the front control panel door.
3. Loosen the screw that connects the left side panel to the front of the enclosure frame (Figure 6-4).
4. The panel is attached to the bottom of the enclosure frame by two snap fasteners. Pull the bottom of the panel out until the panel detaches from the bottom of the enclosure.
5. Lift the panel slightly to release it from the lip at the top of the frame and remove the panel (Figure 6-5).

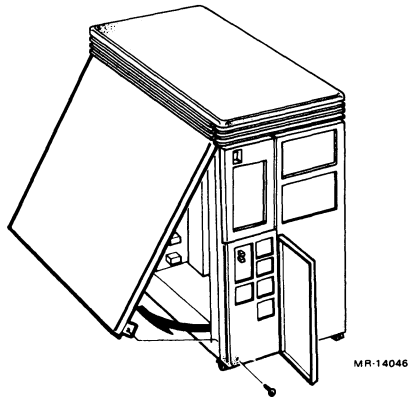


Figure 6-4 Unhooking the Left Side Panel

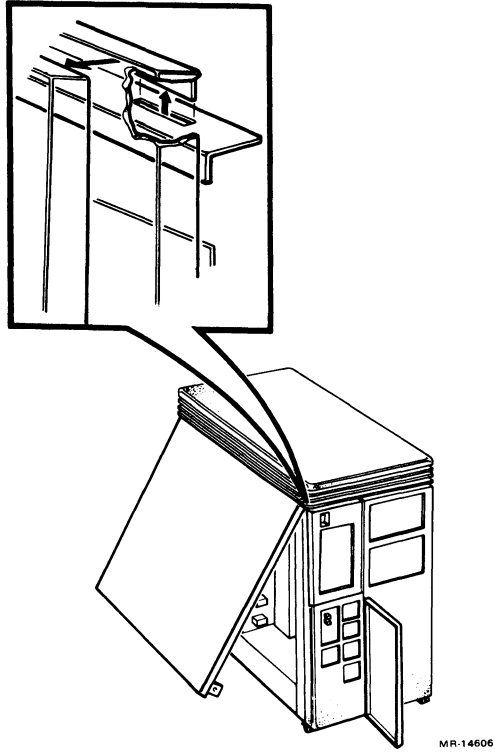
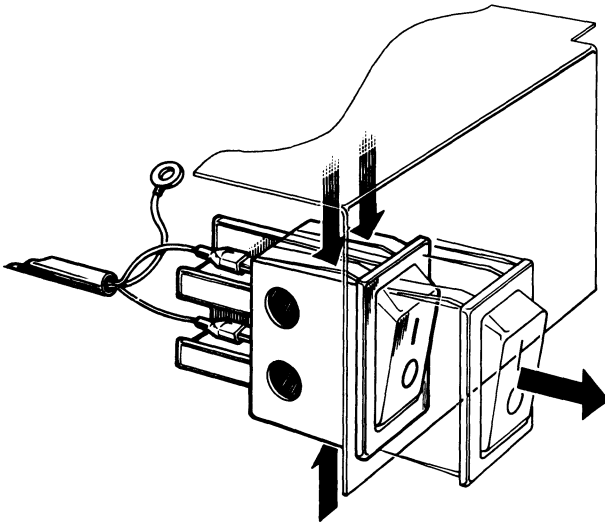


Figure 6-5 Removing the Left Side Panel

### 6.3 ON/OFF SWITCH REMOVAL

1. Remove the left side panel as described in Section 6.2.2.
2. Unplug the On/Off switch cable from the power supply.
3. Remove the nut that holds the cable's ground lead to the enclosure frame. Disconnect the ground lead.
4. Press the top and bottom of the On/Off switch and push the switch and its cable out from the inside of the front panel (Figure 6-6).

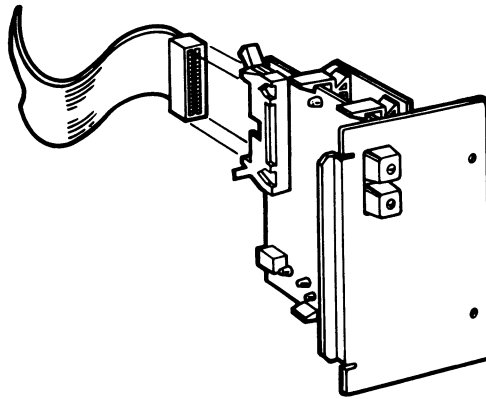


MR-16571

Figure 6-6 On/Off Switch Removal

## 6.4 CPU CONSOLE BOARD REMOVAL

1. Remove the left side panel as described in Section 6.2.2.
2. Disconnect the ribbon cable from the CPU console board (Figure 6-7).
3. Remove the two screws that hold the CPU console board assembly to the control panel.
4. Remove the board from the plastic brackets.



MR-14048

Figure 6-7 CPU Console Board Removal

## **6.5 13.3 cm (5.25 in) MASS STORAGE DEVICE REMOVAL**

The following procedure applies to both removable and fixed media drives.

1. Remove both side panels as described in Sections 6.2.1 and 6.2.2.
2. The front panel is attached to the enclosure by four snap fasteners. Remove the front panel by pulling it from the frame until the snap fasteners detach.
3. Disconnect all signal cables and dc power cables from the device.
4. Push down on the release tab found below the front of the device and slide the device out of the shelf.

### **6.5.1 RD52 Read/Write Board Removal**

#### **NOTE**

**Replace the main printed circuit board (MPCB) only on RD52 disk drives with a DIGITAL P.N. 30-21721-02.**

**Screws located on the slide plate and MPCB are different sizes. Make sure you reinstall the screws in their proper location.**

1. Remove the four Phillips screws retaining the slide plate and ground clip. Set the slide plate aside (Figure 6-8).
2. Unplug the 2-pin connector (Figure 6-9).
3. Remove the two Phillips screws that attach the front bezel to the drive.

