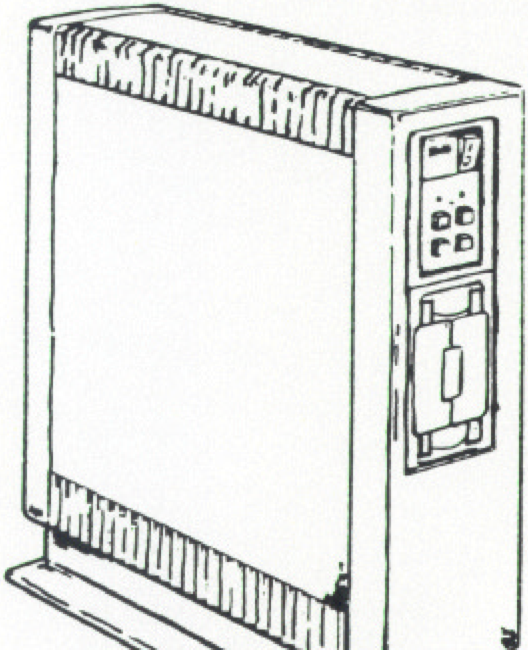
AZ-FE06A-TN

MicroVAX II
630QY, 630QZ

TECHNICAL MANUAL



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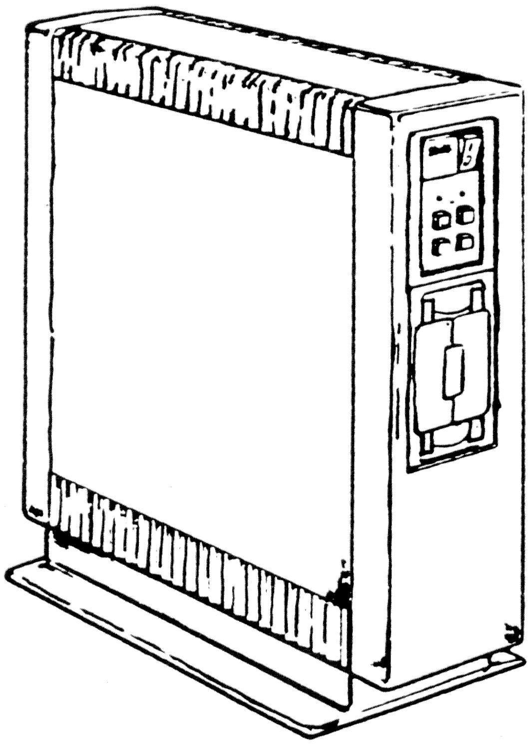

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Chapter 6 - FRU REMOVAL AND REPLACEMENT PROCEDURES

CHAPTER 1--ENCLOSURE

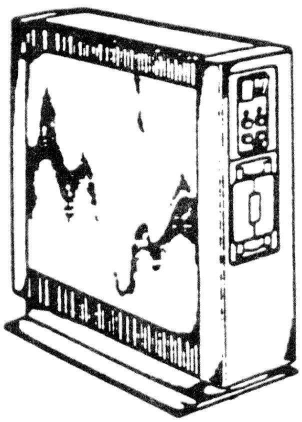
1.1 INTRODUCTION

The BA23 micro systems enclosure (figure 1-1) supports the MicroVAX computer systems and a wide variety of hardware options. The air-cooled enclosure operates in an open office environment and includes the following major components:

- o BA23-A frame.
- o Front control panel.
- o Mass storage area.
- o Backplane.
- o Power supply and fans.
- o Rear I/O (input/output)distribution panel.

Chapter 2 discusses the contents of a base MicroVAX II system.

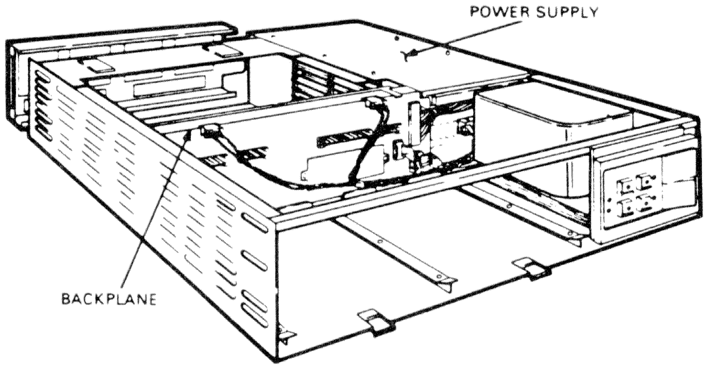
Figure 1-1 Floorstanding BA23 Enclosure



1.2 BA23-A FRAME

The BA23-A frame houses the power supply and the backplane assembly. It also provides space for two 5 1/4 inch (13.3 cm) mass storage devices (figure 1-2).

Figure 1-2 BA23-A Frame



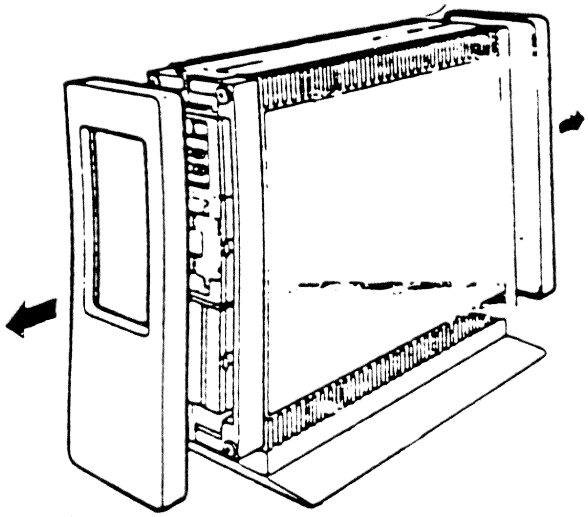
The BA23-A frame mounts in a rack, or in a floorstand. The floorstand converts to tabletop use. Table 1-1 shows the dimension and weight of the various configurations.

Table 1-1 MicroVAX II Systems Dimensions and Weights

	Floorstand	**Tabletop**	**Rackmount**
Height	64.2 cm (24.5 in)	17.7 cm (7 in)	13.3 cm (5.2 in)
Width	25.4 cm (10 in)	56.2 cm (22.13 in)	48.25 cm (19 in)
Depth	72.6 cm (28.6 in)	72.6 cm (28.6 in)	64.3 cm (25.3 in)
Weight	31.75 Kg (70 lbs)	29.5 Kg (65 lbs)	24 Kg (53 lbs)

A removable bezel covers the front of the BA23-A frame. The floorstand and tabletop models also have a removable rear bezel (figure 1-3).

Figure 1-3 BA23 Removable Bezels

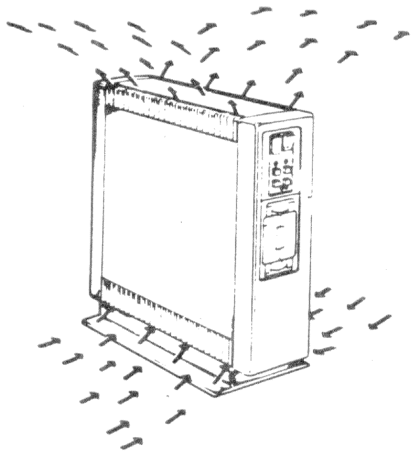


1.2.1 AIR CIRCULATION

The BA23-A frame contains two fans which draw air from the bottom of the enclosure (figure 1-4).

- 1 above the control panel.
- 1 above the power supply.

Figure 1-4 Airflow



1.3 FRONT CONTROL PANEL

The front control panel of the enclosure contains the system controls and indicators (figure 1-5); table 1-2 describes their function.

Figure 1-5 BA23 Front Control Panel

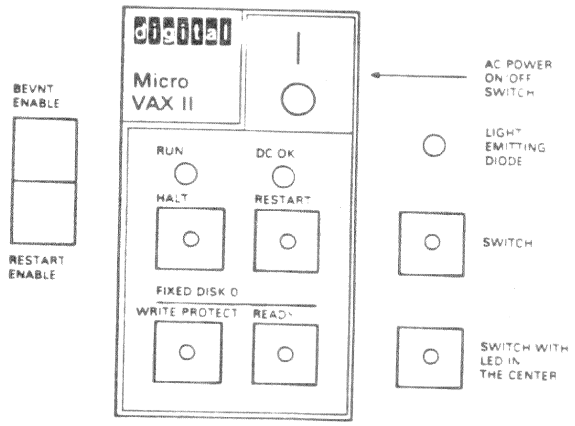


Table 1-2 Front Panel Controls And Indicators

Control/ Indicator	Position/ Condition	Description
1/0	1/Lit	Rocker switch with integral red indicator. Lights red when system ac power is ON.
	0/Unlit	System ac power is OFF.
DC OK	Lit	Green LED. Lights when all dc voltages are present and within tolerance.
	Unlit	The Q22-bus BDCOK (dc bus power is OK) signal is negated.
Run	Lit	Green LED. Lights when the CPU is executing in run mode.
	Unlit	The CPU is executing in console mode.
Halt	Out/Unlit	Push-on/push-off button with integral red LED. Normal position for running user software.
	In/Lit	Red LED. Stops normal software operation. Puts the CPU in console mode and the system accepts only console commands (see Appendix C). NOTE: The rear SLU panel HALT-ENABLE switch overrides this button when the HALT-ENABLE switch is set to the disable position. Thus, the red LED on the HALT button can be lit, while the system is not really halted. (see 1.3.1)

Restart		Momentary-contact pushbutton. When pressed (and enabled), causes a power-down/power-up sequence to be simulated, to restart CPU operation. NOTE - the Restart/Enable switch overrides this switch when the Restart/enable switch is set to the disable position (see 1.3.1)
Fixed-Disk 0 Write-Protect	Out/Unlit	Push-on/push-off button with integral yellow LED. Normal operation. Enables disk read and write operations.
	In/Lit	Lights yellow. Data cannot be written to the disk (data can be read from the disk).
Ready	In/Unlit	Push-on/push-off button with integral green LED. Prevents fixed disk read and write operations.
	Out/Lit	Normal operation. Lights green. Enables disk reads and writes.

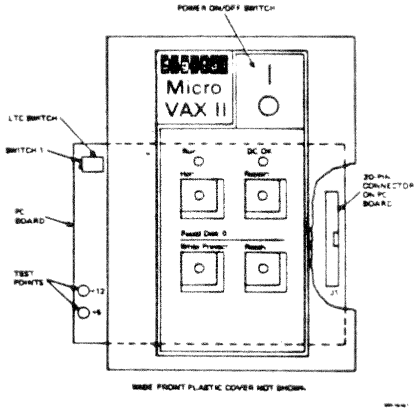
1.3.1 CONTROL PANEL PRINTED CIRCUIT BOARD

The control panel printed circuit (PC) board lies behind the molded plastic front control panel. This board provides access to +5V and +12V test points and to a line time clock (LTC) switch. The LTC DIP switch unit has two switches labeled 1 and 2 (figure 1-6). Setting switch 1 to ON enables the Q-22 bus BEVENT timing signal and allows the LTC to funtion under software control. Switch one is refered to as the BEVENT Enable switch.

Setting Switch 2 (Restart Enable) to ON, allows the front control panel Restart switch to function as desribed in table 1-2. Setting the Restart Enable switch to OFF, disables the front control panel Restart switch.

NOTE
The KA630 CPU does not use BEVENT timing at this time. Set the BEVENT Enable to the OFF position.

Figure 1-6 Control Panel With PC Board



The PC board also contains the system buttons, LEDs, and a 20-pin connector (J1) for the backplane assembly cable. A bracket on the rear of the moulded front panel holds the system power ON/OFF switch.

1.4 MASS-STORAGE

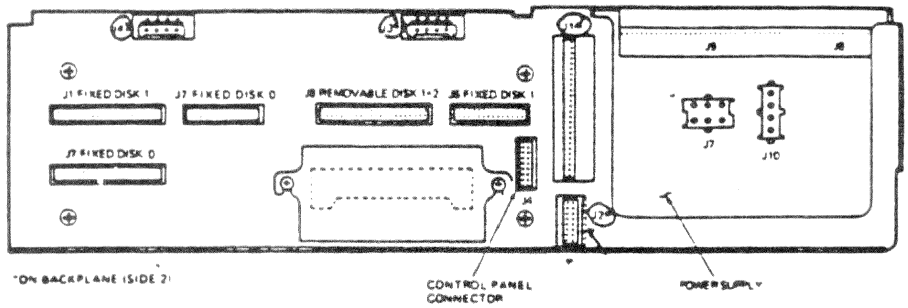
The front bezel covers two slots used for mounting standard 5 1/4 in (13.3 cm) mass-storage devices. The top (or right) slot usually contains a diskette or tape drive. The bottom (or left) slot usually contains a fixed disk drive.

1.5 BACKPLANE ASSEMBLY

The Backplane Assembly consists of three major parts (Figure 1-7):

- o BA23-A Mass Stroage signal distribution panel.
- o Sheet metal mounting bracket.
- o Q22-bus backplane.

Figure 1-7 Backplane Assembly, Front View

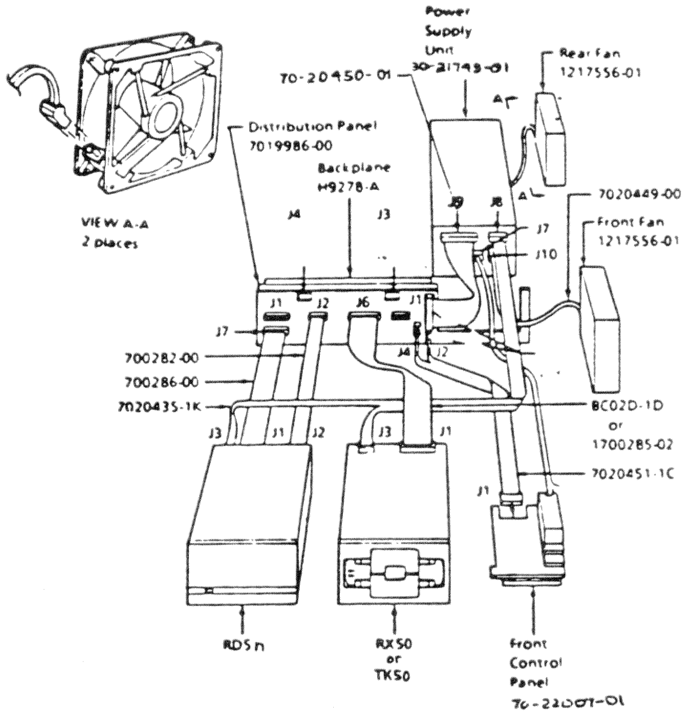


1.5.1 MASS-STORAGE SIGNAL DISTRIBUTION PANEL

RX50 diskette and RD5n fixed-disk drives installed in the BA23 enclosure connect to the mass-storage signal distribution panel. Figure 1-8 shows the internal cabling setup for the BA23 enclosure.

A TK50 tape drive installed in a BA23 enclosure connects directly to its controller module.

Figure 1-8 Internal Cabling In A BA23 Enclosure



The signal distribution panel carries the signals from an RQDX controller module installed in the Q22-bus backplane. Six connectors on the signal distribution panel provide the following functions:

- J8 Removable Disk 1+2 - provides the signals to an RX50 diskette drive. An RX50 diskette drive contains two disk units. When a fixed disk drive is present, the ROM code commonly labels these as Disk Unit 1 (DU1) and Disk Unit 2 (DU2).

- J7 Fixed Disk 0 (two connectors) - provide the signals to the first fixed disk drive to be booted. The ROM code commonly labels this fixed disk drive as Disk Unit 0 (DU0).

- J1 Fixed Disk 1 and J5 Fixed Disk 1 - provide the signals to the second fixed disk drive to be booted. Use these connectors when installing a second fixed disk drive in the BA23 enclosure. The ROM code commonly labels this disk drive as Disk Unit 1 (DU1).

NOTE
The MicroVAX systems do not support a second fixed disk drive installed in the BA23 enclosure at this time.

- J4 - provides the signals to the control panel printed circuit (PC) board from the mass-storage signal distribution panel.

1.5.2 H9278 BACKPLANE

The H9278 backplane supports a maximum of 30 ac loads and 20 dc loads. Ac loading is the amount of capacitance a module presents to a bus signal line; one ac load equals 9.35 picofarads (pf). Dc loading is the amount of dc leakage a module presents to a bus signal line; one dc load is approximately 105 microamperes (uA). The backplane itself presents 7 ac loads and no dc loads.

Four connectors on side 2 of the backplane provide the following functions (figures 1-7 and 1-8):

- J1 - provides the connection for the power supply backplane cable which carries the dc power and signals from the power supply.
- J2 - provides the signals to the control panel printed circuit board from an installed CPU module.
- J3 and J4 - provide for termination of the mass-storage power cable when no mass storage device is present.

The backplane has an eight layered printed circuit board which is arranged as follows:

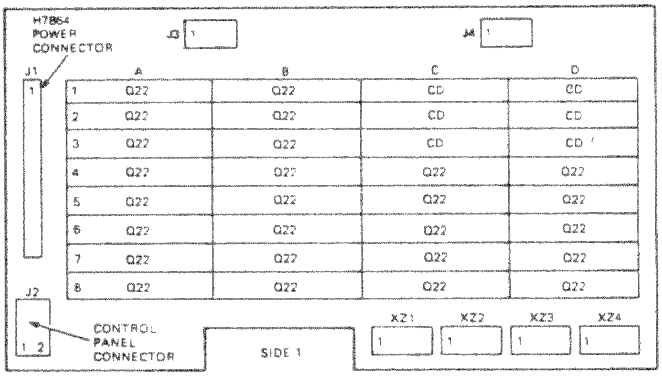
Layer	1	Signal
	2	Signal
	3	+5vdc from power supply regulator
	4	Ground
	5	Ground
	6	+12vdc from power supply regulator
	7	Signal
	8	Signal

Chapter 4 discusses the configuration rules for the backplane.

The backplane implements the extended LSI-11 Bus, which uses 22-bit addressing. This bus is commonly referred to as the "Q22-bus".

The backplane contains eight slots of connectors for the insertion of modules compatible with the Q22 bus. Four rows, A, B, C, and D run across each slot. Figure 1-9 shows the connectors that supply the Q22-bus signal to the modules.

Figure 1-9 Backplane



NOTES
1. CONNECTORS J1, J2, J3, AND J4 ARE MOUNTED ON SIDE 2.
2. XZ1—4 ARE BACKPLANE TERMINATOR SOCKETS. THE SIP TERMINATION RESISTORS MOUNTED IN XZ1—4 MUST BE REMOVED WHEN EXPANDING BEYOND THIS BACKPLANE.
3. J3 AND J4 ARE NOT POWER SOURCES. THEY ARE USED TO SUPPLY POWER TO THE BACKPLANE WHEN THE RD51-A FIXED DISK DRIVE OR RX50-AA DISKETTE DRIVE IS NOT INSTALLED.