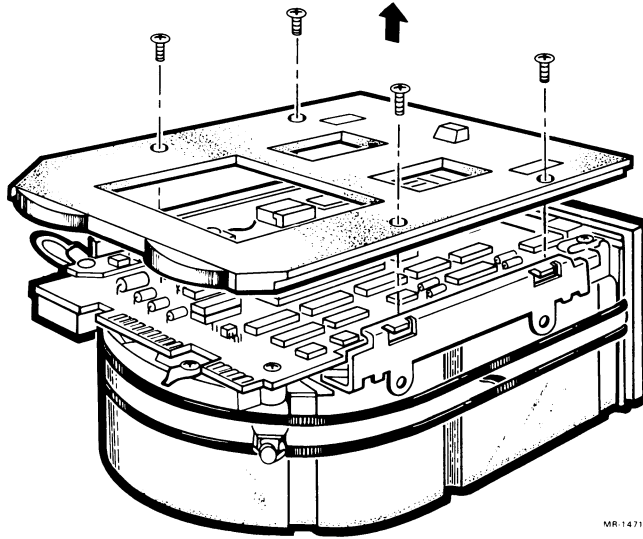


Figure 6-8 Removing the Slide Plate

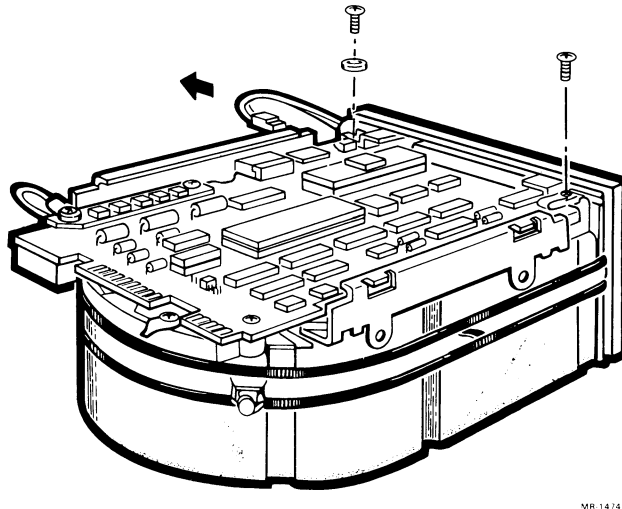
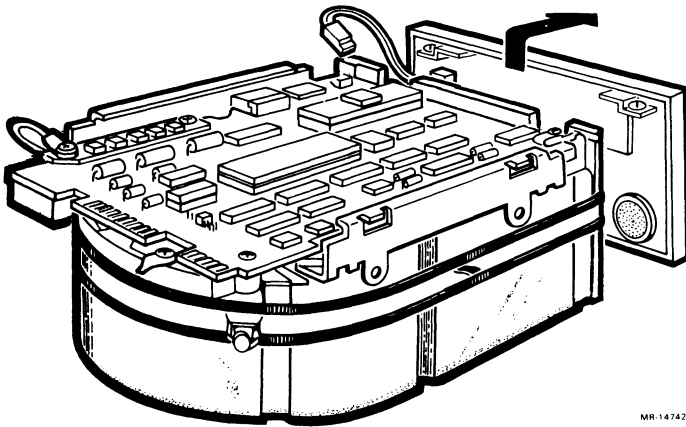


Figure 6-9 Removing the 2-Pin Connector and Screws

4. Remove the front bezel by pulling it away from the drive. The bezel is held in place with pop fasteners (Figure 6-10).
5. Remove the three Phillips screws from the heatsink, grounding strip, and the corner opposite the heatsink (Figure 6-11).
6. Lift the MPCB straight up until it clears the chassis. This disconnects P4, a 12-pin fixed plug (Figure 6-12).
7. Disconnect P5, a 10-pin connector.



MR-14742

Figure 6-10 Removing the Front Bezel



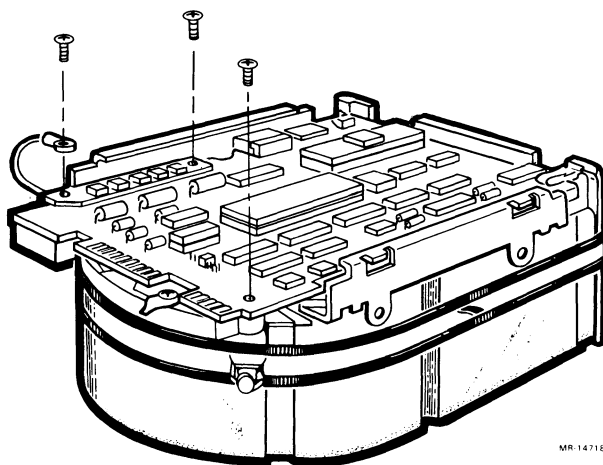


Figure 6-11 Removing Phillips Screws from Heatsink

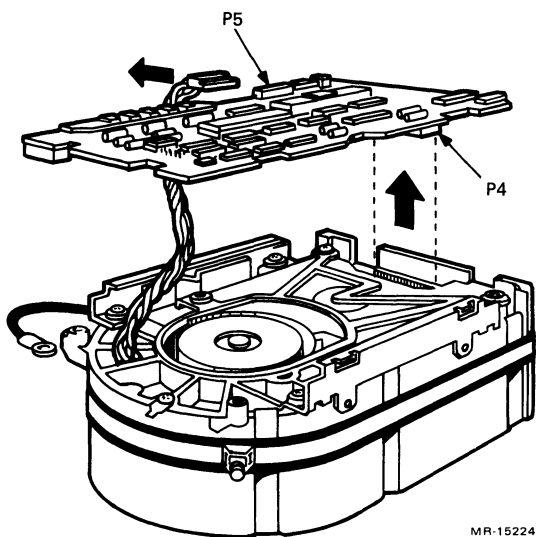


Figure 6-12 Removing the MPCB

### **6.5.2 RD53 Read/Write Board Removal**

The RD53 read/write board is the only part of an RD53 drive that is replaceable. Always try replacing the read/write board before you replace an entire RD53 drive.