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

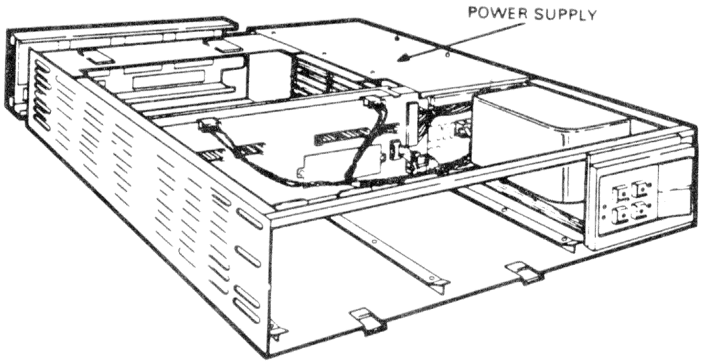
NOTE: The C and D rows of slots 1, 2, and 3 provide an interconnection between the three slots. This interconnection is refered to as the "CD interconnect." Only modules conforming to the "CD interconnect" specification should be installed in the CD rows. Any dual-height Q22-bus module may be installed in the AB rows of slots 2 and 3 (slot 1 is used by the CPU module).

NOTE: Dual height modules in either the AB or CD rows of slots 3 through 8 require another dual height module or an M9047 grant card in the other two rows of the slot.

1.6 POWER SUPPLY AND FANS

The power supply (figure 1-10) features protection against excess voltages, currents, and temporary fluctuations in the ac supply.

Figure 1-10 Location Of Power Supply



This power supply is a 230 watt unit that supplies +5vdc at 4.5 A to 36.0 A and +12vdc at 0.0 A to 7.0A to:

- o The backplane.
- o The fixed disk drive.
- o The diskette drive (or tape drive)

It also generates three system control signals to the backplane. The power supply asserts two of these signals, BDCOK H and BPOK H, when the system power is stable. The third signal, BEVENT L, is an external line clock interrupt request to the CPU. The LTC switch on the control panel PC board enables the BEVENT L signal.

The power supply also includes two +10vdc at 0.45 A fan outputs for the front and rear dc fans. The fan voltages can be increased to +12vdc by changing a power supply jumper; however, the 630QA module thermal and acoustical specifications are based on the +10 volt setting. The required fan power does not effect the 230 watt output specification. See table 1-3 for the power supply specifications.

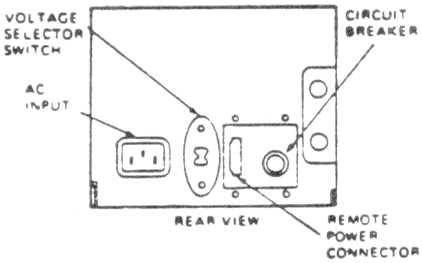
Table 1-3 H7864 Power Supply Specifications

+5vdc Output	
Voltage	+5.1 vdc +/- 2.5%
Current	36.0 A maximum 4.5 A minimum
Overcurrent	37 A minimum (averaged over 1 msec. must not trip) 42 A maximum (averaged over 1 msec. must trip)
Ripple and Noise	50 mv peak-to-peak maximum
+12vdc Output	
Voltage	+12.1 vdc +/- 2.5%
Current	7.0 A maximum 0 A minimum
Normal Overcurrent	7.2 A minimum (averaged over 1 sec must not trip) 8.0 A maximum (averaged over 1 sec must trip)
Startup Overcurrent	9.0 A for 10 sec minimum (must not trip) 10.0 A for 5 sec minimum (must not trip) 11.5 A for 1 sec minimum (must not trip) 13.0 A for 500 usec (must trip)
Ripple and Noise	75 mv peak-to-peak maximum

The rear of the power supply contains a connector for remote power control (figure 1-11). An ac input connector provides compatibility with international line cords. A circuit breaker protects the input power line. The voltage select (VOLT SEL) swith selects two ranges as follows:

- o 120V = 88 - 128 volts ac.
- o 240V = 176 - 256 volts ac.

Figure 1-11 Power Supply Rear View



The rear fan power cable is an integral part of the H7864 power supply.

The front of the power supply contains four connectors that provide the following functions (see figures 1-7 and 1-8):

- o J7 - provides the power for the front control panel.

- o J8 - provides the signals for the mass-storage power cable. The mass-storage power cable terminates in J3 on the backplane assembly if an removable media drive is not present, and in J4 if an RD5n fixed disk is not present.

- o J9 - provides the power for the backplane. The backplane power cable terminates in J1 of the backplane assembly.

- o J10 - provides the power for the front fan.

1.7 REAR I/O DISTRIBUTION PANEL

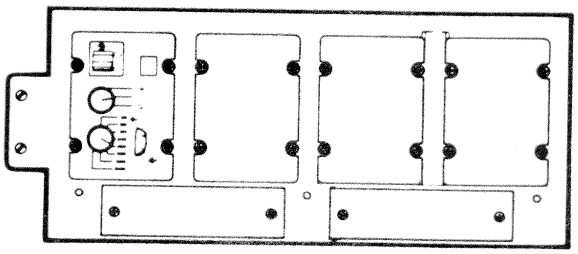
External devices connect to the system through the rear I/O distribution panel of the BA23 enclosure.

Each module that connects to an external device comes with an internal cable, a filter connector, and an insert panel. Together, these three items are referred to as a cabinet kit. Chapter 3 provides cabinet kit information for modules that support external devices.

The filter connectors mount in the insert panels. The insert panels install in cutouts in the rear I/O distribution panel. The BA23 rear I/O distribution panel provides a place to install up to six insert panels, two of which can contain 50-pin connector insert panels.

Figure 1-12 shows the rear I/O distribution panel with the SLU display panel of the KA630-A CPU module, which is typically installed in the top (or left) cutout.

Figure 1-12 Rear I/O Distribution Panel



The rear I/O distribution panel has six cutouts as follows:

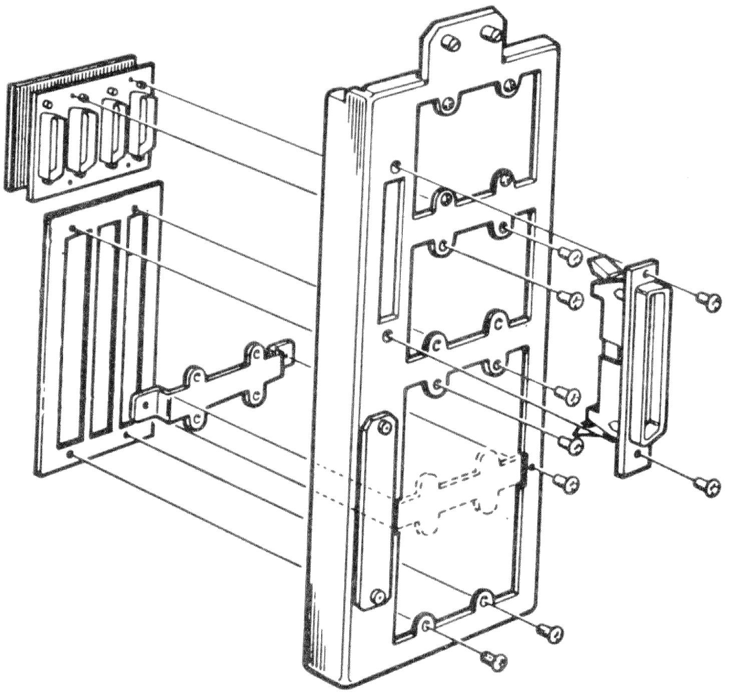
- o Type "A" (2) = 1.6 X 8.1 cm (.6 X 3.2 in).
- o Type "B" (4) = 6.2 X 8.1 cm (2.5 X 3.2 in).

Insert panels correspond to these I/O distribution panel cutouts:

- o Type "A" = 2.5 X 10.1 cm (1 X 4 in).
- o Type "B" = 6.6 X 8.2 cm (2.6 X 3.2 in).

In addition, a removable bracket between the third and fourth cutout permits installation of three more type A insert panels by installing an adaptor plate. Figure 1-13 shows typical type "A" and type "B" insert panels, and the adaptor plate.

Figure 1-13 I/O Insert Panels And Adaptor Plate



CHAPTER 2 - BASE SYSTEM

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, will also support one or two MS630-memory modules, adding up to 8MByte of additional 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 one or 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.

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 a subset of the VAX console program, power-up diagnostics, and boot programs for standard devices.

Q22-bus map/interface. Direct Memory Access (DMA) for all local memory. The KA630-A fields Q22-bus interrupt requests BR7-4.

Support for up to four gigabytes (2**32) of virtual memory.

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 a MicroVAX local memory interconnect in the CD rows of backplane slots 1 through 3, and through a cable between the CPU and MS630 memory modules.

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

* J1, for a cable connecting to an MS630 memory module.

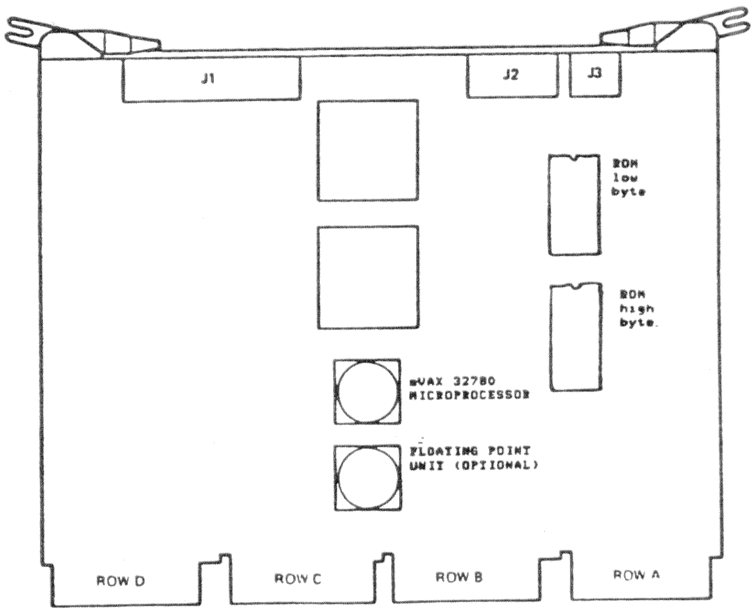
* J2, for a cable to the configuration and display connector on the CPU Patch Panel Insert.

* 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 into a slot that contains the MicroVAX local memory interconnect. It is normally installed in slot 1. It must not be installed in slots 4 - 8.

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 pushed
* an external halt signal
* execution of a halt instruction
* a 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), the console program may be directed to output the console program in any one of 11 languages. The user language is recorded in battery backed up RAM (see section 2.2.3) so that the selected 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.

The message "Performing normal system tests." is displayed. A countdown of ongoing diagnostic tests is displayed on the console terminal, on the CPU Patch Panel Insert LED Display, 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 the corresponding messages are described in Chapter 5.

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 B). 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 will try 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. The console program then branches to the VMB, which attempts to bootstrap an operating system from one of the following devices, in the order shown.

Table 2-1 Console Program Boot Sequence

	Controller Type	Q22-bus CSR address	Controller	Designation
1.	MSCP (Disk)	17772150 (first) floating (additional)	RQDX RC25 KDA	DUmn * DAmn DJmn (removable disk) DUmn (fixed disk)
2.	MSCP (Tape)	17774500 (first) floating (second)	TQK50	MUmn
3.	PROM	program searches for valid signature block at 4Kbyte boundaries within Q22-bus address range	MRV11	PRAn
4.	Ethernet adapter	17774440 (first) 17774460 (second)	DEQNA	XQAn XQBn

* m = MSCP disk designator (A = first, B = second etc.)
  n = unit number

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

The system can also be directed to enter VMB through console I/O mode by using the boot command, followed by the unit designation and number (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.

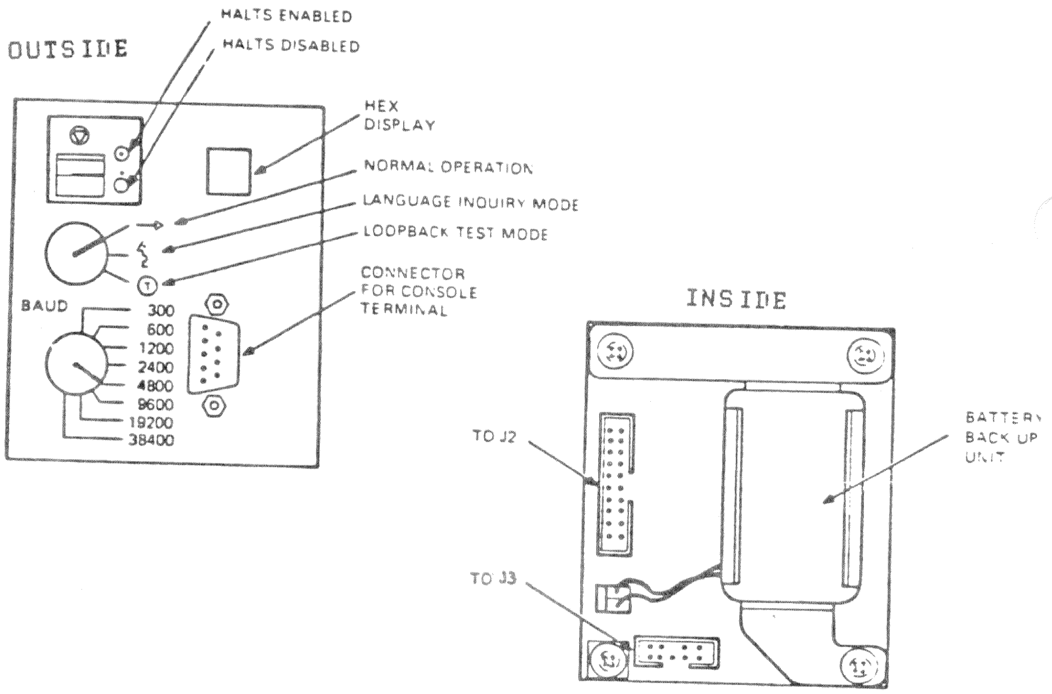
2.2.3 CPU Patch Panel Insert

The CPU Patch Panel Insert (figure 2-2) is mounted in the I/O distribution panel of the system 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



The three switches on the CPU Patch Panel Insert provide the following functions:

1 **Halt Enable** - (2-position toggle)

Switch Position	Function
Dot outside circle	Halts are disabled (factory setting). On power-up or restart, the system will attempt to load software from one of the devices at the completion of start-up diagnostics.
Dot inside circle	Halts are enabled. On power-up or restart, the system will enter console I/O mode at the completion of start-up diagnostics.

2 **Power-Up Mode Selection** - (3-position rotary)

Switch Position	Mode
0 (arrow)	Run (factory setting). If the console terminal supports the MCS, the user will be 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 will be 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.

3 **Baud Rate Select** - (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 that of the console terminal.

LED Display

Displays numbers of on-going steps of power-up tests and booting procedures. If a failure occurs, the display indicates the field replaceable unit (FRU) that is the most probable cause of the failure. Chapter 5 lists the definitions of the test numbers.

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 KA630-A CPU Module User's Guide (EK-UVAX2-TM-001).

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 256K RAM chips.

Table 2-2 MS630 Memory Module Versions

Version	Storage (Mbyte)	Module Height	Module Number
MS630-AA	1	Dual	M7607-AA
-BA	2	Quad	M7608-AA
-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-pin cable. This cable is installed between J1 of the KA630-A CPU and the corresponding J connector on one or both MS630 modules.

No hardware settings on the module are necessary.

CAUTION

MS630-B modules can only be installed in slots 2 or 3. They must not be installed in Q22-bus slots. MS630-AA can only be installed in the CD rows of slots 2 or 3.

Chapter 3 - SYSTEM OPTIONS

3.1 Introduction

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

1. Communications
2. Disk Storage Devices
3. Tape Storage Devices

Each option section includes configuration set-ups and a description of the cabinet kit required to install the module. Detailed documentation for each device is also listed.

NOTE

Current and bus loads for the following options are listed in chapter 4, table 4-1.

3.1.1 Ordering Options

Two items must be ordered to get al the parts necessary for an option: a base module and a cabinet kit.