1. Remove the four Phillips screws retaining the slide plate and ground clip. Set the plate aside (Figure 6-13).
2. Loosen the two captive screws that hold the read/write board in place.
3. Rotate the board upward (the board pivots in hinge slots at the front of the drive). Being careful not to strain any of the connectors or cables, tilt the board over center until it comes to rest against the outer frame.

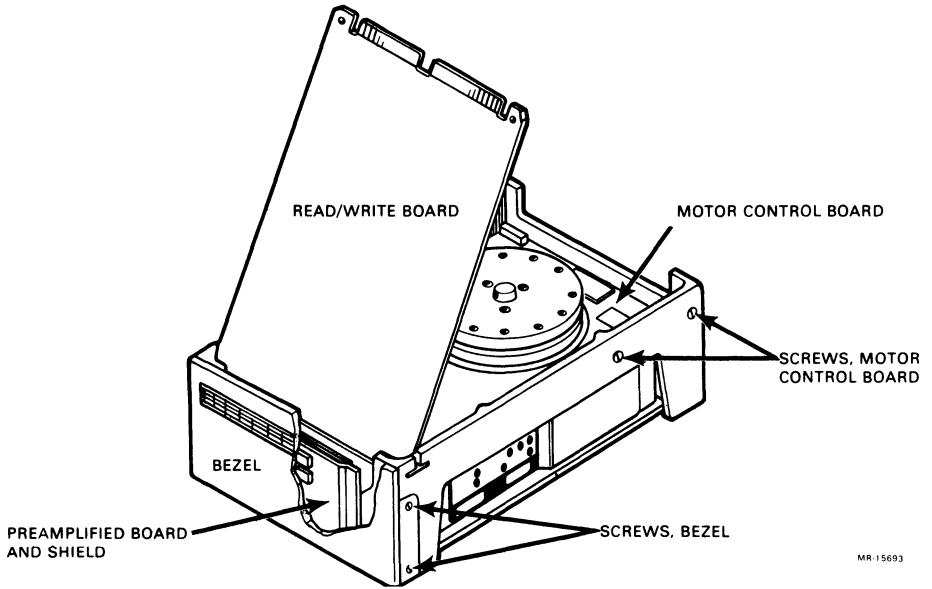
#### **CAUTION**

**Flexible circuit material is fragile and requires careful handling to avoid damage.**

4. Disconnect the motor control board connector J8 and the preamplifier board connector J9 from the read/write board. Both connectors and cables are fragile; handle them with care.
5. Lift the board out of the hinge slots.

#### **NOTE**

**Make sure to set the jumpers and switches for the new board to the same positions as the old one.**



MR-15693

Figure 6-13 RD53 Read/Write Board Removal

## **6.6 FAN REMOVAL**

The following two sections list the procedures for removing the card-cage fan and the mass storage fan. The fan in the power supply is not an FRU.

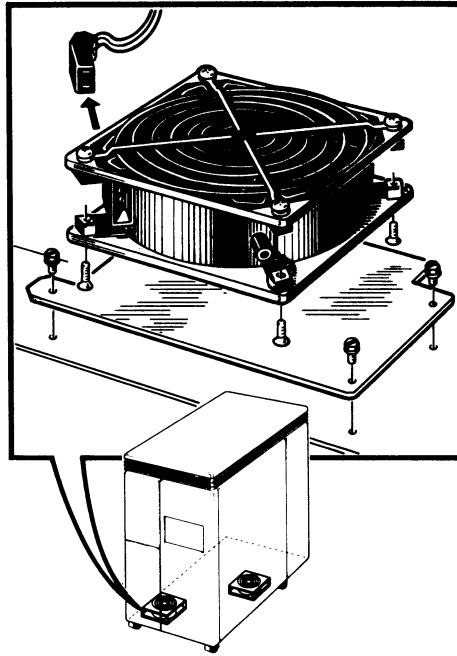
### **6.6.1 Mass Storage Fan Removal**

1. Remove the left side panel as described in Section 6.2.2.
2. Note that the dc power cable's plug is contoured to fit along the side of the fan. Disconnect the cable from the fan. When replacing the fan, be sure to align the cable the same way.
3. Remove the three screws that connect the fan's metal base plate to the enclosure frame (Figure 6-14).

#### **NOTE**

**Observe the alignment of the fan before removing it. Be sure to align the replacement fan in the same direction.**

4. Remove the four screws that connect the fan to the metal base plate.



MR-14050

Figure 6-14 Mass Storage Fan Removal

### 6.6.2 Card-Cage Fan Removal

1. Remove the right side panel as described in Section 6.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.
3. Slide the tray below the card cage partially out (Figure 6-15).
4. Note that the cable's dc power plug is contoured to fit along the side of the fan. Disconnect the cable from the fan. When replacing the fan, be sure to align the cable the same way.
5. Remove the four screws that connect the fan to the tray.

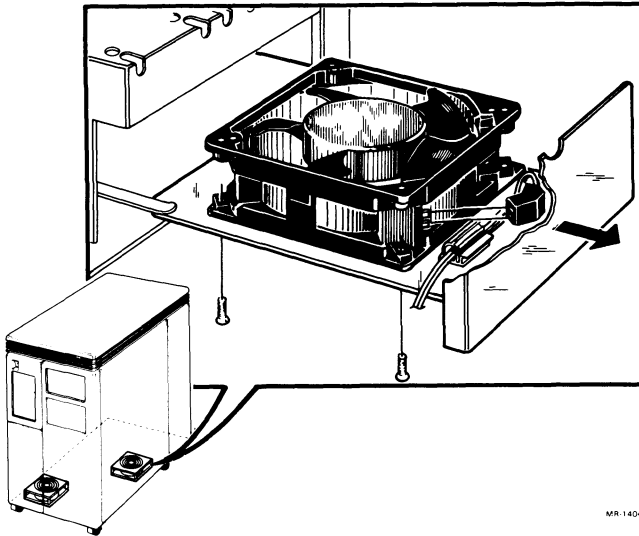


Figure 6-15 Card-Cage Fan Removal

## 6.7 MODULE REMOVAL

### **CAUTION**

**Static electricity can damage modules. Always use a grounded wrist strap and grounded work surface when working with or around modules.**