Example:	DEQNA-M	base module
	CK-DEQNA-KB	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 an address location reserved in memory for the address or vector of that particular module. Modules with fixed addresses and vectors are usually shipped with the correct configuration for use as the first module of that type. If two modules of the same type are used, the factory setting for 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 will depend 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:

```
A
21 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. It is only necessary to be able to change bits A12 - A2 to set the CSR address within a typical range. 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.

3.2 Communications

3.2.1 DEQNA Ethernet Interface

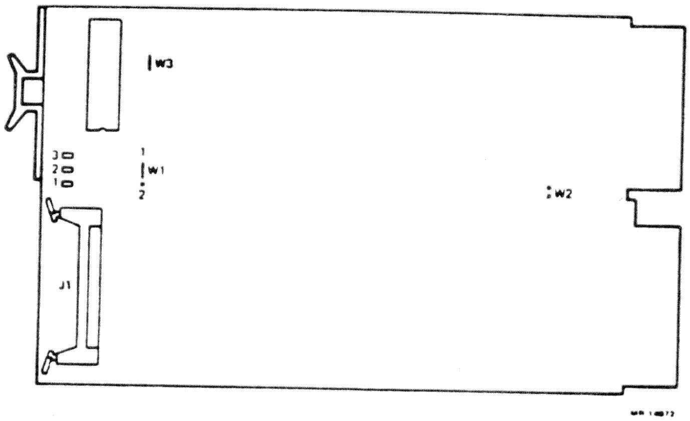
Order:	DEQNA-M	base module
	CK-DEQNA-KB	cabinet kit (type A filter connector and internal cable)

Module Number: M7504

The DEQNA is a dual-height module used to connect a Q-bus system to a local area network (LAN) based on Ethernet. The Ethernet is a communications system which allows data exchange between computers within a moderate distance (2.8 km/ 1.74 mi). The DEQNA can transmit data at a rate of 1.2 Mbytes per second, through coaxial cable. For high Ethernet traffic, an additional DEQNA may be installed.

The module is configured using three jumpers, W1 through W3 (figure 3-1).

Figure 3-1 DEQNA Module Layout



Jumper 1 (W1) determines the CSR address assignment. The DEQNA CSR addresses are fixed, as follows:

Module	CSR Address
1	17774440
2	17774460

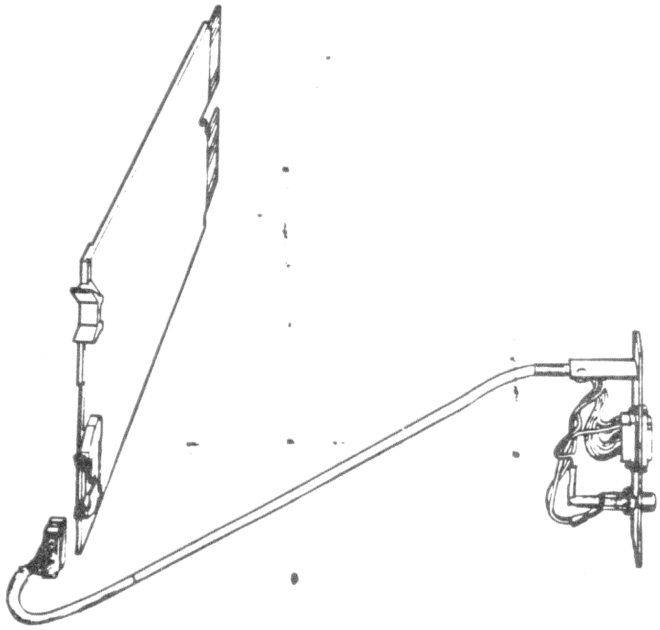
If two DEQNAs are to be installed, move jumper W1 of the second DEQNA onto the left and center pins (module edge towards you, figure 3-1).

The interrupt vector is written into a read/write register by software. No hardware configuration is required. The interrupt vectors are as follows:

Module	Interrupt Vector
1	120
2	floating

Jumper W2 is normally removed. When removed, it provides 'fair' access to all DMA devices using the Q22-bus by causing the DEQNA to wait 5 usecs. 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.

Figure 3-2 DEQNA Internal Cabling



For further information, refer to the DEQNA User's Guide (EK-DEQNA-UG-001).

3.2.2 DHV11 Asynchronous Multiplexer - (eight lines)

Order:	DHV11-M	base module
	CK-DHV11-AB	cabinet kit (2 type B filter connectors, 2 internal cables)

Module Number: M3104

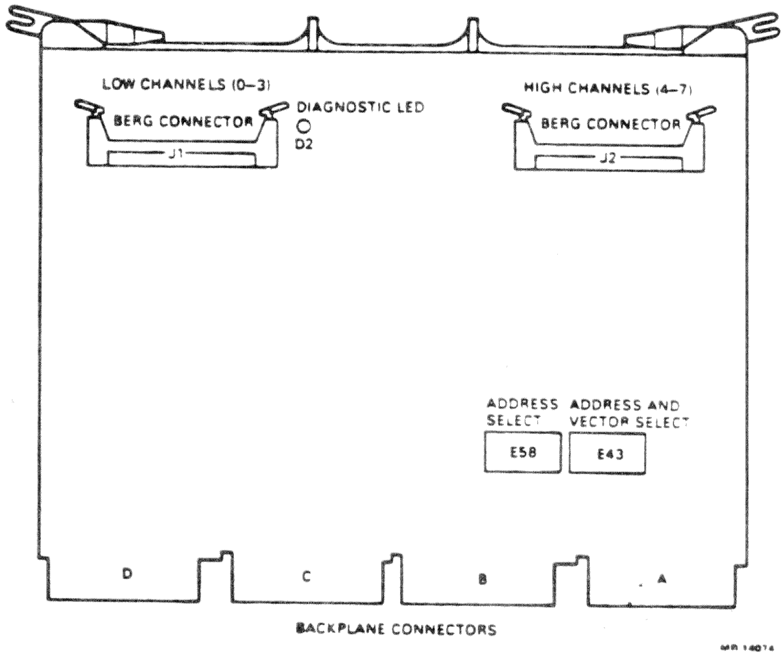
The DHV11 (figure 3-3) is an asynchronous multiplexer that provides support for up to eight serial lines, for data communications. It is a quad-height module with the following features:

* 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
	DF112
Bell modems:	103
	113
	203c
	202d
	212

Figure 3-3 DHV11 Module Layout



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 3-1 and 3-2 show the factory and common settings.

Table 3-1 DHV11 CSR Address

CSR Address	A12 E58 1	A11 2	A10 3	A9 4	A8 5	A7 6	A6 7	A5 8	A4 <-Add. bits E43 1 <- Switches	
17760440	0	0	0	0	1	0	0	1	0	
17760460	0	0	0	0	1	0	0	1	1	(factory)
17760500	0	0	0	0	1	0	1	0	0	

1 = switch on   0 = switch off

Table 3-2 DHV11 Interrupt Vector

Settings	V8 E43-3	V7 4	V6 5	V5 6	V4 7	V3 8 <- Switch *	
300	0	1	1	0	0	0	(factory)
310	0	1	1	0	0	1	

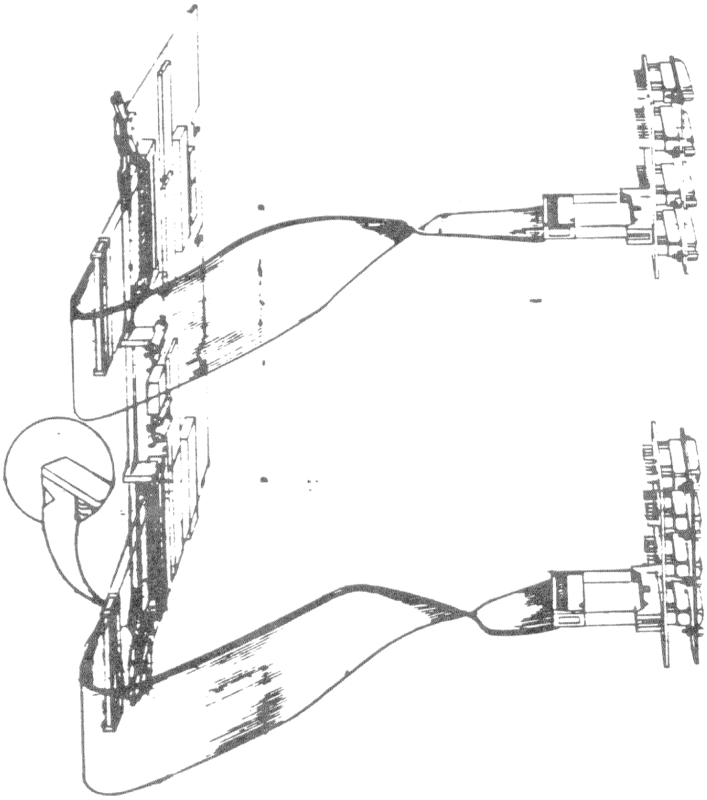
1 = switch closed   0 = switch open
* E43 switch 2 is not used

NOTE

The actual address and vector of the DHV11 will depend on what other modules are installed in the system. Refer to paragraph 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.

Figure 3-4 DHV11 Internal Cabling



For further information, refer to the DHV11 Technical Manual (EK-DHV11-TM-001).

3.2.3 DLVJ1 Asynchronous Interface - (four lines)

Order:	DLVJ1-M	base module
	CK-DLVJ1-LB	cabinet kit (type B filter connector, internal cable)

Module Number: M8043

The DLVJ1 (formerly DLV11-J) is a dual-height module that connects a Q-bus to up to four asynchronous serial lines (channels 0 - 3), for data communications. The serial lines must conform to EIA and CCITT standards. The DLVJ1 acts as four separate devices. The factory configuration of the module sets CH-3 as the console serial line unit (SLU).

NOTE

The DLVJ1 is not supported by the MicroVMS operating system.

The DLVJ1 module is configured using wire-wrap pins (figure 3-5). The CSR address for two DLVJ1 modules are fixed. Table 3-3 lists the factory setting for the CSR address of the first channel (CH-0). The CSR address of the other channels is 10 (octal) greater. For example, if CH-0 is set at 17776500, the CH-1 CSR address will be 17776510, CH-2 will be 17776520 etc., with the following exception: when CH-3 is configured as the console device, its address is fixed at 17777560, regardless of the setting of the other channels.

Table 3-3 DLVJ1 CSR Address

Module	CH-0 CSR Address	A12	A11	A10	A9	A8	A7	A6	A5 <-Add. bits
1	17776500	1-x	1-x	1-x	0-x	1-x	R	x-h	0-x (factory*)
2	17776540	1-x	1-x	1-x	0-x	1-x	R	x-h	1-x

R = no wire-wrap = 0
x-y = wire-wrap on pins x and y
0-x = 0   1-x = 1
* C1 and C2 are wire-wrapped on pins 1 and x. This sets the CH-3 CSR address to 17777650. To configure CH-3 as a non-console device, C1 and C2 should be wire-wrapped on pins 0 and x.

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, then the interrupt vector of CH-1 is 310, CH-2 is 320 etc, with the following exception: when CH-3 is configured as the console device, its interrupt vector is fixed at 60, regardless of the setting of the other channels. The factory configuration is shown in table 3-4.

Table 3-4 DLVJ1 Interrupt Vector

Settings	V8	V7	V6	V5	V4	V3	<- Vector bits
300	-	x-h	x-h	0-x	-	-	(factory*)
340	-	x-h	x-h	1-x	-	-	

x-h = jumper inserted between pins x and h = 1
0-x = jumper inserted between 0 and x = 0
1-x = jumper inserted between 1 and x = 1
*CH-3 interrupt vector is 60 (receive) and 64 (transmit)

NOTE

The actual interrupt vector of the DLVJ1 depends on the other modules in the system. Refer to paragraph 4.1.5 for guidelines for determining the interrupt vector.

Figure 3-5 DLVJ1 Module Layout

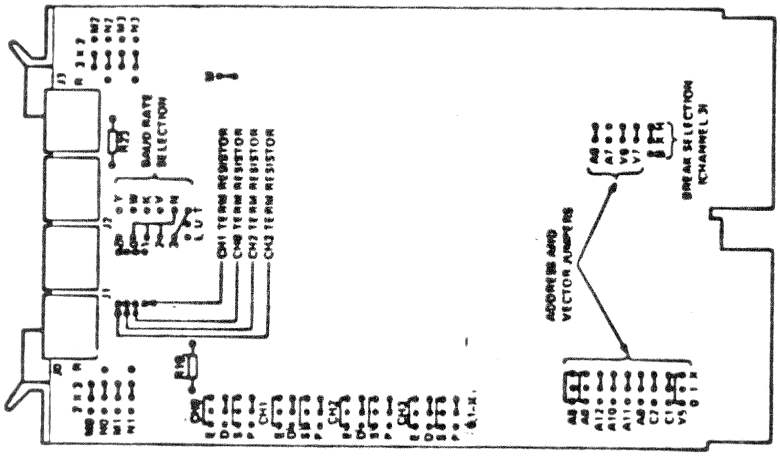
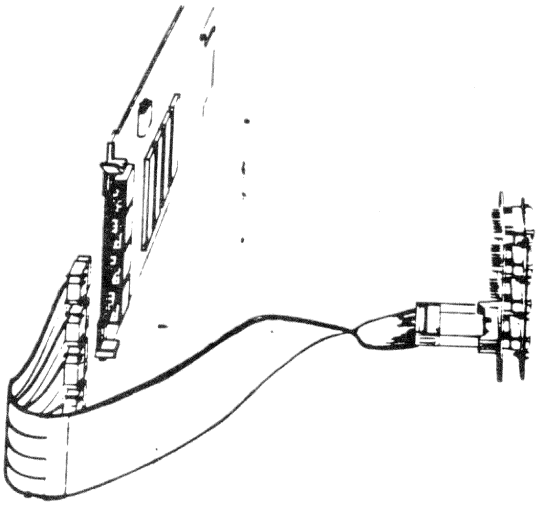


Figure 3-6 shows the internal cable set-up for the DLVJ1.

Figure 3-6 DLVJ1 Internal Cabling



For further information, refer to the DLV11-J Users Guide (EK-DLVIJ-UG).

3.2.4 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, each of which has a different interface capability. The option you choose depends on the interface requirements of your system. Table 3-5 lists the four system options and their corresponding upgrade components. Table 3-6 lists the interface for each system option, and the appropriate external cable.

Table 3-5 DMV11 Versions

Upgrade (base module + cabinet kit)	Module number	Module connector	I/O Panel insert type
DMV11-M + CK-DMV11-AB	M8053	J2 (of 2)	B
-M + -BB	M8053	J1 (of 2)	A
-N + -CB	M8064	J1 (of 1)	B
-M + -FB	M8053	J2 (of 2)	B

Table 3-6 DMV11 Interfaces

Order (base module + cabinet kit)	Interface	External cable
DMV11-M + CK-DMV11-AB	EIA RS232-C/CCITT V.28	BC22E or BC22F
-M -BB	CCITT V.35/DDS	BC17E *
-N -CB	integral modem	BC55S or BC55T
-M -FB	RS423-A/CCITT V.24	BC55D

* cable included in the -BB cabinet kit

The CSR address and interrupt vector of the DMV11 are configured by means of switches (figures 3-7, 3-8). The CSR address and interrupt vector are both floating. Tables 3-7 and 3-8 show the factory setting and another common setting.

Table 3-7 DMV11 CSR Address

CSR Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	<- Add. bits
	E53 (M8053)								E54 (M8053)		
	E58 (M8064)								E59 (M8064)		<-Switches
	8	7	6	5	4	3	2	1	2	1	
177760340	0	0	0	0	0	1	1	1	0	0	(factory)
177760360	0	0	0	0	0	1	1	1	1	0	

1 = on = closed   0 = off = open

Table 3-8 DMV11 Interrupt Vector

Interrupt Vector	V8	V7	V6	V5	V4	V3	<- Vector bits
	E54 (M8053)						
	E59 (M8064)						<- Switches
	8	7	6	5	4	3	
300	0	1	1	0	0	0	(factory)
310	0	1	1	0	0	1	

1 = on = closed   0 = off = open

NOTE

The actual settings will depend on the other modules in the system. Refer to paragraph 4.1.5 for guidelines for setting the CSR address and interrupt vector.

Another DIP switch on the DMV11 controls selectable features. Table 3-9 shows the function of this switch, and a common setting.

Table 3-9 DMV11 Switch Selectable Settings

E107 (M8064)									
E101 (M8053)									
10*	9	8	7	6	5	4	3	2	1
off	off	on	on	on	on	on	on	on	on

on = zero = function disabled
* unused on M8064

Switch 10 OFF for EIA interface, ON for V.35
Switch 9 must be OFF for integral modem (M8064) or when running above 19.2K 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, 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 Protocal (DDCMP) address register tributary/password. This must be set to a unique site address. Further information is contained in the DMV11 Synchronous Controller's User's Guide (EK-DMV11-UG-001).

Figures 3-7 and 3-8 show the location of the DIP switches on the two DMV11 modules. Figures 3-9 and 3-10 show the internal cabling for the four DMV11 interfaces.

Figure 3-7 M8053 Module Layout

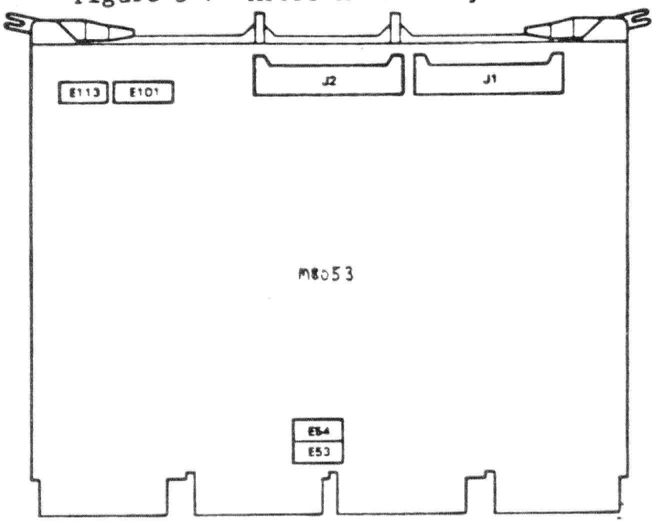


Figure 3-8 M8064 Module Layout

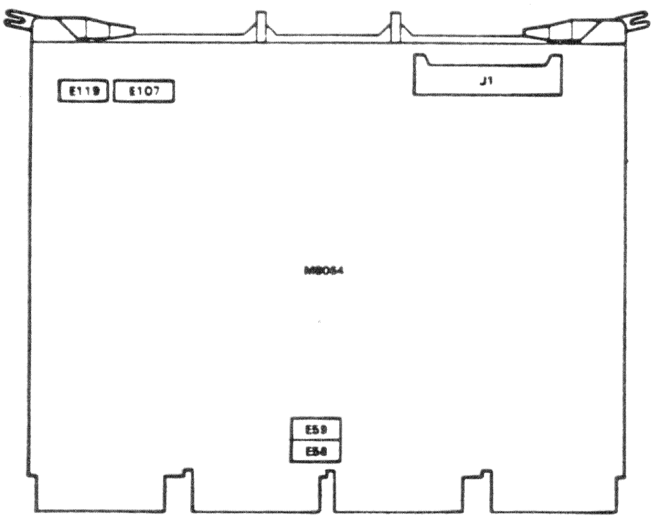


Figure 3-9 M8053 Internal Cabling

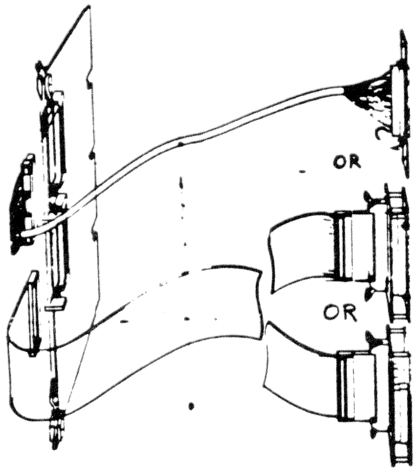
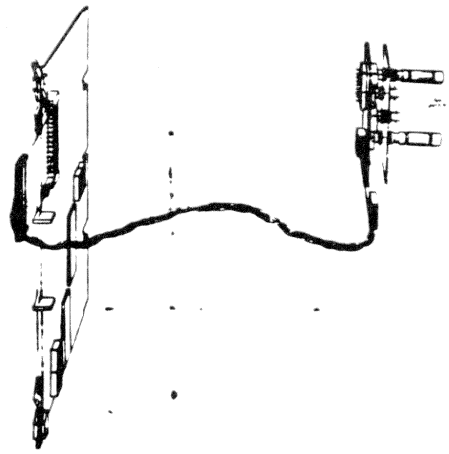


Figure 3-10 M8064 Internal Cabling



For further information, refer to the DMV11 Synchronous Controller Technical Manual (EK-DMV11-TM-001).

3.2.5 DPV11 Synchronous Interface

Order:	DPV11-M	base module