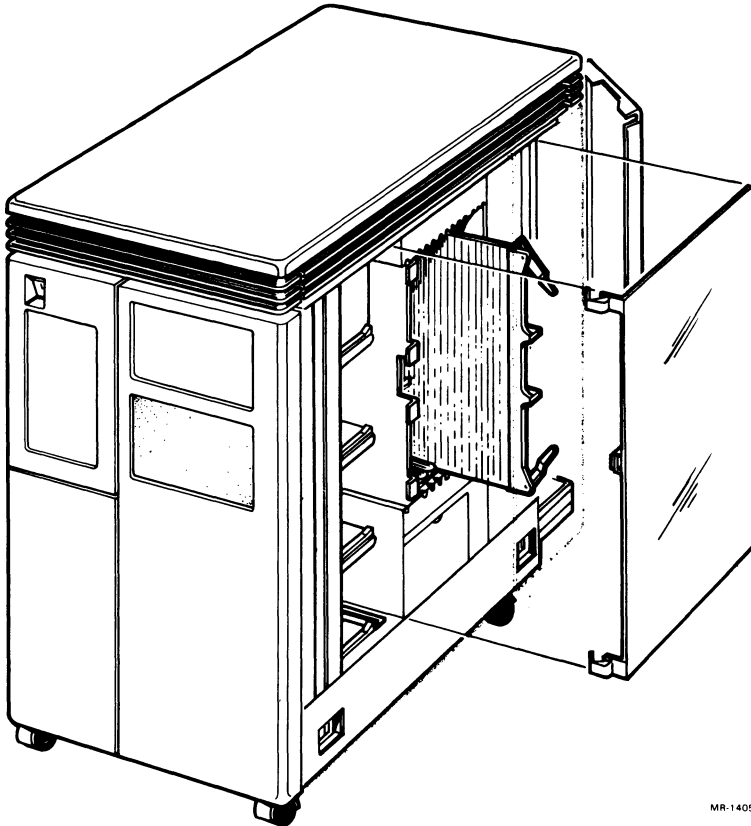
**Remove and install modules carefully to prevent damage to module components and other modules, or possibly changing the switch settings.**

1. Remove the right side panel as described in Section 6.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.
3. Carefully but firmly pull the levers which hold the module in place. Slide the module partially out of the backplane (Figure 6-16).
4. Note the alignment of any cables attached to the module. Disconnect the cables.
5. Remove the module from the enclosure.

### **NOTE**

**Be sure that the jumper and switch configurations on the replacement module are the same as those on the module removed.**

**Before removing a module from the backplane, be sure to note the position of all modules and the alignment of any cables that you disconnect.**



MR-14051

Figure 6-16 Module Removal

When installing modules, make sure the levers latch properly as you seat the module in the backplane.

Replacement modules come wrapped in special antistatic packaging material. A silica gel packet is also included to prevent damage from moisture. Use this antistatic packaging material and silica gel packet to protect any modules you store, transport, or return.

If you install a dual-height module in slots 1 through 4 of the backplane, you must install it in the AB rows. MS630-AA memory modules must be installed in the CD rows of slot 2 or 3. If you install dual-height modules in slots 5 through 12 of the backplane, you must install a grant continuity card (M9407) or a second dual-height module in the other two rows of the slot.