	CK-DPV11-AB	cabinet kit (type A filter connector, internal cable)

Module Number: M8020

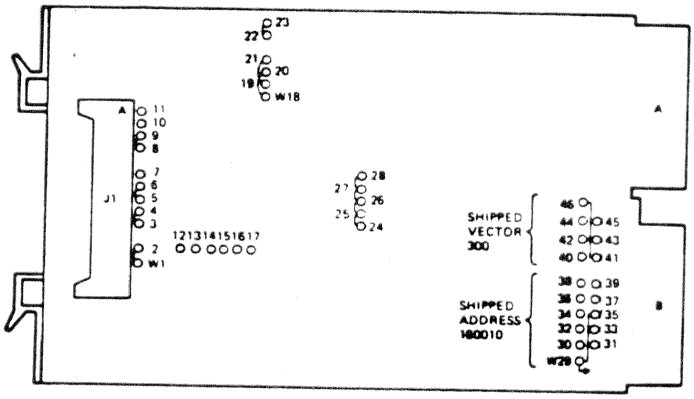
The DPV11 is a dual-height module that connects the Q-bus to a modem, using a synchronous serial-line. The serial-line conforms to the following EIA standards:

RS-232-C
RS-423-A
RS-422-A

EIA compatibility is provided for use in local communications only (timing and data leads only). The DPV11 is intended for character-oriented protocols, such as Digital Data Communications Message Protocol (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 3-11).

Figure 3-11 DPV11 Module Layout



The CSR address and interrupt vector are both floating. Tables 3-10 and 3-11 show factory and common settings.

Table 3-10 DPV11 CSR Address

Setting	A12 W31	A11 W30	A10 W36	A9 W33	A8 W32	A7 W39	A6 W38	A5 W37	A4 W34	A3 W35	<- Add. bits / <- 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	0	1	1	0	0	1	

1 = jumper inserted between pin Wxx and pin 29 (ground)
0 = jumper removed

Table 3-11 DPV11 Interrupt Vector

Interrupt Vector	V8 W34	V7 W42	V6 W41	V5 W40	V4 W44	V3 W45	<- Vector bits / <- Pin
300	0	1	1	0	0	0	(factory)
310	0	1	1	0	0	1	

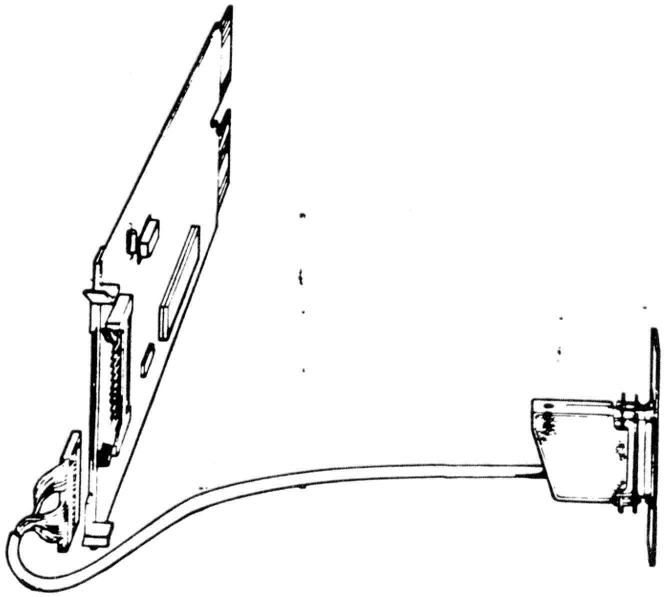
1 = jumper inserted between pin Wxx and pin 46 (ground)
0 = jumper removed

NOTE

The actual settings of the DPV11 will depend on the other modules in the system. Refer to paragraph 4.1.5 for guidelines for setting the CSR address and interrupt vector.

Figure 3-12 shows the internal cabling of the DPV11.

Figure 3-12 DPV11 Internal Cabling



For further information, refer to the DPV11 Synchronous Interface Users Manual (EK-DPV11-UG).

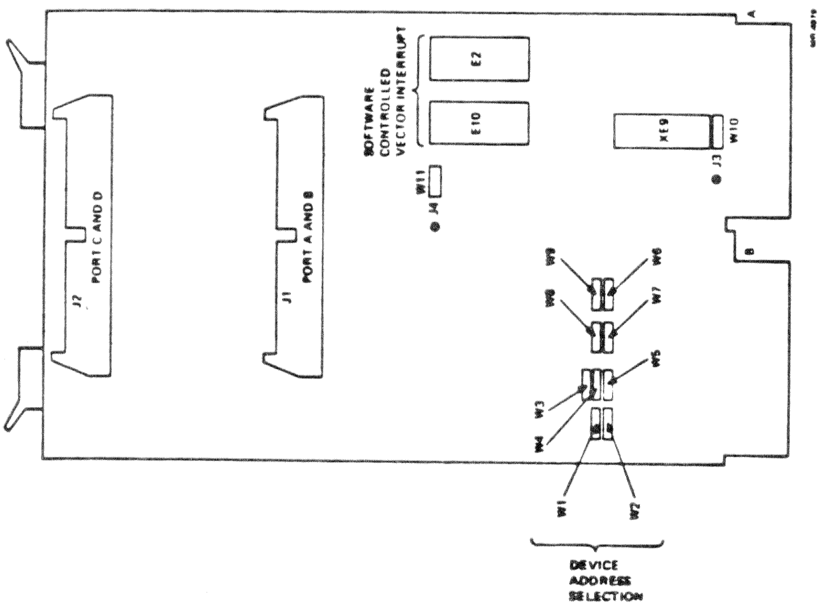
3.2.6 DRV11-J High-Density, Parallel Interface - (four lines)

Order:	DRV11-J	base module
	CK-DRV1J-KA	cabinet kit (2 type A filter connectors, 2 internal cables)

Module Number: M8049

The DRV11-J (figure 3-13) 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.

Figure 3-13 DRV11-J Module Layout



The interrupt vector is set under program control. The CSR address of the module is fixed and is set with jumpers W1 through W9. Table 3-12 lists the factory configuration.

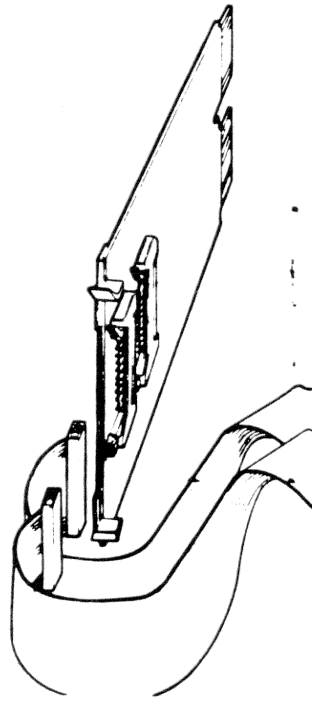
Table 3-12 DRV11-J CSR Address

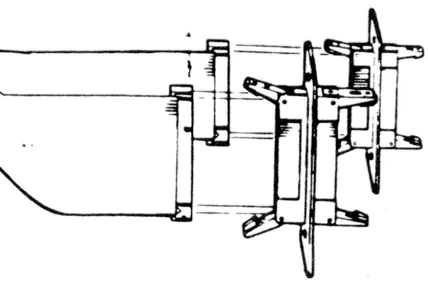
Module	Starting Address	A12 W1	A11 W2	A10 W3	A9 W4	A8 W5	A7 W6	A6 W7	A5 W8	A4 W9	<- Add. bits <- Jumpers
1	17764160	0	1	0	0	0	0	1	1	1	(factory)
2	17764140	0	1	0	0	0	0	1	1	0	

1 = installed 0 = removed

Figure 3-14 shows the internal cabling layout for the DRV11-J.

Figure 3-14 DRV11-J Internal Cabling





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

3.2.7 DZQ11 Asynchronous Multiplexer - (four lines)

Order:	DZQ11-M	base module
	CK-DZV11-DB	cabinet kit (1 type B filter connector, 1 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 RS423-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 3-15). The CSR and interrupt vector are floating. Tables 3-13 and 3-14 show the factory and common settings.

Figure 3-15 DZQ11 Module Layout

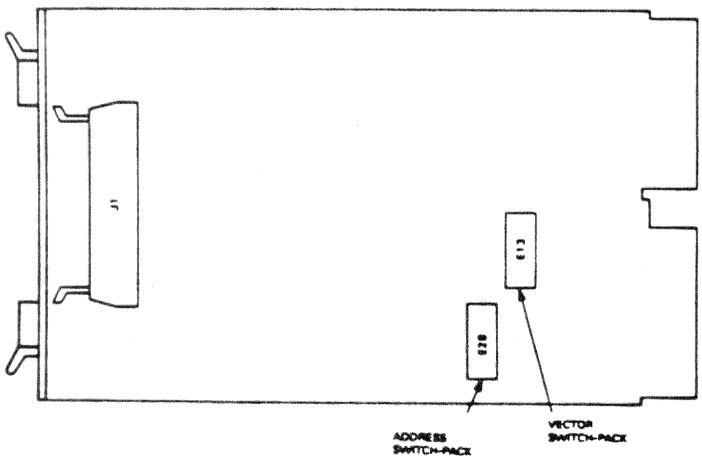


Table 3-13 DZQ11 CSR Address

CSR Address	A12 E28 1	A11 2	A10 3	A9 4	A8 5	A7 6	A6 7	A5 8	A4 9	A3 10	<-switches
17760010	0	0	0	0	0	0	0	0	0	1	(factory)
17760100	0	0	0	0	0	0	1	0	0	0	

0 = switch open 1 = switch closed

Table 3-14 DZQ11 Interrupt Vector

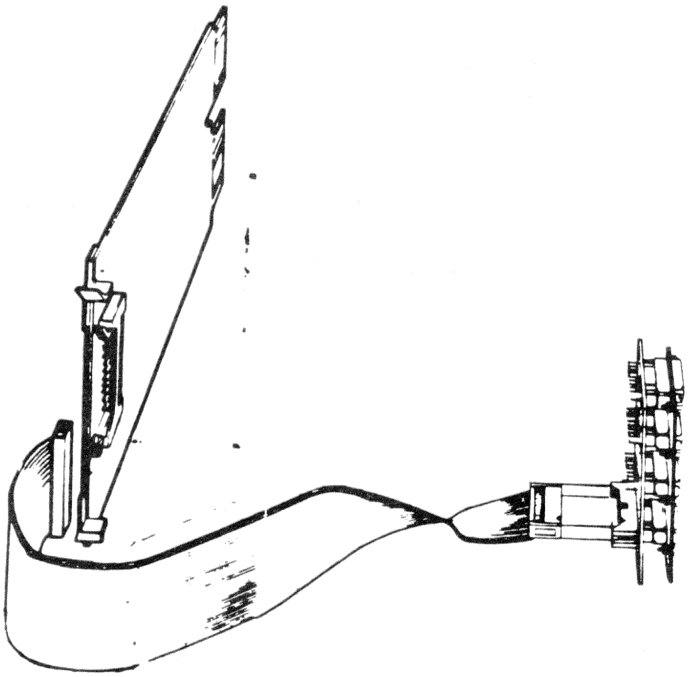
Interrupt Vector	E13 1	V8 2	V7 3	V6 4	V5 5	V4 V3 6	<- switches
300	0	1	1	0	0	0	(factory)
310	0	1	1	0	0	1	

0 = switch open 1 = switch closed

E13 switch 7 is not used. E13 switch 8 must be ON, and E13 switches 9 and 10 must be OFF for normal operation.

Figure 3-16 shows the internal cabling for the DZQ11.

Figure 3-16 DZQ11 Internal Cabling



For further information, refer to the DZQ11 Asynchronous Multiplexer's User's Guide (EK-DZQ11-UG-001).

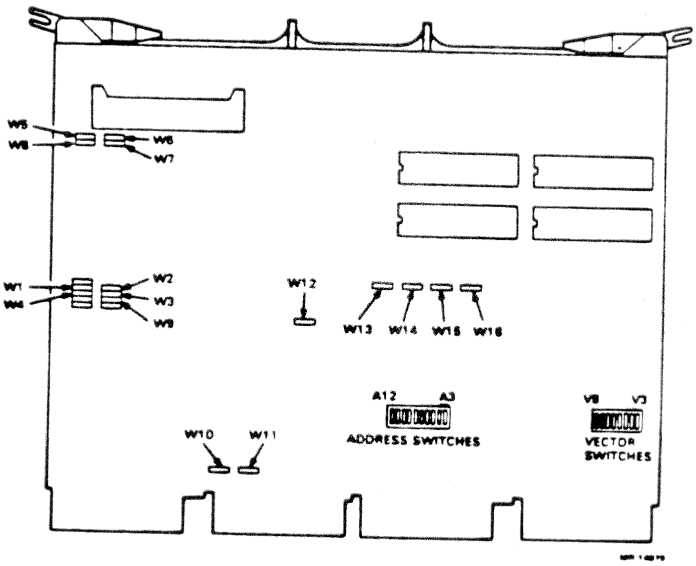
3.2.8 DZV11 Asynchronous Multiplexer - (four lines)

Order:	DZV11-M	base module
	CK-DZV11-DB	cabinet kit (1 type B filter connector, 1 internal cable)

Module Number: M7957

The DZV11 (figure 3-17) is a quad-height module that connects a Q22-bus to up to four asynchronous serial-lines. It conforms to the RS-232 interface standard, and permits dial-up (auto-answer) operation with modems using full-duplex operations.

Figure 3-17 DZV11 Module Layout



The DZV11 is configured using 16 jumpers and 2 DIP switches.

The CSR address and interrupt vector of the DZV11 are both floating. Tables 3-15 and 3-16 list the factory settings.

Table 3-15 DZV11 CSR Address

CSR 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	1	(factory)
17760100	0	0	0	0	0	0	1	0	0	0	

1 = switch closed   0 = switch open

Table 3-16 DZV11 Interrupt Vector

Interrupt Vector	V8	V7	V6	V5	V4	V3	<- Vector bits
	E2						
	1	2	3	4	5	6	<- Switches
300	0	1	1	0	0	0	(factory)
310	0	1	1	0	0	1	

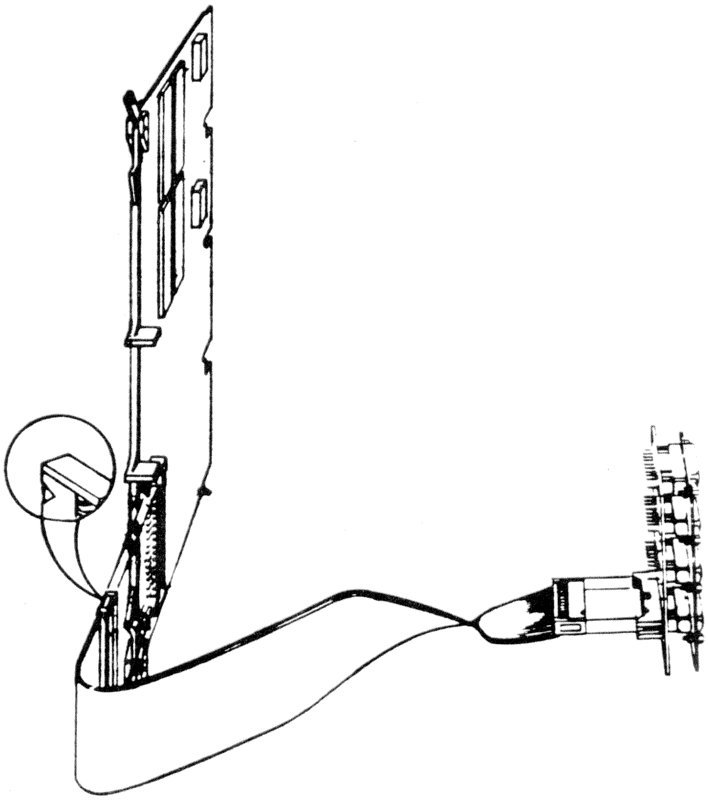
1 = switch closed   0 = switch open

NOTE

The actual settings of the DZV11 will depend on the other modules in the system. Refer to paragraph 4.1.5 for guidelines for setting the CSR address and interrupt vector.

Figure 3-18 shows the internal cabling layout.

Figure 3-18 DZV11 Internal Cabling



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

3.2.9 LPV11 Interface Module - (for LP25 system printer)

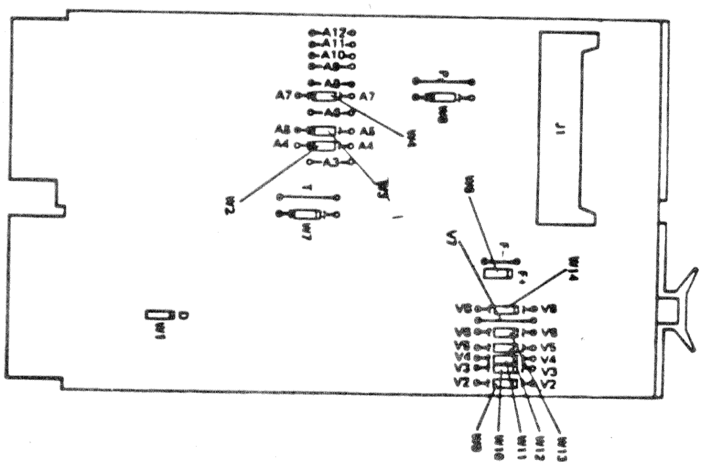
Order: LPV11-AD (includes LP25-DA printer and LPV11 controller) For 64/96 US character set.

CK-LPV1A-KA cabinet kit (includes 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 Q-22 bus and a line printer. It is configured using jumpers (figure 3-19).

Figure 3-19 LPV11 Module Layout



The CSR address and interrupt are both fixed. Tables 3-17 and 3-18 list the factory configuration. Figure 3-20 shows the internal cabling set-up.

Table 3-17 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)

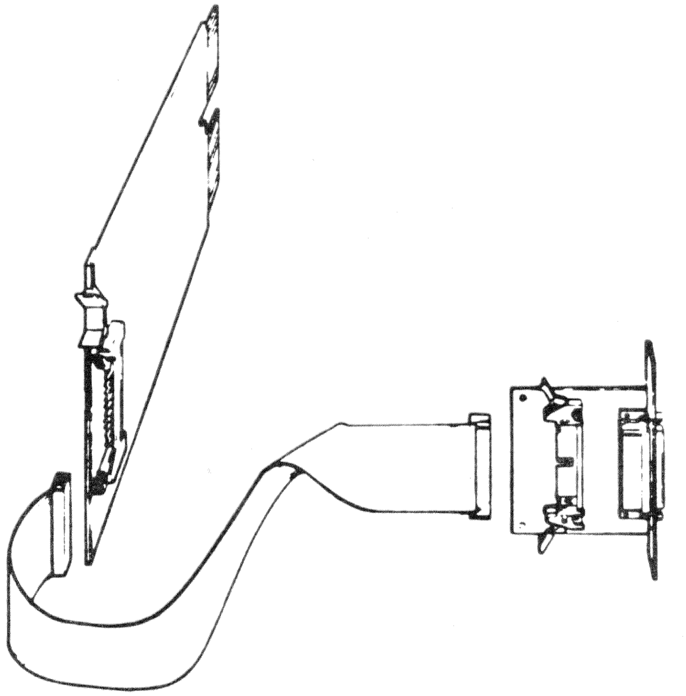
0 = installed 1 = removed

Table 3-18 LPV11 Interrupt Vector

Interrupt Vector	V8	V7	V6	V5	V4	V3	V2	<- Vector bits
	W14	V7	W13	W12	W11	W10	W9	<- jumper
200	0	1	0	0	0	0	0	(factory)

0 = installed 1 = removed

Figure 3-20 LPV11 Internal Cabling



3.3 Disk Storage Devices

3.3.1 RQDX2 Disk Controller

Order: RQDX2-AA (controller kit)

An RQDX2-AA controller kit includes the following:

1. RQDX2 controller module
2. 17-00285-02 50-pin signal cable

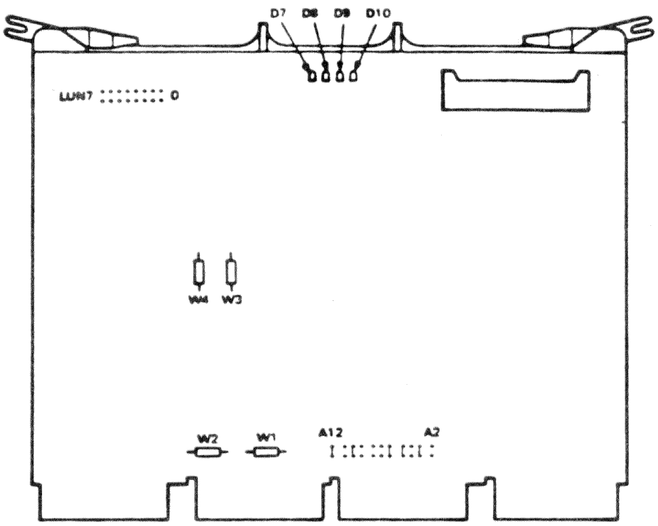
Module Number: M8639-YB

The RQDX2 controller is used to interface fixed-disk drives and diskette drives to the Q22-bus. It is an intelligent controller with on-board microprocessors. 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 can control a maximum of four drives. Each fixed-disk counts as one drive. Each RX50 counts as two drives.

Figure 3-21 shows the jumper and LED locations for the RQDX controller.

Figure 3-21 RQDX2 Module Layout



The CSR address of the first RQDX2 is fixed. If a second RQDX2 is installed, its CSR address will float. Table 3-19 lists the factory setting and common settings for a second RQDX2.

Table 3-19 RQDX2 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
possible settings for a second RQDX2:												
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	0	1	1	1	1	1	1	

1 = installed   0 = removed

The interrupt vector for the RQDX2 is set under program control. The first RQDX2 is assigned a fixed interrupt vector of 154. If a second RQDX2 is installed, its interrupt vector will float.

NOTE

The RQDX2 is an MSCP device. 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 table 4-3.

In addition to the CSR address and interrupt vector, Logical Unit Number (LUN) jumpers (0 - 7) on the module must be configured. When the RQDX2 is shipped, all of the LUN jumpers are removed. This is the correct configuration for the first RQDX2 module in a system and will assign LUNs 0 - 3 to the module. If a second RQDX2 module is added, a jumper should be installed onto pin 2, to assign its LUNs to a value of 4 - 7. The jumpers represent a binary weighted value and can thus be configured to begin at any LUN from 0 to 35, as shown in table 3-20:

Table 3-20 RQDX2 LUN Jumpers

LUN Jumper:	5	4	3	2	1	0
Binary weighted value:	32	16	8	4	2	1
LUN assigned: 0	all jumpers out (factory setting)					
1						in
2					in	
3					in	in
4				in		
5				in		in
etc.						
35	in				in	in

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

3.3.2 RD51, RD52, RD53 Disk Drives

Factory Installed: RD5nA-AA (disk kit) n = 1, 2 or 3

An RD5nA-AA kit includes the following:

1. RD5n-A : disk drive
2. 17-00282-00 : 20-pin cable to signal distribution panel
3. 17-00286-00 : 34-pin cable to signal distribution panel

The RD51, RD52 and RD53 are fixed-disk drives with formatted storage capacities of 10, 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.

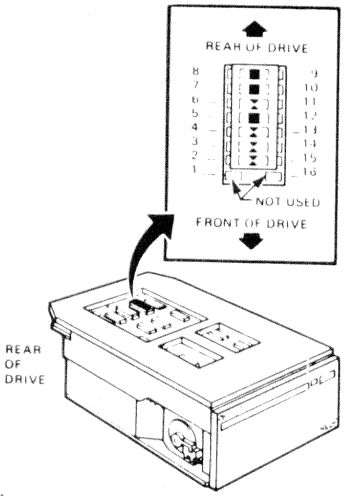
3.3.2.1 Factory Configuration

The RD51 read/write printed circuit board (PCB) has a DIP shunt jumper consisting of seven breakable metal strips (figure 3-22). Table 3-21 lists the configuration of the seven strips.

Table 3-21 RD51 DIP Shunt Jumper Configuration

Pin numbers	Connection
1 to 16	not used (nearest front of drive)
2 to 15	intact
3 to 14	intact
4 to 13	intact
5 to 12	broken
6 to 11	intact
7 to 10	broken
8 to 9	broken (nearest rear of drive)

Figure 3-22 RD51 Disk Drive and Shunt Jumper



The RD52 read/write PCB has five pairs of pins (figure 3-23) that are used to select the drive. To configure an RD52 as drive DU0, place a jumper on pins DS3. To configure an RD52 as drive DU1, place a jumper on pins DS4.

The RD53 read/write PCB has four switches at its rear edge numbered as follows:

```
  REAR OF DRIVE
4    3    2    1
-----------------
```

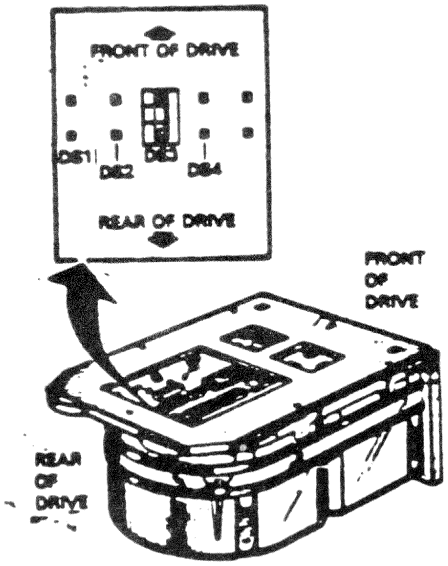
To configure an RD53 as drive DU0, depress switch 3. To configure the RD53 as DU1, depress switch 4.

If an RD5n 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
* 113-UC/11C23-UE RD52 Upgrade Installation Guide

Figure 3-23 RD52 Disk Drive and Shunt Jumper



3.3.3 RX50 Diskette Drive

Factory Installed: RX50A-AA

Field Upgrade: Same as factory installed option

The RX50A-AA kit includes the following:

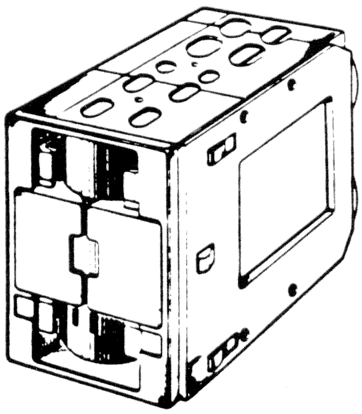
RX50-AA	:	diskette drive
17-00285-02	:	34-pin cable RX50 to signal dist. board

The RX50 (figure 3-24) is a random-access, dual-diskette storage device that uses two single-sided 5 1/4" 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.

NOTE

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

Figure 3-24 RX50 Diskette Drive



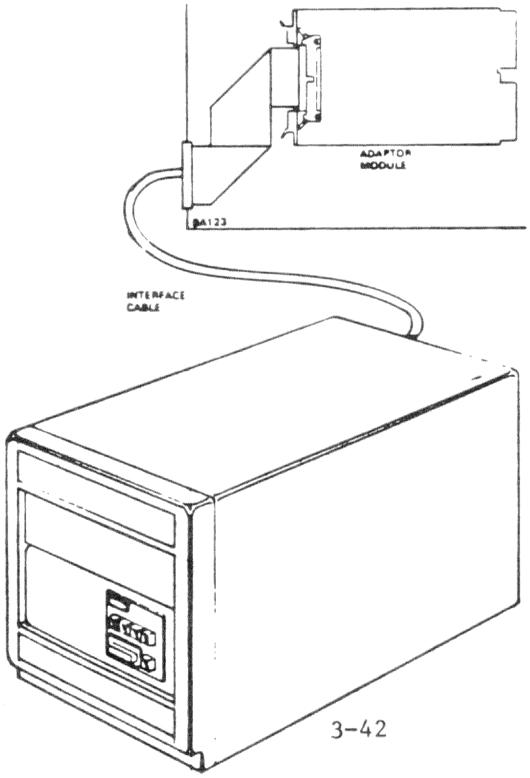
3.3.4 RC25 Disk Subsystem

Factory Installed: RQC25-AA (-AB) (table-top RC25 drive, cartridge and controller module) -AA = 120V, -AB = 240V

Field Upgrade: RC25-DA (-DB) (table-top RC25 w/cartridge)
KLESI-QA (controller module, cables)

The RC25 is a stand-alone mass-storage disk subsystem (figure 3-25) with a capacity of 52 Mbytes. It contains two 8-inch, double-sided disks, each with a capacity of 26 Mbytes. One disk is fixed and one is removable. Both disks are mounted on and driven by the same spindle.

Figure 3-25 RC25 Disk Subsystem



The M7740 controller module is an MSCP device. The CSR address of the M7740 controller module is configured using a DIP switch, E58, and a jumper (figure 3-26). Table 3-22 lists the factory setting and other common settings. The interrupt vector is set under program control.

Table 3-22 M7740 CSR Address

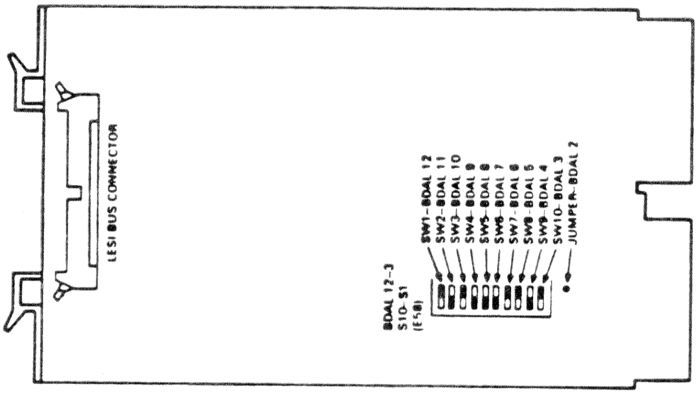
Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2 <- Add. bits
	<---------			E44	Switches			--------->			Jumper
	1	2	3	4	5	6	7	8	9	10	
17772150	1	0	1	0	0	0	1	1	0	1	0* <-(factory)
possible addresses if second MSCP device:											
17760334	0	0	0	0	0	1	1	0	1	1	1**
17760354	0	0	0	0	0	1	1	1	0	1	1

1 = switch on 0 = switch off
* 0 = jumper on left and center pin (module edge towards you)
** 1 = jumper on right and center pin

NOTE

The M7740 and the M8639-YB (RQDX2 controller) are both MSCP devices. The first MSCP device in a system is assigned a CSR address of 17772150. If more than one MSCP device is installed in the same system, the CSR address of the second device must be set within the floating range (see table 4-3).

Figure 3-26 M7740 Module Layout



3.35 TK50 Tape Drive Subsystem

The TK50 Tape Drive Subsystem can be installed in the BA23 enclosure, or can be ordered as a stand-alone desktop unit.

Order: TK50-AA (tape drive, cartridge)
TQK50-AA (controller module, internal cable)

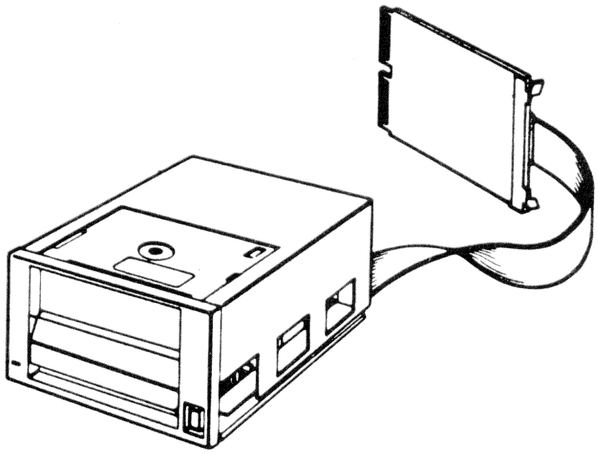
NOTE: Both parts must be ordered for a complete sub-system.

Stand-alone unit: TK50-DA (-DB) (DA = 120V, DB = 240V line cord)
TQK50-AB (controller module, internal cable, filter connector)

NOTE: Both parts must be ordered for a complete sub-system.

The TK50 is a streaming tape drive subsystem (figure 3-27) that uses 95 Mbyte magnetic tape cartridges for backup data storage.

Figure 3-27 TQK50 Tape Drive Subsystem



The M7546 controller module provides the interface between the TK50-AA tape drive and the Q22-bus.

Figure 3-28 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

The hardware revision level DIP switch is set to match the module revision level, which is stamped on the back of the module. Check the revision level stamped on the module with the switch settings. The eight switches in this DIP switch represent a binary weighted value, as shown in table 3-23:

Table 3-23 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

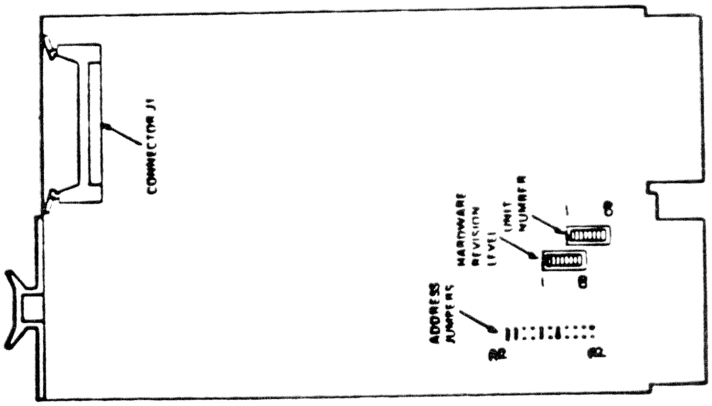
The unit number may be specified using the unit number DIP switch. It is not necessary to change this switch from the factory setting if the MicroVMS operating system is installed. The unit number is set as shown in table 3-24:

Table 3-24 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

Figure 3-28 M7546 Module Layout



The M7546 controller is a Tape Mass-Storage Control Protocol (TMSCP) device. The CSR address for the first M7546 controller is fixed and is set using jumpers (figure 3-28). If an additional TK50 subsystem is added, the CSR address of the second controller will float. Table 3-21 lists the fixed CSR address for the first and common settings for a second controller.

Table 3-24 Controller Module M7546 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)
possible addresses for second controller:												
17760404	0	0	0	0	1	0	0	0	0	0	1	
17760444	0	0	0	0	1	0	0	1	0	1	1	

1 = jumper installed 0 = jumper installed
* A2 is the jumper nearest the module edge

The interrupt vector is fixed at 260 and is set under program control.

For further information, refer to the TK50 Tape Drive Subsystem User's Guide (EK-LEP05-OM-001).

CHAPTER 4 - CONFIGURATION

4.1 Configuration Rules

There are several factors to consider when configuring a MicroVAX system in a BA23 enclosure:

1. Module physical priority
2. Backplane and I/O panel expansion space
3. Power requirements
4. 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.

* The KA630-A CPU is installed in slot 1..

* MS630-B memory modules are installed in slots 2 and 3.

* MS630-AA memory modules are installed in the CD rows of slots 2 and 3.

* If other dual-height modules are installed in slots 1 - 3, they must be placed in the AB rows. No grant continuity card is necessary.

NOTE

If slots 2 and 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 by installing M9047 grant continuity cards in the AB rows.

* Dual-height modules installed in slots 4 - 8 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 module sequence:

1. KA630-A CPU

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. Communications Module - Smart DMA
    DEQNA M7504

11. Asynchronous Communications Module - With Silo/DMA
    DHV11 M3104

12. Streaming Tape Controller - Smart DMA
    TQK50 M7546

13. Mass Storage Controller - Smart DMA
    KLESI   M7740
    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

Backplane:

There are eight backplane slots available for Q-22 bus compatible modules. The configuration examples in this chapter show the slots occupied by modules and the number of open slots remaining.

I/O Panel Insert Space:

There are two type A (1X4) and four type B (2X3) cutouts available on the back panel for mounting I/O panel inserts. Table 4-1 lists the type of inserts used for each module. The configuration worksheet (figure 4-1) is used to keep track of the number of inserts that have been used.

4.1.3 Power Requirements

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

Current: at +5vdc = 36 amps
            +12vdc = 7 amps

Power: 230 watts

NOTE

Maximum +5vdc and +12vdc current cannot be drawn at the same time, or the 230 watt limit will be exceeded.

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 (amps) +5v	+12v	Power (watts)	Bus Loads AC	DC	I/O Inserts A=1x4,B=2x3
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)
DRV11-LP	M7941	0.9	0.0	4.5	2.8	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	
KLESI-QA	M7740	3.0	0.0	15.0	2.3	1.0	A
RQDX2	M8639-YB	6.4	0.1	33.2	2.0	1.0	
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		0.9	2.5	34.5	-	-	
TK50-AA		1.35	2.4	33.55	-	-	

4.1.4 Bus Loads

Table 4-1 lists the AC and DC bus loads for each Q22-bus module.

Figure 4-1 Configuration Worksheet

1. Write the module and mass-storage device name in the columns beside the backplane slot and mass-storage space numbers.

2. Refer to table 4-1. Enter the +5v and +12v currents, power and I/O panel insert size for each module and mass-storage device.

3. The column totals must not exceed the limits listed at the bottom.

------------ADD THESE COLUMNS-----------

BACKPLANE SLOT		MODULE	CURRENT (amps) +5V	+12V	POWER (watts)	I/O PANEL INSERTS B (2X3)	A (1X4)
1	AB						
	CD						
2	AB						
	CD						
3	AB						
	CD						
4	AB						
	CD						
5	AB						
	CD						
6	AB						
	CD						
7	AB						
	CD						
8	AB						
	CD						
MASS STORAGE	1						
	2						
TOTAL THESE COLUMNS:			---	---	---	---	---
MUST NOT EXCEED:			36.0	7.0	230	4	2 *

* If more than 2 type A filter connectors are required, an adapter template (pn 74-27740-01) may be used. This will allow three additional type A filter connectors, but will reduce the available type B cutouts to 2.

4.1.5 Module CSR Addresses / 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 options that will be installed in the system.

2. If there is a F in the vector column, the device has a floating vector. Assign a vector to each option checked, starting at 300 and continuing in the following sequence:

   300, 310, 320, 330, 340, 350, 360, 370

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
TQK25	M7605	1		224	N72520
TQK50	M7546	1		260	N74500
KLESI-QA	M7740	1		154	N72150
RLV12	M8061	1		160	N74400
RQDX2	M8639	1		154	N72150

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

4.1.5.1 Floating CSR Addresses

Table 4-3 Floating CSR Addresses

* = 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 will not effect the addresses of devices above it.

Device	Substitute the numbers below for the nnn in 17760nnn								
DZQ/V 1				100	100	100	100	100	100
DZQ/V 2				* 110	* 110	110	* 110	110	* 110
DZQ/V 3				* 120		120		120	
DPV11	* 270	* 270	* 270		* 310	* 330	* 310	* 330	* 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

4.2 Configuration Examples

The BA23-A enclosure can be used for a variety of configurations. The following examples show typical base and advanced systems.

Table 4-4 shows the backplane set-up for a base system, which can be expanded at a later time.

Table 4-4 Base System

Mass storage device: RX50
RD52

Backplane slot#	Row A	Row B	Row C	Row D	I/O cutouts (standard I/O) (1X4) 2	I/O cutouts (standard I/O) (2X3) 4
1	KA630-AB (quad) cpu					1
2	M9047 grant card		Empty			
3	M9047 grant card		Empty			
4	DZV11 (quad) 4 line multiplexer					1
5	RQDX2 (quad) rd/rx controller					
6						
7						
8						
				total used :	0	2
				available :	2	2

The configuration shown in table 4-5 demonstrates the expandability of a MicroVAX system in the BA23-A enclosure. It includes the following features:

* 9 Mbytes of main memory
* 1 RD53 fixed-disk drive, providing 71 Mbytes of mass-storage
* 1 eight-line asynchronous multiplexer, providing ports for 8 terminals
* a DEQNA module to connect to Ethernet
* an LPV11 module for an LP25 printer
* a TK50-AA tape drive for system loading and backup

Table 4-5 Advanced System

Mass storage device: RD53
Backup device: TK50-AA

Backplane slot #	Backplane Row A B	Backplane Row C D	I/O cutouts (standard I/O) (1X4) 2	I/O cutouts (standard I/O) (2X3) 4
1	KA630-AA quad cpu, 1Mbyte mem. + FPP			1
2	MS630-BB (quad) 4 Mbyte memory			
3	MS630-BB (quad) 4 Mbyte memory			
4	LPV11 prt (dual)	DEQNA net (dual)	2	
5	DHV11 (quad) 8 line multiplexer			2
6	TQK50 cont (dual)	M9047 grant card		
7	RQDX2 (quad) rd/rx controller			
8				
		total used :	2	3
		available :	0	1

CHAPTER 5--DIAGNOSTICS

5.1 Introduction

This chapter performs two basic functions. It provides:

1. An overview of the diagnostic and maintenance tools available for use with the MicroVAX II.

2. A roadmap for the diagnosis and repair of failures.

5.2 KA630 Boot and Diagnostic ROM

The MicroVAX II boot and diagnostic ROM tests the basic functionality of the KA630 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 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 while each test is being run. 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 8 or less, on the console terminal. Table 5-1 also lists the probable field replaceable units (FRUs) for each particular nonzero value.

Table 5-1. LED Status and Error Messages.

LED	ERROR MESSAGE/PROBABLE FRU FAILURES
F	WAITING FOR DCOK 1. KA630-A module (does not recognize DC OK assertion) 2. Power supply (negating DC OK on bus) 3. A Q22-bus device (negating DC OK on bus) 4. Backplane (DC OK shorted to another signal) 5. Power supply cable (defective or not properly connected)
E	WAITING FOR POK 1. KA630-A module (does not recognize P OK assertion) 2. Power supply (negating P OK on bus) 3. A Q22-bus device (negating P OK on bus) 4. Backplane (P OK shorted to another signal)
D	RUNNING CHECKSUM TEST ON CPU ROM 1. KA630-A module
C	SEARCHING FOR RAM MEMORY REQUIRED FOR CPU ROM PROGRAMS 1. KA630-A module 2. MS630 module(s) 3. KA630-A/MS630 interconnect cable (short- or open circuited)
B	READ KA630-A IPCR REGISTER (accesses Q22-bus) 1. KA630-A module 2. A Q22-bus device (preventing the CPU from acquiring the bus) 3. Backplane (preventing the CPU from acquiring the bus)

A TESTING VCB01 VIDEO CONSOLE DISPLAY (if present)

1. Keyboard for VCB01 (defective or not connected)
2. Video display for VCB01 (defective or not connected)
3. VCB01 module
4. KA630-A module (can't read or write Q22 bus; may be shorting Q22-bus)
5. A Q22-bus device (preventing the CPU from acquiring the bus)
6. Backplane (preventing the CPU from acquiring the bus)
7. VCB01 distribution insert

9 IDENTIFYING CONSOLE TERMINAL

1. KA630-A module (if console does not respond within 6 seconds, CPU will proceed to 7)

8 LANGUAGE INQUIRY OR CPU HALTED

NOTE: When the LED is stopped at 8, the system is either: 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, it will time out and continue testing within 2 to 6 minutes.

NOTE: Before the console reaches 8, a heading should appear which 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, the following problems should be suspected:

1. KA630-A module (probably console interface)
2. Console cables (defective or not connected)
3. Console baud rate (mismatched)
4. Console terminal (powered off)
5. Console terminal (broken)
6. 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

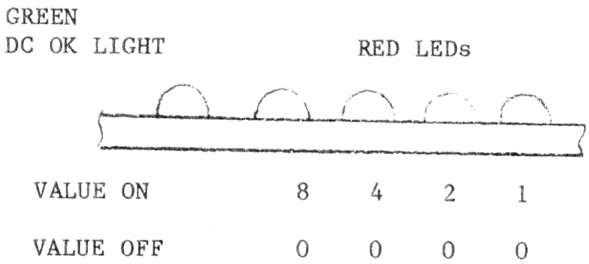
1. KA630-A module
2. Q22-bus device (preventing the CPU from acquiring the bus)
3. Backplane (preventing the CPU from acquiring the bus)

4 CPU INSTRUCTION AND REGISTER TESTS

1. KA630-A module

3	RUNNING INTERRUPT TESTS 1. KA630-A module 2. Q22-bus device (incorrectly requesting interrupt) 3. Backplane (Q22-bus BR line shorted)
2	SEARCHING FOR BOOTSTRAP DEVICE NOTE: Be sure to try the remedies in the <u>Troubleshooting</u> section of the Owner's Manual before exploring these possibilities. NOTE: Please 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. 1. RQDX controller, RD5n drive, RX50 drive, or interconnect cable defective or not properly connected. 2. TQK50 controller, TK50 drive, or interconnect cable defective or not properly connected. 3. MRV11D module 4. DEQNA module 5. KA630-A module
1	BOOTSTRAP DEVICE FOUND 1. Q22-bus bootstrap device 2. Signal cable to bootstrap device (defective or not connected) 3. Power cable to bootstrap device (defective or not connected) 4. KA630-A module
0	TESTING COMPLETED

Figure 5-1. LEDs on the KA630-A CPU module



The 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.

Console Terminal Error Messages

Error messages reported on the console terminal are formatted as shown in Figure 5-2.