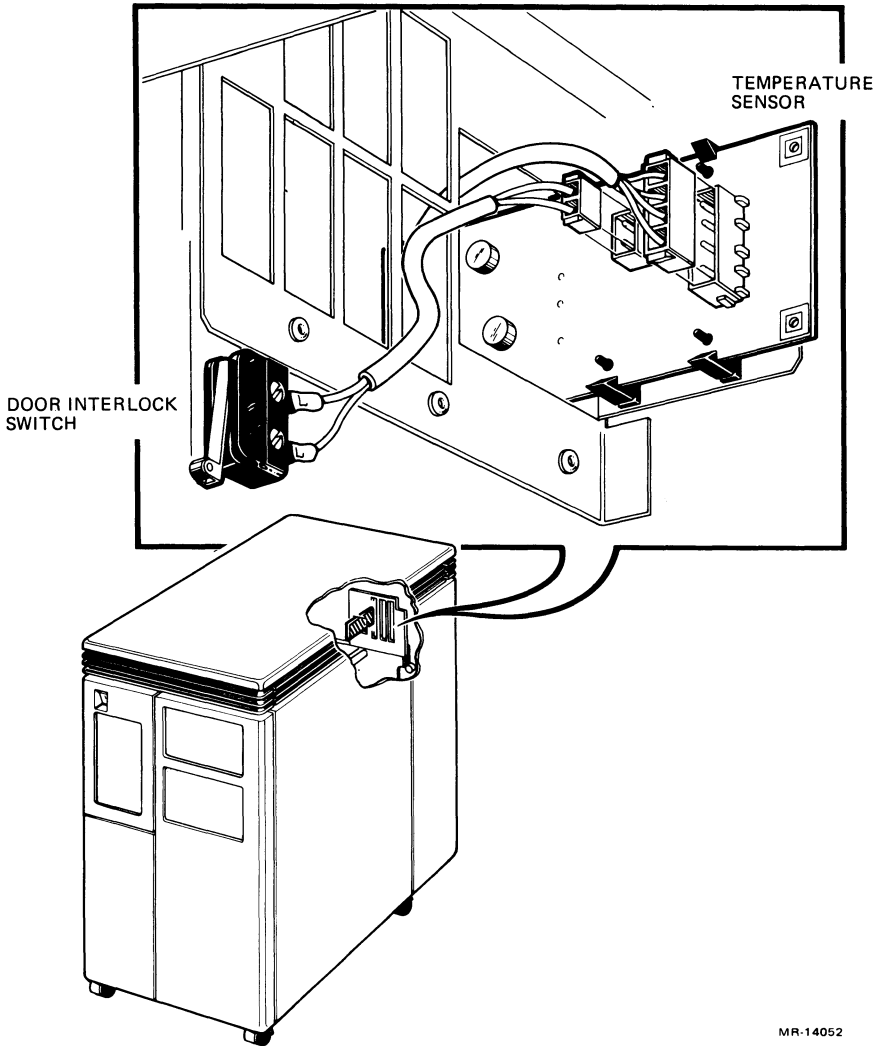


## **6.8 DOOR INTERLOCK SWITCH REMOVAL**

1. Remove the right side panel as described in Section 6.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.
3. A cable connects the interlock switch to the temperature sensor. Disconnect the cable from the temperature sensor (Figure 6-17).
4. Remove the two screws that connect the switch to the side of the card cage and remove the switch and the cable.

## **6.9 TEMPERATURE SENSOR REMOVAL**

1. Remove the right side panel as described in Section 6.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.
3. A cable connects the interlock switch to the temperature sensor. Disconnect the cable from the temperature sensor (Figure 6-17).
4. A cable connects the temperature sensor to the power supply. Disconnect the cable from the temperature sensor.
5. Remove the temperature sensor from the four plastic brackets connecting it to the enclosure frame.



MR-14052

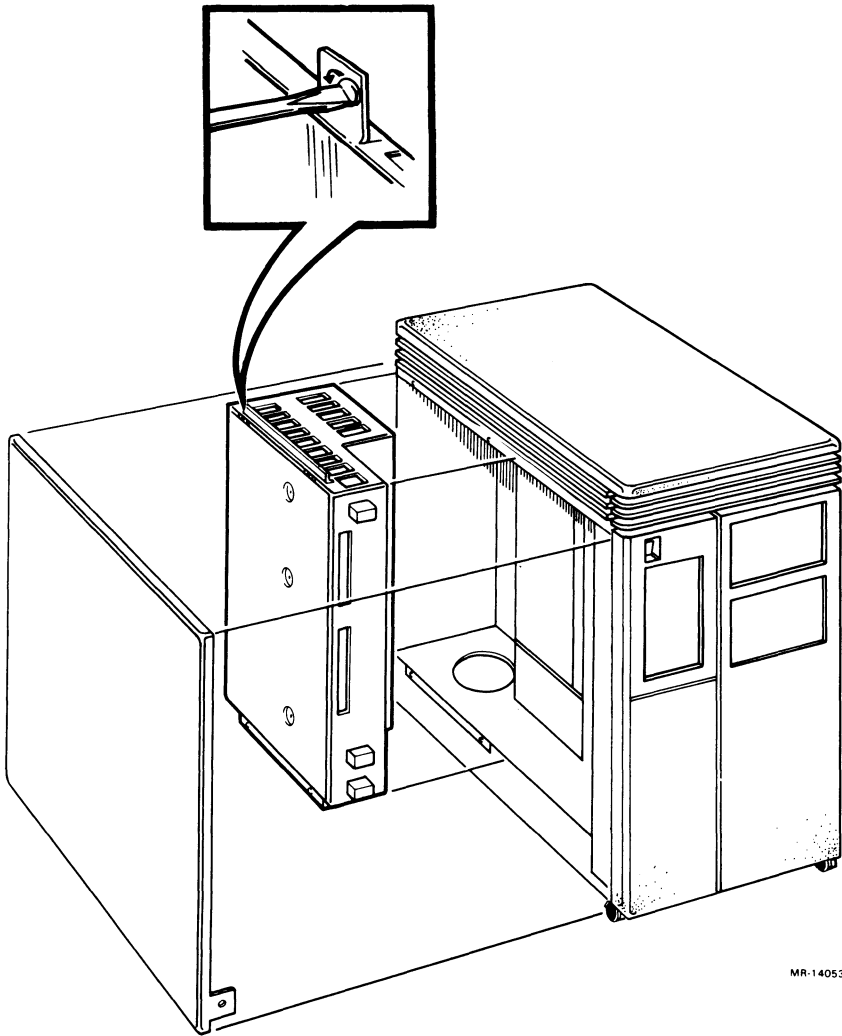
Figure 6-17 Door Interlock Switch/Temperature Sensor

## **6.10 POWER SUPPLY REMOVAL**

1. Remove the left side panel as described in Section 6.2.2.
2. Note the location and alignment of all cables attached to the power supply.  
Disconnect all cables, including the ac power cable at the rear of the system.
3. Remove the four 1/4 turn fasteners holding the power supply to the enclosure frame and remove the power supply (Figure 6-18).

### **CAUTION**

**Before installing a new power supply, verify that the voltage select switch at the rear of the power supply is set for the correct ac voltage. Damage to the system could result if the switch is not properly set.**