```
1.   KA630-A.XX

2.   Performing normal system tests.

3.   7..

4.   ? <subtest>  <p1> <p2> <p3>

5.   Failure.
     Normal operation not possible.
```

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 rear I/O panel insert.

4. Indicates that the countdown sequence has been interrupted. Displays a diagnostic message which includes the question mark, a subtest code number and up to three parameters. A list of console error messages, and their explanations, is given in Appendix B.

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, and Tables 5-2 through 5-4 explaining the definitions of possible LED readings, and the likely field replaceable units (FRUs).

Figure 5-3 LED orientation on the DEQNA module

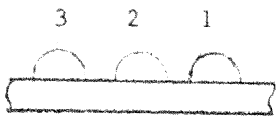


Table 5-2 DEQNA Module LED indications

LEDS			DEFINITION/FRU
3	2	1	
ON	ON	ON	Performing DEQNA Station Address PROM test 1. DEQNA module 2. KA630 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 (shorted, opened, or not connected) 3. Fuse in distribution insert
OFF	OFF	OFF		The DEQNA passed all power-up tests.

+---+

Figure 5-4 LED orientation on the RQDX2 module

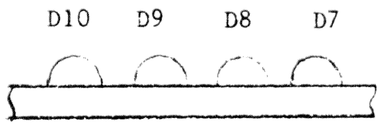


Table 5-3 RQDX2 Module LED Indications

LEDs				Definition/FRU
D10	D9	D8	D7	
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 TK50 module

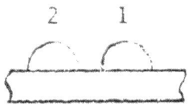


Table 5-4 TK50 Module LED Indications

LEDs 2	LEDs 1	Definition
ON THEN OFF	OFF	Module/drive interaction test fails 1. TQK50 module 2. TK50 drive 3. Interconnect cable
OFF	ON	TQK50 module failed power-up test 1. TQK50 module
OFF	OFF	Module power-up test and module/drive interaction tests both failed 1. TQK50 module 2. TK50 drive 3. Interconnect cable
ON THEN OFF	ON	Module and drive working properly

Several supported options for the MicroVAX II system have a single LED which indicates proper operation of that option. Those options include:

DRV11 (on indicates proper operation)
DHV11 (on indicates proper operation)

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 II 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 menu tree which provides access to the various functions on the MicroVAX Maintenance System.

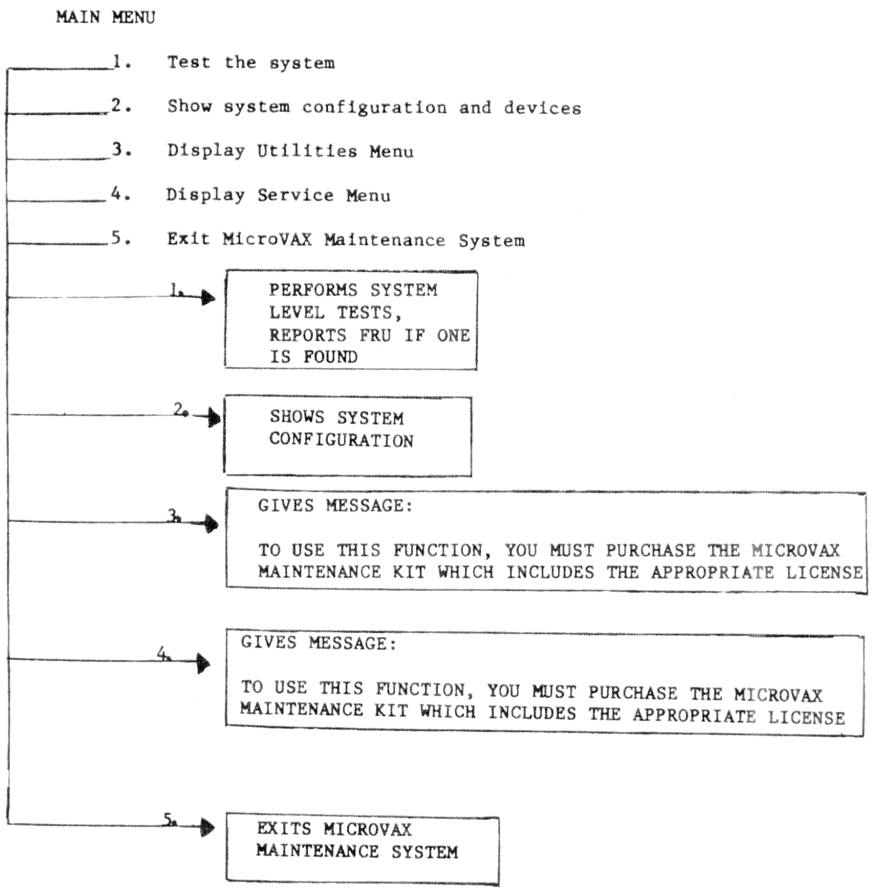


FIGURE 5-6. The Menu Tree for the MicroVAX Maintenance System.

5.4.1 Configuration Verification (menu item #1)

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.

5.4.2 System Tests (menu item #2)

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

5.5 Troubleshooting

When the MicroVAX II system or a supported option fails or exhibits erratic behavior, one of several tools may be used to help diagnose the problem. The primary tools used to troubleshoot the MicroVAX II system are:

--Front panel indicators and lights

--Power-up self-tests

--The MicroVAX II Owner's Manual

--The MicroVAX II System Technical Manual (this manual)

--MicroVAX Maintenance System--installation version

--The MicroVAX II 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 Owner's Manual.

Most problems exhibited by a MicroVAX II system will 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).

CPU problems

Memory problems

Mass storage problems

Communications problems

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 5-7 outlines the general procedure for troubleshooting the system when either an operating system or the MicroVAX Maintenance System fails to boot.

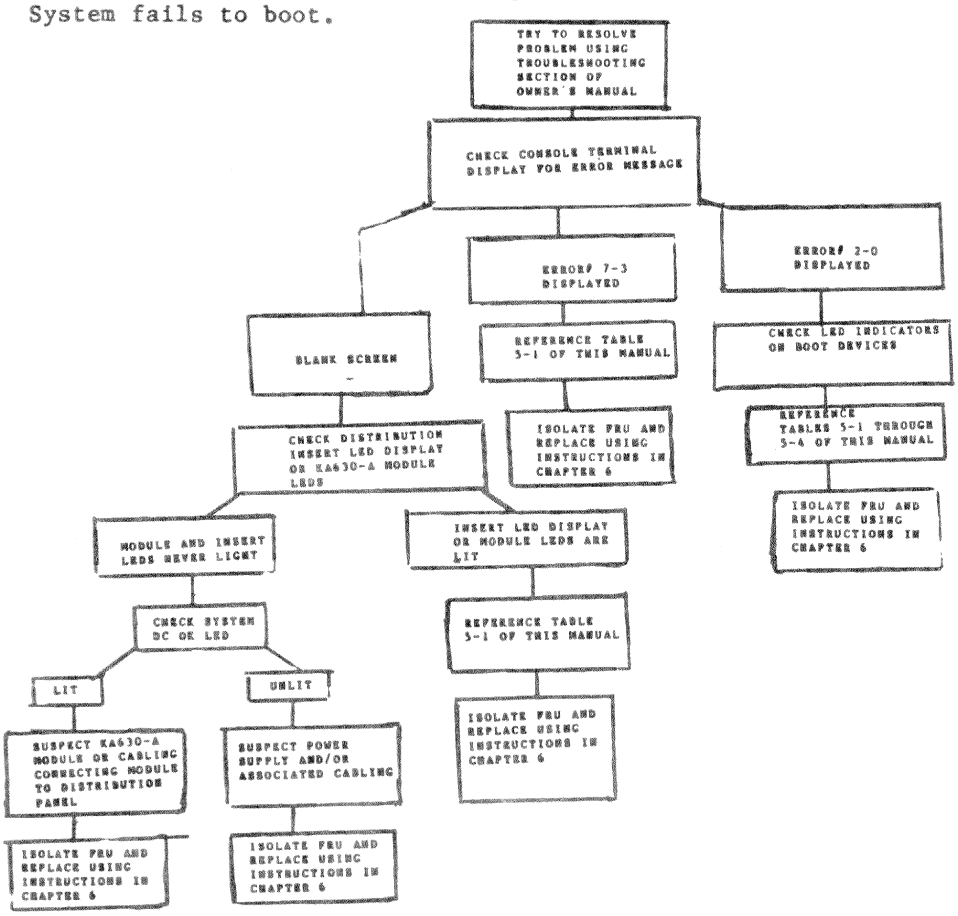


Figure 5-7. Troubleshooting flow for fail-to-boot problems.

1. Monitor the console terminal to determine where in the power-up self-test the system is failing. If the console remains blank, check the LED on the CPU I/O distribution insert, and consult Table 5.1 of this manual to determine the cause of the problem and the suspected FRU. If the LED also remains blank, check the front panel LED on the system, and continue as shown in Figure 5-4 to determine the cause of the problem and probable FRU.

   A. The LED has run through power-up tests--the I/O distribution insert may have been indavertently left in the loopback mode, causing the console to be bypassed.

   B. The LED has stopped at a value other than F--the console or the cable which connects the console to the I/O distribution panel is probably faulty.

   C. The LED also stops at a value of F--the CPU, the I/O distribution insert, or the cable which connects the insert to the CPU is probably faulty.

   D. The LED also remains blank--check the front panel on the system, and continue as shown in Figure 5-7 to determine the cause of the problem and the probable FRU.

2. If the console stops between 7 and 3, use the console information, combined with the information in Section 5.2 to determine the cause of the problem and the suspected FRU.

3. If the console stops between 2 and 0, use the console information and the LED indicators on individual module, combined with the information in Sections 5.2 and 5.3 to determine the cause of the problem and the suspected FRU.

5.5.2 Device-Specific Problems

Figure 5-8 outlines the general troubleshooting procedure when the system can boot the MicroVAX Maintenance System, but a problem with a specific device is suspected.

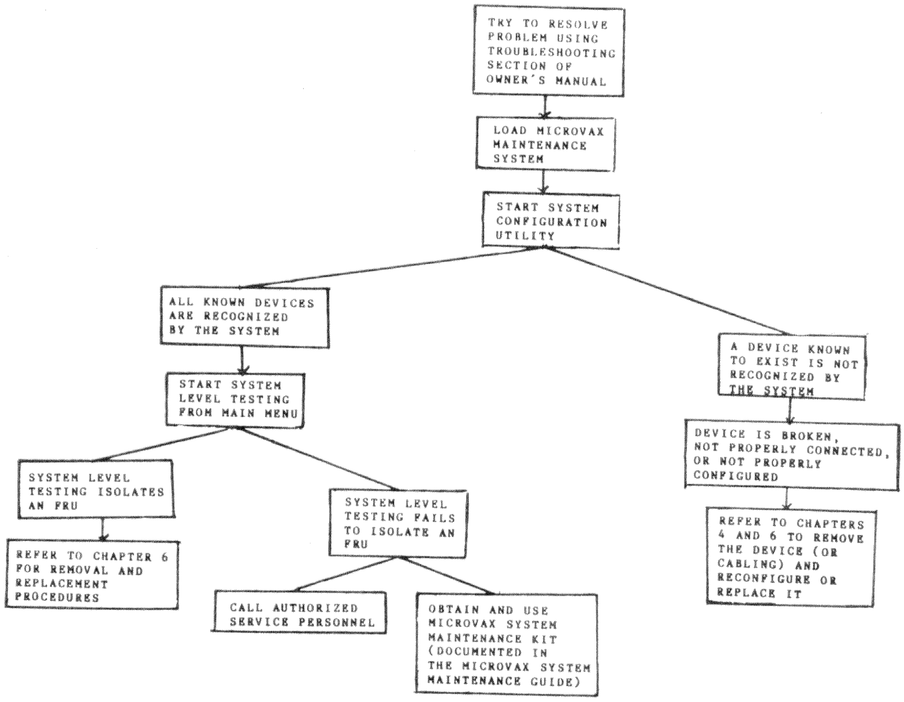


Figure 5-8. Troubleshooting flow for Device-Specific problems.

1. Boot the MicroVAX Maintenance System.

2. Run the configuration procedure available from the Main Menu. Check to make sure that all devices known to be in your system appear on the screen. If a device known to exist does not appear on the display:

   A. It is improperly connected or is broken--refer to Chapter 6 for removal and replacement information.

   B. It is configured to the wrong address--refer to Chapter 6 for removal and replacement information, and refer to Section 4.1.5 for configuration instructions.

3. Run the system level tests available from the Main Menu. After approximately 6 minutes or less, the screen should display the results of testing. Once the testing has begun, one of three cases should occur:

   A. The test locates a suspected FRU--refer to Chapter 6 of this manual for removal and installation of the FRU.

   B. The test fails, but does not locate a suspected FRU--look at device LEDs and refer to Section 5.3, contact authorized service personnel, or refer to the MicroVAX II System Maintenance Guide.

   C. The system passes but you still suspect a problem--look at device LEDs and refer to Section 5.3, contact authorized service personnel, or refer to the MicroVAX II System Maintenance Guide.

CHAPTER 6--FRU REMOVAL AND REPLACEMENT PROCEDURES

6.1 INTRODUCTION

This chapter describes the removal and replacement procedures for the field replacable units (FRUs) in the BA23 enclosure. Figure 6-1 shows the major FRUs as seen from the front of the enclosure. Table 6-1 provides a list of the FRUs and their part numbers.

CAUTION