MR-14053

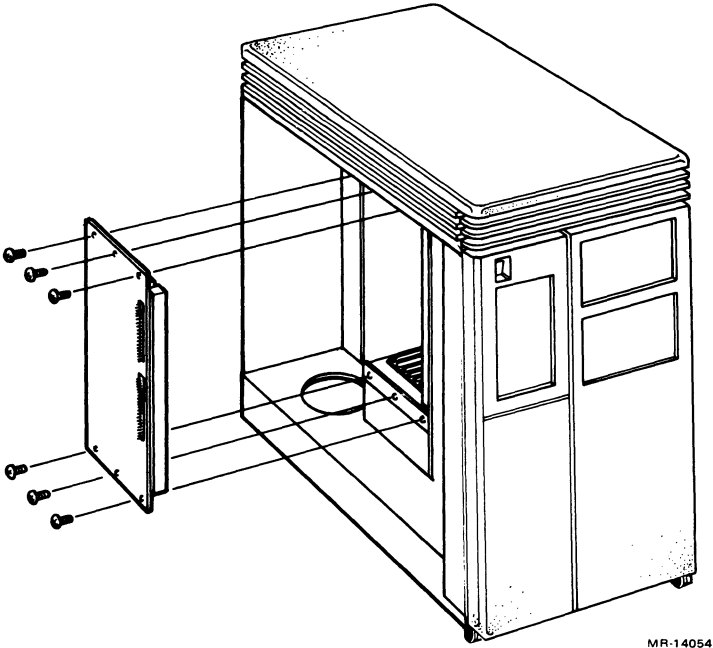
Figure 6-18 Power Supply Removal

## **6.11 BACKPLANE REMOVAL**

1. Remove both side panels as described in Sections 6.2.1 and 6.2.2.
2. Slide all modules partially out of the backplane, including the signal distribution board.
3. Remove the power supply as described in Section 6.10.
4. There is a metal plate between the backplane and the power supply. Remove the six screws that hold the plate to the enclosure frame.
5. Lift the metal plate and the backplane out of the back of the card cage (Figure 6-19).
6. Remove the screws that hold the metal plate to the backplane.

The backplane is replaced as follows:

1. Insert the screws that hold the metal plate to the backplane.
2. Place the backplane and the metal plate at the back of the card cage.
3. Insert a module in the first and the last card guide of the card cage.
4. Align the backplane so that the two modules can be fully inserted into the backplane. Insert the modules.
5. Insert the six screws that hold the metal plate to the enclosure frame.
6. Check the alignment of the backplane by inserting all of the system modules in their original slots.
7. Replace the power supply by reversing the procedure described in Section 6.10.



MR-14054

Figure 6-19 Backplane Removal

## 6.12 FILTER CONNECTOR REMOVAL

1. Turn the system off and unplug the ac power cord from the wall socket.
2. Open the rear door.
3. Disconnect any cables attached to the filter connector. Note where the cables were attached.
4. Remove the right side panel as described in Section 6.2.1.
5. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.

### **NOTE**

**Some of the internal cables that connect to the back of filter connectors may not be keyed. Observe the alignment of the internal cables and be sure to reconnect them the same way.**

6. Disconnect any cables that connect the filter connector insert to modules inside the enclosure.
7. Remove the screws that hold the filter connector to the I/O distribution panel.
8. Remove the filter connector.





### A.1 CONSOLE COMMAND SYNTAX

The console accepts commands up to 80 characters long. Longer commands are responded to with an error message. The count does not include rubouts, rubbed out characters, or the terminating carriage return.

Commands may be abbreviated. Abbreviations are formed by dropping characters from the end of a keyword. All commands are recognized from their first character.

Multiple adjacent spaces and tabs are treated as a single space by the console. Leading and trailing spaces and tabs are ignored.

Command qualifiers can appear after the command keyword, or after any symbol or number in the command.

All numbers (addresses, data, counts) are in hexadecimal. (Note, though, that symbolic register names include decimal digits.) Hex digits are 0 through 9, and A through F. The console does not distinguish between upper and lower case either in hex numbers (A through F) or in commands. Both are accepted.

### A.2 REFERENCES TO PROCESSOR REGISTERS AND MEMORY

The KA630 console is implemented by macrocode executing from ROM. For this reason, the actual processor registers may not be modified by the command interpreter. When console I/O mode is entered, the console saves the processor registers in a scratch page and all command references to them are directed to the corresponding scratch page locations, not to the registers themselves. When the console reenters program mode, the saved registers are restored and any changes then become operative. References to processor memory are handled normally except where noted below.

Generally, a free page on the interrupt stack is used for the scratch page, so the console does not modify the machine state. If a free page on the interrupt stack cannot be located, the console program uses the last valid page in contiguous physical memory and the original machine state is lost. This should occur only on power-up.

References to the console scratch page by EXAMINE and DEPOSIT commands must be qualified by the /U qualifier. (Access is primarily to simplify debugging of the console program.) The binary load and unload commands may not reference the console scratch page.

### **A.3 CONSOLE COMMANDS**

#### **A.3.1 Binary Load and Unload (X)**

Command Syntax:

X <address> <count> <CR> <checksum>

The X command is for use by automatic systems communicating with the console. It is not intended for use by operators. The console loads or unloads (that is, writes to memory, or reads from memory) the specified number of data bytes, starting at the specified address.

If bit 31 of the count is clear, data is to be received by the console and deposited into memory. If bit 31 of the count is set, data is to be read from memory and sent by the console. The remaining bits in the count are a positive number indicating the number of bytes to load or unload.

The console accepts the command upon receiving the carriage return. The next byte the console receives is the command checksum, which is not echoed. The command checksum is verified by adding all command characters, including the checksum, (but not including the terminating carriage return or rubouts or characters deleted by rubout), into an 8-bit register initially set to zero. If no errors occur, the result is zero. If the command checksum is correct, the console responds with the input prompt and either sends data to the requester or prepares to receive data. If the command checksum is in error, the console responds with an error message. The intent is to prevent inadvertent operator entry into a mode where the console is accepting characters from the keyboard as data, with no escape sequence possible.

If bit 31 of the count is clear (binary load commands), the console responds with the input prompt, then accepts the specified number of data bytes for depositing to memory, and an additional byte of received data checksum. The data is verified by

adding all data characters and the checksum character into an 8-bit register initially set to zero. If the final contents of the register is non-zero, the data or checksum is in error, and the console responds with an error message.

If bit 31 of the count is set (binary unload commands), the console responds with the input prompt, followed by the specified number of bytes of binary data. As each byte is sent it is added to a checksum register initially set to zero. At the end of the transmission, the 2's complement of the low byte of the register is sent.

If the data checksum is incorrect on a load, or if memory errors or line errors occur during the transmission of data, the entire transmission is completed, and then the console issues an error message. If an error occurs during loading, the contents of the memory being loaded are unpredictable.

Echo is suppressed during the receiving of the data string and checksums.

It is possible to control the console through the use of the console control characters (<CTRL> C, <CTRL> S, <CTRL> O, etc.) during binary unload commands. It is not possible during binary load commands, as all received characters are valid binary data.

Data being loaded with a binary load command must be received by the console at a rate of at least one byte per second. The command checksum that precedes the data must be received by the console within 10 seconds of the <CR> that terminates the command line. The data checksum must be received within 10 seconds of the last data byte. If any of these timing requirements are not met, the console aborts the transmission by issuing an error message and prompting for input.

The entire command, including the checksum, may be sent to the console as a single burst of characters at the console's specified character rate. The console is able to receive at least 4 Kbytes of data in a single X command.

### A.3.2 BOOT

Command Syntax:

BOOT [<qualifier list>] [<device>]

The device specification is of the format **ddcu**, where **dd** is a two-letter device mnemonic, **c** is an optional one-digit controller number, and **u** is a one-digit unit number.

The console initializes the processor and starts VMB running. VMB boots the operating system from the specified device. The default bootstrap device is determined as described in the section on system bootstrapping.

### Qualifier:

- /R5:<data> – After initializing the processor and before starting VMB, R5 is loaded with the specified data. This allows a console user to pass a parameter to VMB. (To remain compatible with previous processors, /<data> is also recognized and has the same result.)

### A.3.3 Comment (!)

#### Command Syntax:

! <comment>

The comment command is ignored. It is used to annotate console I/O command sequences.

### A.3.4 CONTINUE

#### Command Syntax:

CONTINUE

The processor begins instruction execution at the address currently contained in the program counter. Processor initialization is not performed. The console enters program I/O mode.

### A.3.5 DEPOSIT

#### Command Syntax:

DEPOSIT [<qualifier list>] <address> <data>

This command deposits the data into the address specified. If no address space or data size qualifiers are specified, the defaults are the last address space and data size used in a DEPOSIT or EXAMINE command. After processor initialization, the default address space is physical memory, the default data size is long, and the default address is zero.

If the specified data is too large to fit in the data size to be deposited, the console ignores the command and issues an error response. If the specified data is smaller than the data size to be deposited, it is extended on the left with zeros.

The address may also be one of the following symbolic addresses:

- PSL – The processor status longword. No address space qualifier is legal. When PSL is examined, the address space is identified as M (machine dependent).
- PC – The program counter (general register 15). The address space is set to /G.
- SP – The stack pointer (general register 14). The address space is /G.
- Rn – General register n. The register number is in decimal. The address space is /G. For example:

D R5 1234 is equivalent to D/G 5 1234

D R10 6FF00 is equivalent to D/G A 6FF00

- '+' – The location immediately following the last location referenced in an EXAMINE or DEPOSIT command. For references to physical or virtual memory spaces, the location referenced is the last address, plus the size of the last reference (1 for byte, 2 for word, 4 for long). For other address spaces, the address is the last address referenced, plus one.
- '-' – The location immediately preceding the last location referenced in an EXAMINE or DEPOSIT command. For references to physical or virtual memory spaces, the location referenced is the last address minus the size of this reference (1 for byte, 2 for word, 4 for long). For other address spaces, the address is the last address referenced minus one.
- '\*' – The location last referenced in an EXAMINE or DEPOSIT command.
- '@' – The location addressed by the last location referenced in an EXAMINE or DEPOSIT command.

Qualifiers:

- /B – The data size is byte.
- /W – The data size is word.
- /L – The data size is longword.

- /V – The address space is virtual memory. All access and protection checking occurs. If the access would not be allowed to a program running with the current PSL, the console issues an error message. Virtual space DEPOSITs cause the PTE<M> bit to be set. If memory mapping is not enabled, virtual addresses are equal to physical addresses.
- /P – The address space is physical memory.
- /I – The address space is internal processor registers. These are the registers addressed by the MTPR and MFPR instructions.
- /G – The address space is the general register set, R0 through PC.
- /U – Access to console program memory is allowed. This qualifier also disables virtual address protection checks.
- /N:<count> – The address is the first of a range. The console deposits to the first address, then to the specified number of succeeding addresses. Even if the address is the symbolic address ‘–’, the succeeding addresses are at larger addresses. The symbolic address specifies only the starting address, not the direction of succession. For repeated references to preceding addresses, use REPEAT DEPOSIT – <data>.

### NOTE

**Only memory may be accessed as bytes or words. Registers, the PSL and the IPRs must be accessed using the longword reference. This means that the /B and /W qualifiers may not be used with the /I and /G qualifiers.**

Examples:

D/P/B/N:1FF 0 0	Clears the first 512 bytes of physical memory.
D/V/L/N:3 1234 5	Deposits 5 into four longwords starting at virtual address 1234.
D/N:8 R0 FFFFFFFF	Loads general registers R0 through R8 with –1.
D/N:200 – 0	Starting at previous address, clears 513 bytes.

If conflicting address space or data sizes are specified, the console ignores the command and issues an error response.

### A.3.6 EXAMINE

Command Syntax:

EXAMINE [<qualifier list>] [<address>]

Examines the contents of the specified address. If no address is specified, '+' is assumed. The address may also be one of the symbolic addresses described under Section A.3.5, DEPOSIT.

Qualifiers:

The same qualifiers used with EXAMINE may be used with DEPOSIT.

Response:

<tab> <address space identifier> <address> <tab> <data>

The address space identifier can be:

- P – Physical memory. Note that when virtual memory is examined, the address space and address in the response are the translated physical address.
- G – General register.
- I – Internal processor register.
- M – Machine dependent address (used only for display of the PSL).

### A.3.7 FIND

Command Syntax:

FIND [<qualifier list>]

The console searches main memory starting at address zero for a page-aligned 64-kilobyte segment of good memory, or a Restart Parameter Block (RPB). If the segment or block is found, its address plus 512 is left in SP. If the segment or block is not found an error message is issued, and the contents of SP are unpredictable. If no qualifier is specified, /RPB is assumed.