Static electricity can damage integrated circuits contained on modules installed in the BA23 enclosure and in mass storage devices. Always use a grounded wrist strap (29-11762-00) and grounded work surface when you access any internal part of your microcomputer system.

NOTE
Only qualified service technicians should perform any of these removal and replacement procedures.

Table 6-1 Field Replacable Units

Component	Order Part Number
H7864-A Power supply	30-21749-01
Power supply ac power cable with ac switch	70-20434-01
System dc fan (rear)	12-17556-01
System dc fan (front)	12-17556-01
Dc fan power cable	70-20449-00
Backplane assembly	70-19986-00
Q22-bus backplane	H9278-A
Signal distribution panel	54-15633-00
Backplane dc power cord	70-20450-01
Diskette drive	RX50-AA**
RX/RD power cable	70-20435-1K
RD51 fixed disk drive	RD51-AA**
RD52 fixed disk drive RD52-AA**	30-21721-02**
or	30-23227-02**
RD53 fixed disk drive	RD53-AA**

Table 6-1 Field Replacable Units

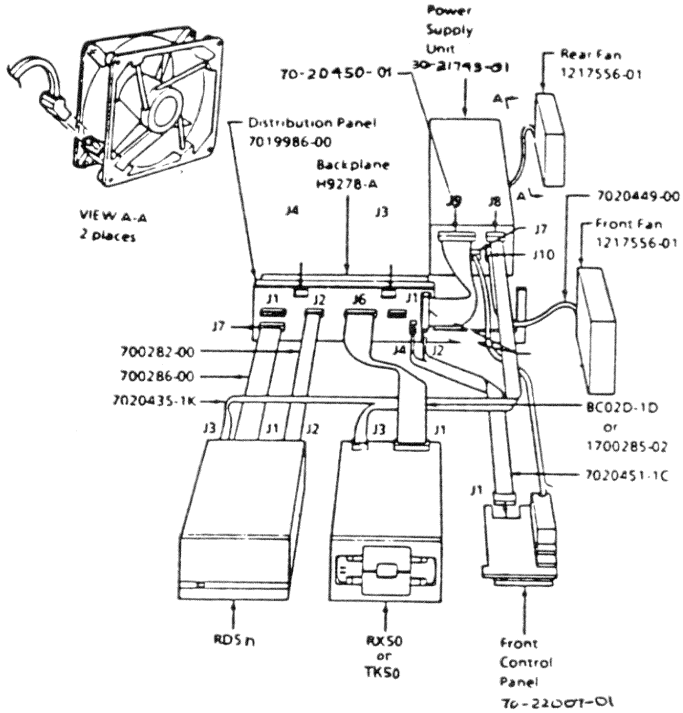
Component	Order Part Number
RD51 read/write printed circuit board	29-24665-00
RD52 main printed circuit board	29-24992-00
RD53 device electronics printed circuit board	29-25339-00
RD51 dip shunt	29-24115-00
RX50 signal cable	17-00285-02
RD5n signal cable (20 wire)	17-00282-00
RD5n signal cable (34 wire)	17-00286-00
Front Control panel	70-22007-01
Control panel cable	70-20451-1C
Patch and filter assembly	70-19979-00
630QA patch panel	54-17644-01
SLU cable 10 pin	17-00624-01
LED cable 20 pin	17-00712-02
Adaptor plate	74-28684-01
I/O distribution panel	70-19979-0
Front Bezel (rack mount)	74-29501-01
Front Bezel (floor/table)	74-29559-0
Rear Bezel	74-27560-0
Pedestal (floor)	74-27012-0
Enclosure plastic skins	70-20469-01
Rack mount kit	70-22025-01
Chassis support kit	70-20761-01
Loopback connectors	12-15336-00
KA630-AA CPU module	M7606-AA
KA630-AB CPU module	M7606-BA
MS630-AA memory module (1 MB)	M7607-AA
MS630-BA memory module (2 MB)	M7608-AA
MS630-BB memory module (4 MB)	M7608-BA
DZQ11	M3106
DZV11	M7957
DZV11 cabinet kit	CK-DZV11-DB
DLVJ1	M8043
DLVJ1 cabinet kit	CK-DLVJ1-LB
DEQNA	M7504
DEQNA cabinet kit	CK-DEQNA-KB
RQDX2	M8639-YA

TK50 drive	TK50-A
TQK50 controller	M7546
TK50/TQK50 interconnect cable	70-22300-01
Grant card	M9047

* A replacement power supply must have the same part number as the power supply you removed.

** If you are adding one of these drives to a previously diskless system, you need to use the RX50Q-AA, RD51Q-AA, RD52Q-AA, or RD53Q-AA options. These options contain the drive and the signal cables.

figure 6-1 BA23 enclosure FRUs



This chapter presents FRU procedures from the front to the rear of the enclosure.

NOTE
Unless otherwise specified, replace FRUs by reversing the order of the removal procedures.

6.2 CONTROL PANEL REMOVAL

Use the following procedure to remove the control panel (Figure 6-2).

1. Unplug the ac power cord from the wall socket.

2. Remove the front plastic cover by holding each end and pulling the cover away from the system

3. Remove the front chassis retaining bracket.

4. Push the subsystem forward.

5. Remove the subsystem storage cover.

6. Remove the four screws retaining the control panel assemply.

7. Disconnect the Berg connector from the control panel.

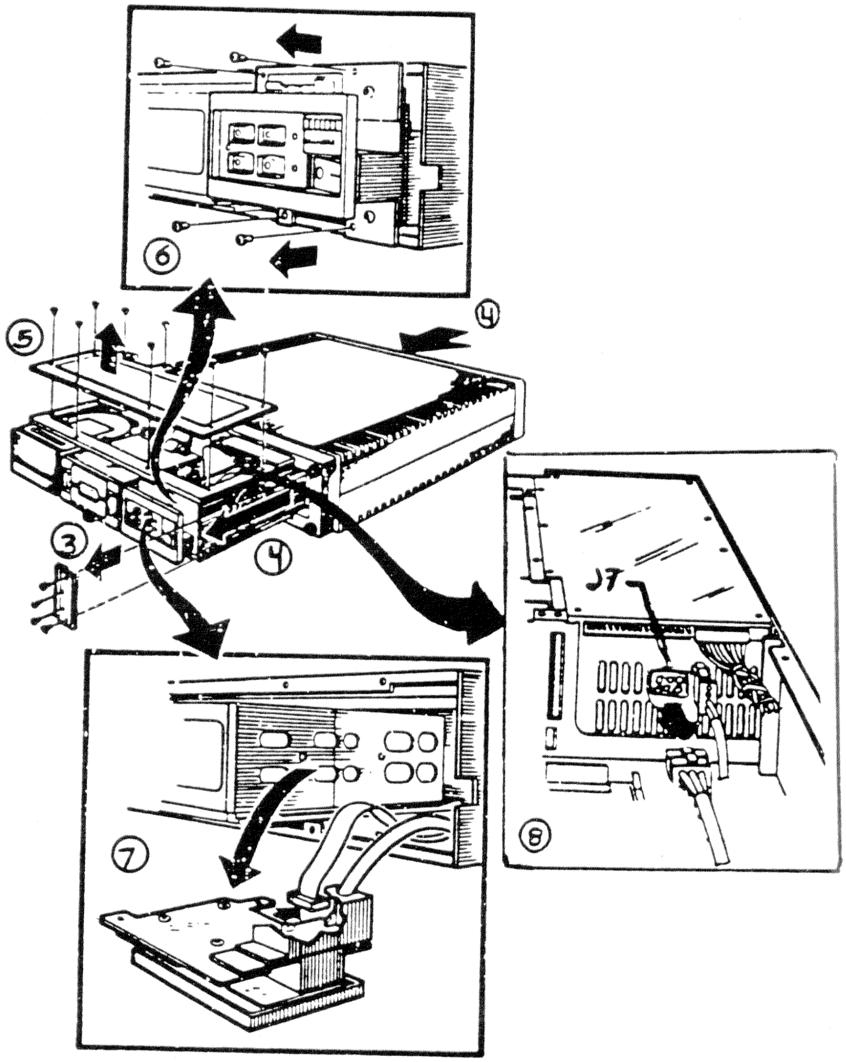
8. Remove the power supply connector from J7 on the power supply.

TO INSTALL A REPLACEMENT CONTROL PANEL

1. Reverse steps 1 through 8.

2. Make sure the LTC switch and the Restart enable switch on the Control panel printed circuit board are in the out position.

Figure 6-2 Remove the Control Panel



6.3 RX50/TK50 DRIVE REMOVAL (RX50 SHOWN)

Use the following procedures to remove the RX50 diskette (TK50 tape) drive (Figure 6-3).

NOTE
The diskette and tape drives are single field replaceable unit (FRUs). Do not disassemble the them or remove any of the printed circuit boards. All adjustments must be made in a special test configuration.

NOTE
Only use formatted RX50K diskette available from Digital and its liscensed distributors.

1. Remove both covers and the ac power cord.

2. Remove the front chassis retaining bracket.

3. Push the subsystem forward.

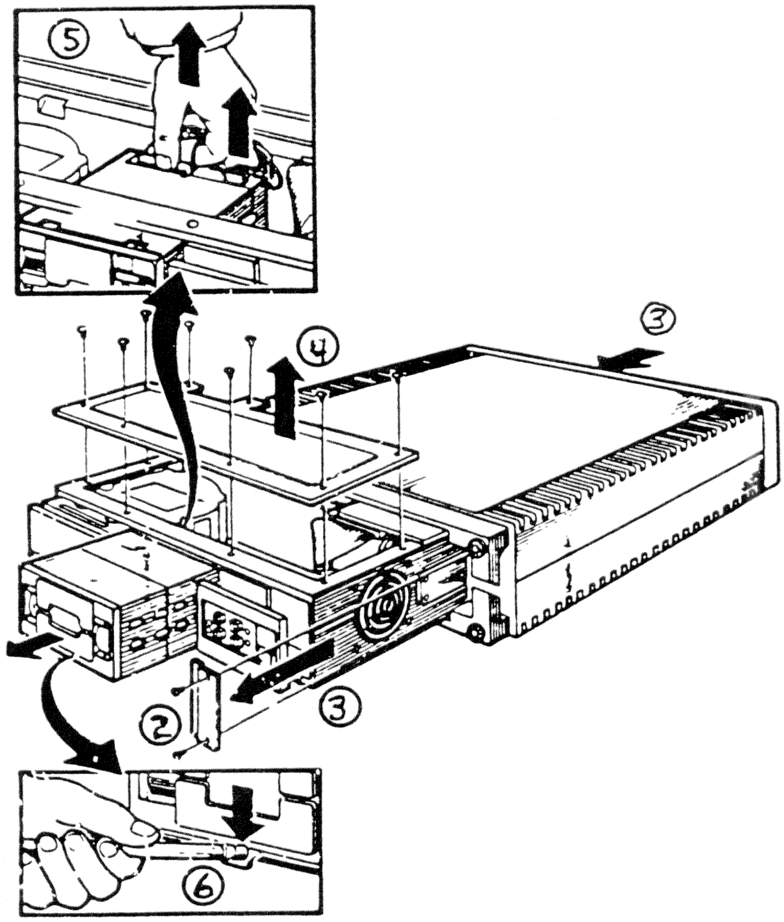
4. Remove the subsystem storage cover.

5. Disconnect the signal cable and the dc power cable from the diskette drive by pulling straight up on the connectors.

6. Push down on the release tab, slide the drive forward and remove.

NOTE
Remove the cardboard shipping insert from a newly installed RX50 diskette drive.

Figure 6-3   RX50/TK50 Drive Removal (RX50 shown)



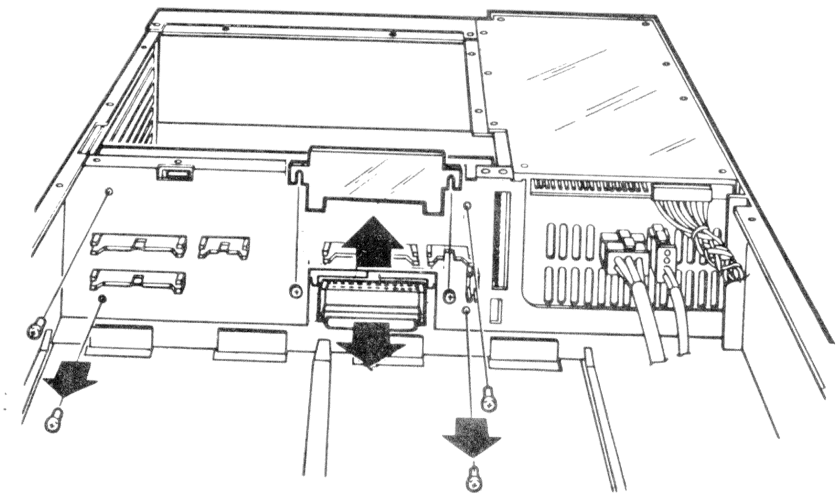
6.3.1 TK50/TQK50 INTERCONNECT CABLE REMOVAL AND INSTALLATION

The TK50 tape drive is connected to its TQK50 controller module via an interconnect cable which runs through the trap door on the signal distribution panel, and underneath the modules in the card cage. Once you have removed the TK50 drive from the BA23 enclosure, use the following procedure to remove the interconnect cable.

1. Release the interconnect cable from the wire tie which holds it to the trap door on the signal distribution panel.

2. Remove the two screws which attach the trap door to the signal distribution panel, and remove the door.

Figure 6-4 Trap Door Removal



3. Disconnect the RQDX controller cable (also present behind the trap door) and move it to the side to provide working room.

4. Go to the rear of the BA23 enclosure and remove the module in slot 8 (the bottom slot) of the backplane (see Section 6.9).

5. From the back of the enclosure, pull the TK50/TQK50 interconnect cable through the signal distribution panel, backplane, and card cage.

   NOTE: When replacing the interconnect cable, be sure to observe the "THIS SIDE UP" marking on the cable. As a check, the striped side of the cable should be nearest the front fan of the enclosure.

   NOTE: When replacing the cable, it is easiest to push the cable from through from the front of the enclosure to the back, rather than from back to front.

   NOTE: When installing a TK50 in a BA23 enclosure which has not previously contained a TK50 drive, make sure to also install the **New** trap door shipped with the TK50. **Do not** try to use the trap door which originally came with the system.

6.4 RD5n FIXED DISK DRIVE REMOVAL

Use the following procedure to remove an RD5n fixed disk drive (Figure 6-5):

> CAUTION: Handle any fixed disk drive with care. Dropping or bumping the drive can damage the disk surface.
>
> NOTE: Package any disk drive to be returned in the replacement disk drive's shipping carton. If the shipping carton is not available, one may be ordered (Digital Part No. 99-90045-01).
>
> NOTE: You must format a newly installed RD5n disk drive before testing the system and using the drive.

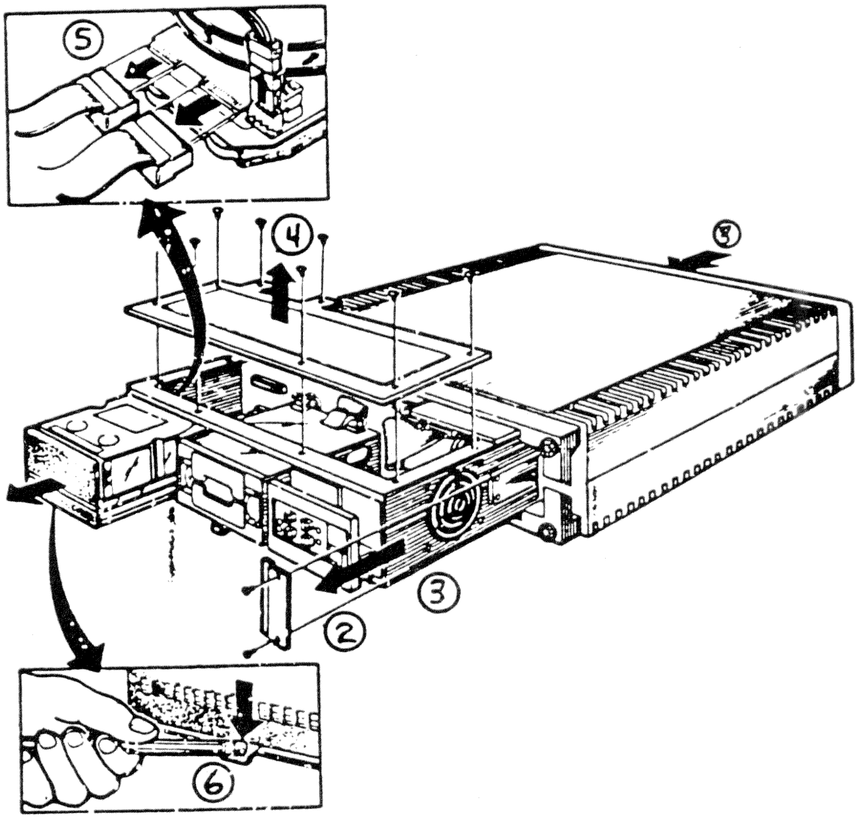
1. Remove both covers and the ac power cord.
2. Removed the front chassis retaining bracket.
3. Push the subsystem forward.
4. Remove the subsystem storage cover.

> CAUTION