### Qualifiers:

- /MEMORY – Searches memory for a page-aligned segment of good memory, 64 kilobytes in length. The search includes a read/write test of memory and leaves the contents of memory unpredictable.
- /RPB – Searches memory for a restart parameter block. The search leaves the contents of memory unchanged.

### A.3.8 INITIALIZE

#### Command Syntax:

#### INITIALIZE

A processor initialization is performed. The following registers are set (all values are hexadecimal):

PSL	041F0000
IPL	1F
ASTLVL	4
SISR	0
ICCS	0
RXCS	0
TXCS	80
MAPEN	0

All other registers are unpredictable.

The previous console reference defaults (the defaults used to fill in unsupplied qualifiers for DEPOSIT and EXAMINE commands) are set to physical address, longword size and address 0.



### **A.3.9 HALT**

Command Syntax:

HALT

The HALT command has no effect, the processor is already halted when in console I/O mode.

### **A.3.10 REPEAT**

Command Syntax:

REPEAT <command>

The console repeatedly displays and executes the specified command. The repeating is stopped by typing <CTRL> C. Any valid console command may be specified for the command with the exception of REPEAT.

### **A.3.11 START**

Command Syntax:

START [<address>]

The console starts instruction execution at the specified address. If no address is given, the current PC is used. If no qualifier is present, macroinstruction execution is started. If memory mapping is enabled, macroinstructions are executed from virtual memory. The START command is equivalent to a DEPOSIT to PC, followed by a CONTINUE command. No INITIALIZE is performed.

### **A.3.12 TEST**

Command Syntax:

TEST [<test number>]

The console invokes a diagnostic test program denoted by <test number>. Valid test numbers are 3 through 7 and B. If no test number is supplied, no test is performed.

### **A.3.13 UNJAM**

Command Syntax:

UNJAM

An I/O bus reset is performed.

## Appendix B

### Console Error Messages and Explanations

---

**Table B-1 Console Error Messages and Explanations**

---

<b>Hex Value</b>	<b>Message</b>	<b>Explanation</b>
02	EXT HLT	Break was typed on the console, QBINIT or QHALT was asserted.
04	ISP ERR	In attempting to push state onto the interrupt stack during an interrupt or exception, the processor discovered that the interrupt stack was mapped NO ACCESS or NOT VALID.
05	DBL ERR	The processor attempted to report a machine check to the operating system, and a second machine check occurred.
06	HLT INST	The processor executed a HALT instruction in kernel mode.
07	SCB ERR3	The vector had bits <1:0> equal to 3.
08	SCB ERR2	The vector had bits <1:0> equal to 2.
0A	CHM FR ISTK	A change mode instruction was executed when PSL<IS> was set.
0B	CHM TO ISTK	The exception vector for a change mode had bit <0> set.
0C	SCB RD ERR	A hard memory error occurred while the processor was trying to read an exception or interrupt vector.
10	MCHK AV	An access violation or an invalid translation occurred during machine check exception processing.

---

**Table B-1 Console Error Messages and Explanations (Cont)**

---

<b>Hex Value</b>	<b>Message</b>	<b>Explanation</b>
11	KSP AV	An access violation or an invalid translation occurred during processing of an invalid kernel stack pointer exception.
15	CORRPTN	The console database was corrupted. The console program simulates a power-up sequence and rebuilds its database.
16	ILL REF	The requested reference would violate virtual memory protection, the address is not mapped, the reference is invalid in the specified address space, or the value is invalid in the specified destination.
17	ILL CMD	The command string cannot be parsed.
18	INV DGT	A number has an invalid digit.
19	LTL	The command was too large for the console to buffer. The message is issued only after receipt of the terminating carriage return.
1A	ILL ADR	The address specified falls outside the limits of the address space.
1B	VAL TOO LRG	The value specified does not fit in the destination.
1C	SW CONF	For example, two different data sizes are specified with an EXAMINE command.
1D	UNK SW	The switch is unrecognized.
1E	UNK SYM	The symbolic address in EXAMINE or DEPOSIT is unrecognized.
1F	CHKSM	The command or data checksum of an X command is incorrect. If the data checksum is incorrect, this message is issued, and is not abbreviated to 'Illegal command.'
20	HLTED	The operator entered a HALT command.

---

**Table B-1 Console Error Messages and Explanations (Cont)**

<b>Hex Value</b>	<b>Message</b>	<b>Explanation</b>
21	FND ERR	A FIND command failed either to find the RPB or 64 kilobytes of good memory.
22	TMOUT	During an X command, data failed to arrive in the time expected.
23	MEM ERR	Parity error detected.
24	UNXINT	An unexpected interrupt or exception has occurred.
40	NOSUCHDEV	No bootable devices found.
41	DEVASSIGN	Device is not present.
42	NOSUCHFILE	Program image not found.
43	FILESTRUCT	Invalid boot device file structure.
44	BADCHKSUM	Bad checksum on header file.
45	BADFILEHDR	Bad file header.
46	BADIRECTORY	Bad directory file.
47	FILNOTCNTG	Invalid program image file.
48	ENDOFFILE	Premature end of file encountered.
49	BADFILENAME	Bad file name given.
4A	BUFFEROVF	Program image does not fit in available memory.
4B	CTRLERR	Boot device I/O error.
4C	DEVINACT	Failed to initialize boot device.
4D	DEVOFFLINE	Device is off-line.
4E	MEMERR	Memory initialization error.
4F	SCBINT	Unexpected SCB exception or machine check.
50	SCBZNDINT	Unexpected exception after starting program image.
51	NOROM	No valid ROM image found.

Console Error Messages and Explanations

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**Table B-1 Console Error Messages and Explanations (Cont)**

---

<b>Hex Value</b>	<b>Message</b>	<b>Explanation</b>
52	NOSUCHNODE	No response from load server.
53	INSFMAPREG	Invalid memory configuration.
54	RETRY	No devices bootable, retrying.

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