> The RD51 fixed disk drive has an exposed head positioner flag on the front right side. DO NOT touch this area. Doing so can cause the head positioner flag to rotate, resulting in damage to the drive.
>
> NOTE
> An RD52 disk drive does not have an exposed head positioner flag.

5. Remove the power plug and two ribbon cables from the RD5n drive.

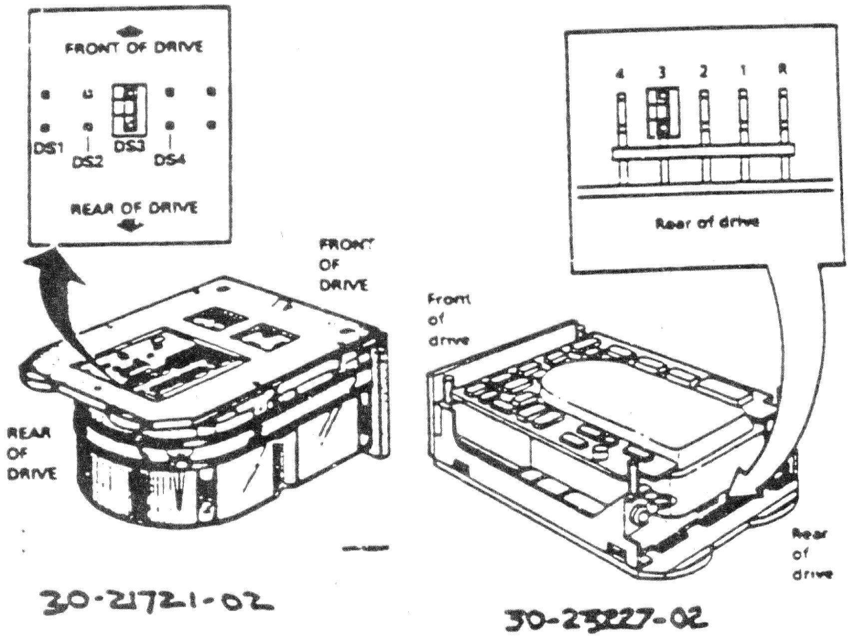
6. Push down on the release tab, slide the RD5n disk drive forward and remove.

Figure 6-5   RD5n Removal (RD51 Disk Drive Shown)



NOTE: To configure an RD5n drive as DUO or DUAO, make sure the jumper clip is set at DS3 (figure 6-6).

Figure 6-6 Set the RD52 Jumper Clip



NOTE
Only format a fixed disk drive when you replace a complete RD5n drive assembly. Refer to Appendix C for instructions.

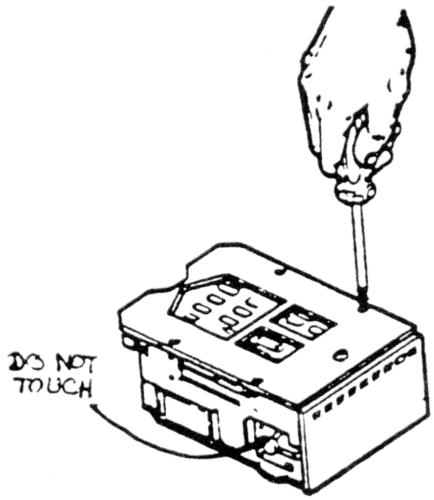
Write-protect any other RD5n disk drives that may be present before you format a newly installed RD5n disk drive. Remember to write enable these additional RD5n disk drives when formatting of the new RD5n disk drive is complete.

6.4.1 RD51 DISK DRIVE READ/WRITE BOARD REMOVAL

The RD51 read/write board is the only part of an RD51 drive that is replacable. Always try replacing the read/write board before you replace an entire RD51 disk drive.

1. Remove the four phillips screws retaining the skid plate. Set the skid plate aside (Figure 6-7)

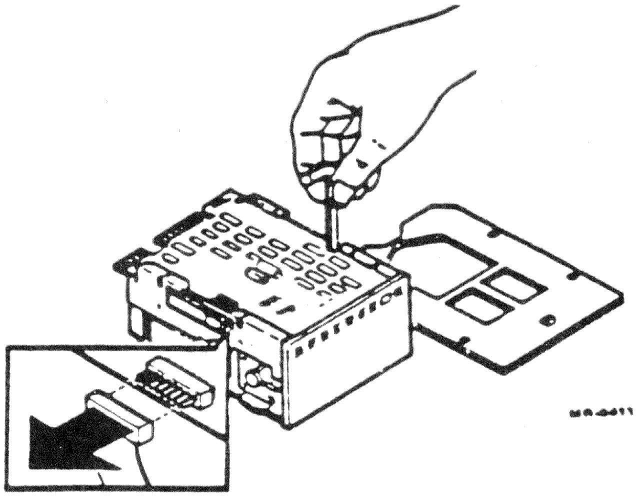
Figure 6-7 RD51 Disk Drive Skid Plate Removal



2. Using a 3/32-inch allen wrench, remove the four screws that hold the read/write printed circuit board to the fixed disk drive (Figure 6-8).

3. Disconnect connector P5 from the side of the board.

Figure 6-8 RD51 disk drive allen screws and connector P5 removal.

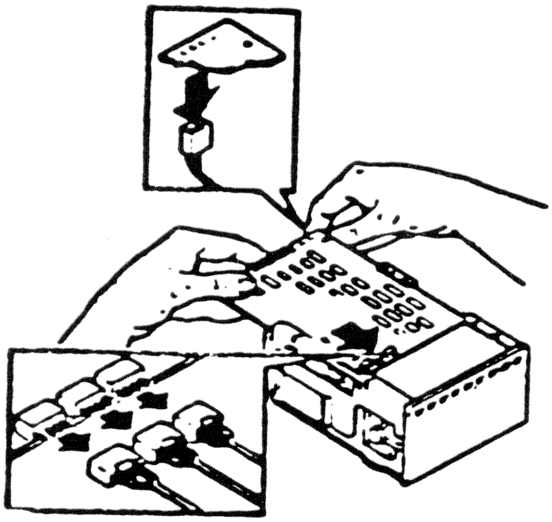


4. Disconnect connectors P6, P7 and P8 from the front of the read/write printed circuit board (Figure 6-9).

5. Disconnect connector P4, a 2 wire connector found on the rear of the read/write printed circuit board next to the dc power connector.

6. Remove the fixed disk drive read/write board.

Figure 6-9   RD51 Disk Drive Connectors P6, P7, P8, and P4



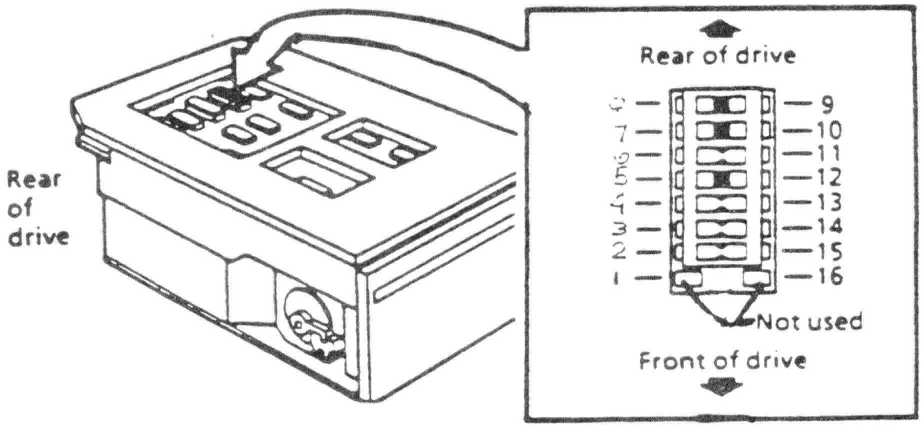
7. Make sure the jumper configuration of the 14-pin DIP shunt pack matches the listing in Table 6-2.

Table 6-2 RD51 Jumper Configuration

Pin Numbers	Pin Connection
1 to 16	Not used*
2 to 15	In
3 to 14	In
4 to 13	In
5 to 12	Out
6 to 11	In
7 to 10	Out
8 to 9	Out

* Place the 14-pin DIP jumper pack in the rear 14 receptacles of the 16-pin socket (Figure 6-10).

Figure 6-10 DIP Shunt Pack Setting



NOTE
You do not need to format an RD51 disk drive when you only replace the read/write board.

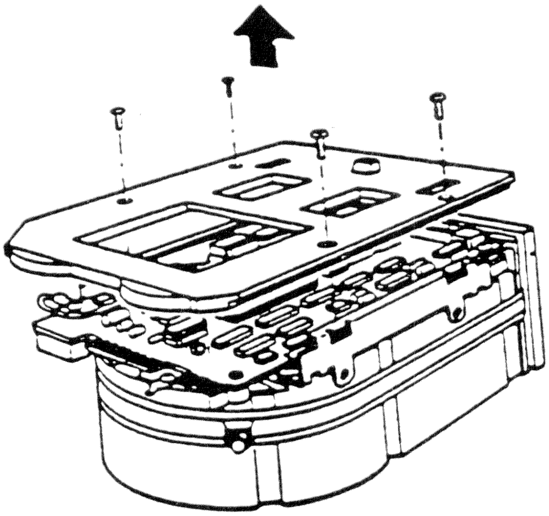
6.4.2 RD52 MAIN PRINTED CIRCUIT BOARD REMOVAL

NOTE
Replace the main printed circuit board (MPCB) only on RD52 disk drives with a drive part number of 30-21721-02.

NOTE
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 6-11).

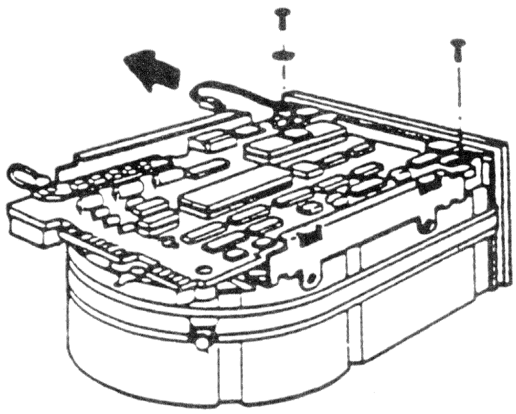
Figure 6-11 Remove the Slide Plate



2. Unplug the 2-pin connector (Figure 6-12).

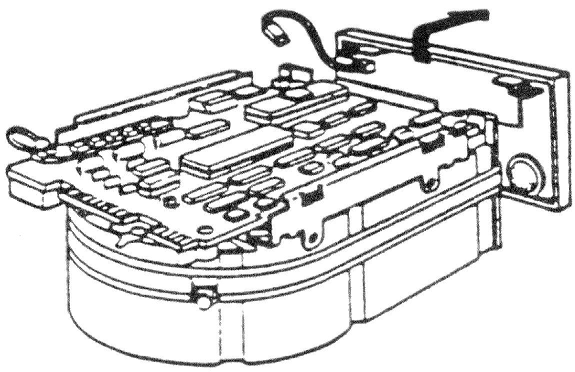
3. Remove the two Phillips screws that attach the front bezel to the drive.

Figure 6-12 Remove the 2-pin Connector and Screws



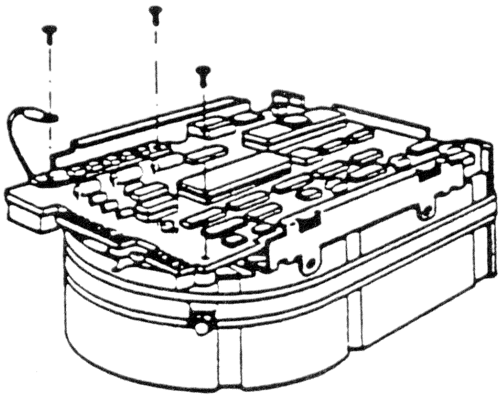
4. Remove the front bezel by pulling it away from the drive. The bezel is held in place with pop fasteners (Figure 6-13).

Figure 6-13 Remove the Front Bezel



5. Remove the three Phillips screws from the heatsink, grounding strip, and the corner opposite the heatsink (Figure 6-14).

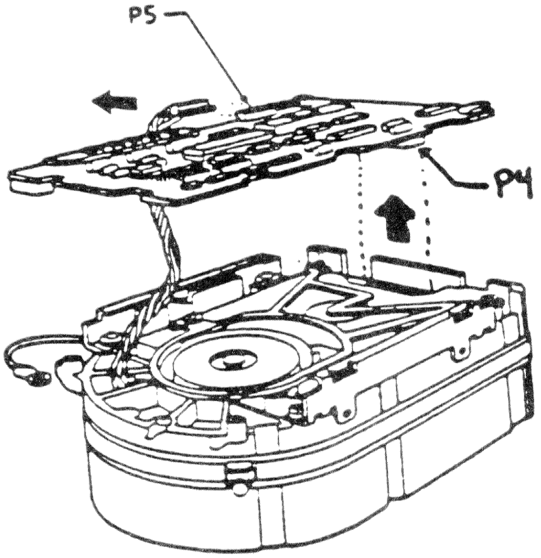
Figure 6-14 Remove Phillips Screws from Heatsink



6. Lift the MPCB straight up until it clears the chassis. This disconnects P4, a 12 pin fixed plug (Figure 6-15).

7. Disconnect P5, a 10-pin connector.

Figure 6-15 Remove the MPCB



6.4.3 RD53 DISK DRIVE DEVICE ELECTRONICS BOARD REMOVAL

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

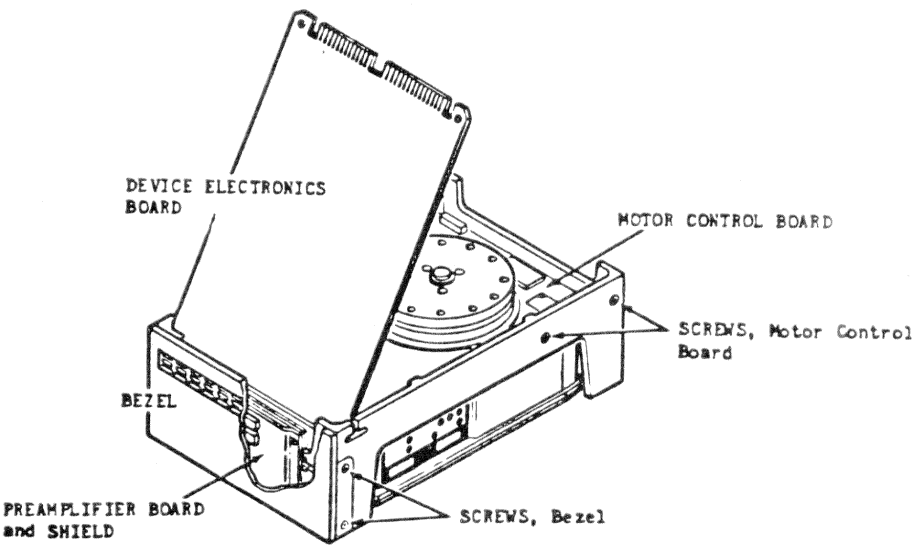
1. Remove the four phillips screws retaining the slide plate and ground clip. Set the plate aside (figure 6-16).

2. Loosen the two captive screws which hold the device electronics 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.

Figure 6-16 RD53 Device Electronics Board Removal



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.

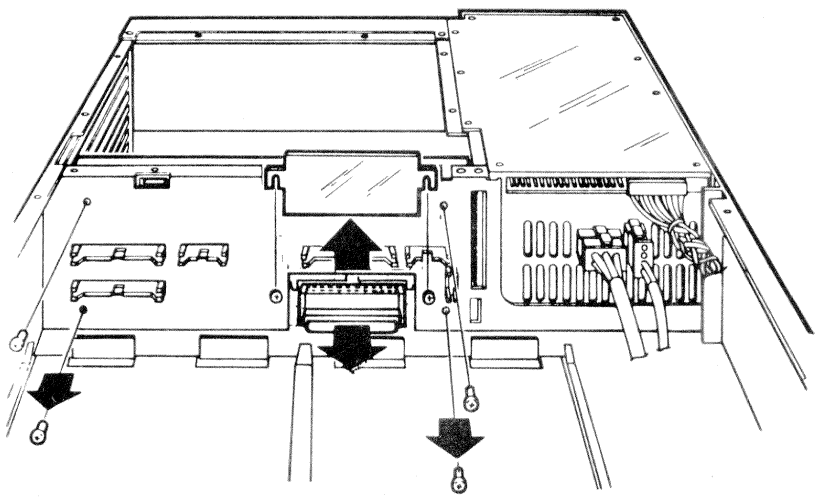
6.4.4 RD5N/RQDX INTERCONNECT CABLE REMOVAL AND INSTALLATION

RD5N and RX50 drives are connected to the signal distribution panel, which is in turn connected to the RQDX controller module via an interconnect cable which runs from the signal ditribution panel underneath the modules in the card cage to the back of the RQDX module. Once you have removed the drives from the BA23 enclosure, use the following procedure to remove the interconnect cable.

1. Release the TK50 interconnect cable (if present) from the wire tie which holds it to the trap door on the signal distribution panel.

2. Remove the two screws which attach the trap door to the signal distribution panel, and remove the door (figure 6-17).

Figure 6-17 Trap Door Removal (non-TK50 model shown)



3. Disconnect the TK50 controller cable (which may also be present behind the trap door) and move it to the side to provide working room.

4. Disconnect the RD5n/RQDX interconnect cable from the connector which was exposed by removing the trap door.

5. Go to the rear of the BA23 enclosure and remove the module in slot 8 (the bottom slot) of the backplane (see Section 6.9).

6. From the back of the enclosure, pull the RD5n/RQDX interconnect cable through the signal distribution panel, backplane, and card cage.

   NOTE: You may also have to remove the TK50/TQK50 cable to get the RD5n/RQDX cable out.

   NOTE: When replacing the cable, it is easiest to push the cable from through from the front of the enclosure to the back, rather than from back to front.

   NOTE: When replacing the TK50/TQK50 interconnect cable, be sure to observe the "THIS SIDE UP" marking on the cable. As a check, the striped side of the cable should be nearest the front fan of the enclosure.

6.5 BACKPLANE ASSEMBLY REMOVAL

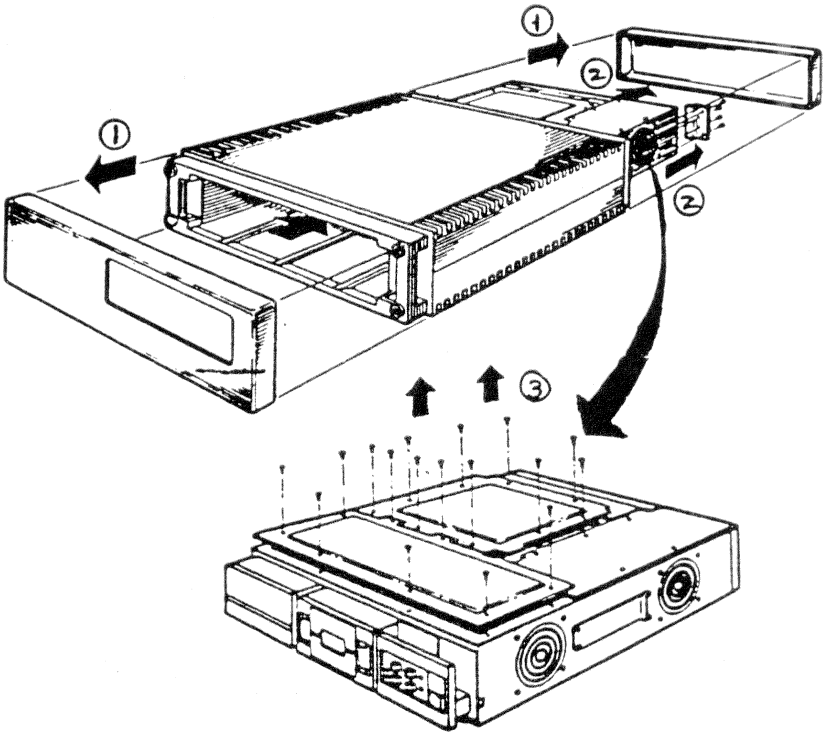
Use this procedure to remove the backplane assembly.

1. Remove the front and rear covers and all cables. Label them for reinstallation later.

2. Remove the rear retaining bracket and slide the subsystem completely out through the back.

3. Remove both the subsystem storage cover and the Q22-bus module cover (Figure 6-18).

Figure 6-18 Backplane Removal (1 of 4)



4. Open the rear I/O panel assembly by loosening the two captive screws, disconnect any cables attached to the I/O panel. Label them for reinstallation later. Note the orientation of the red stripe on any cables you remove.

5. Remove all modules (Figure 6-19) Refer to 6.9 for instructions.

   NOTE: Document the location of each module as it is being removed to help ensure correct reinstallation.

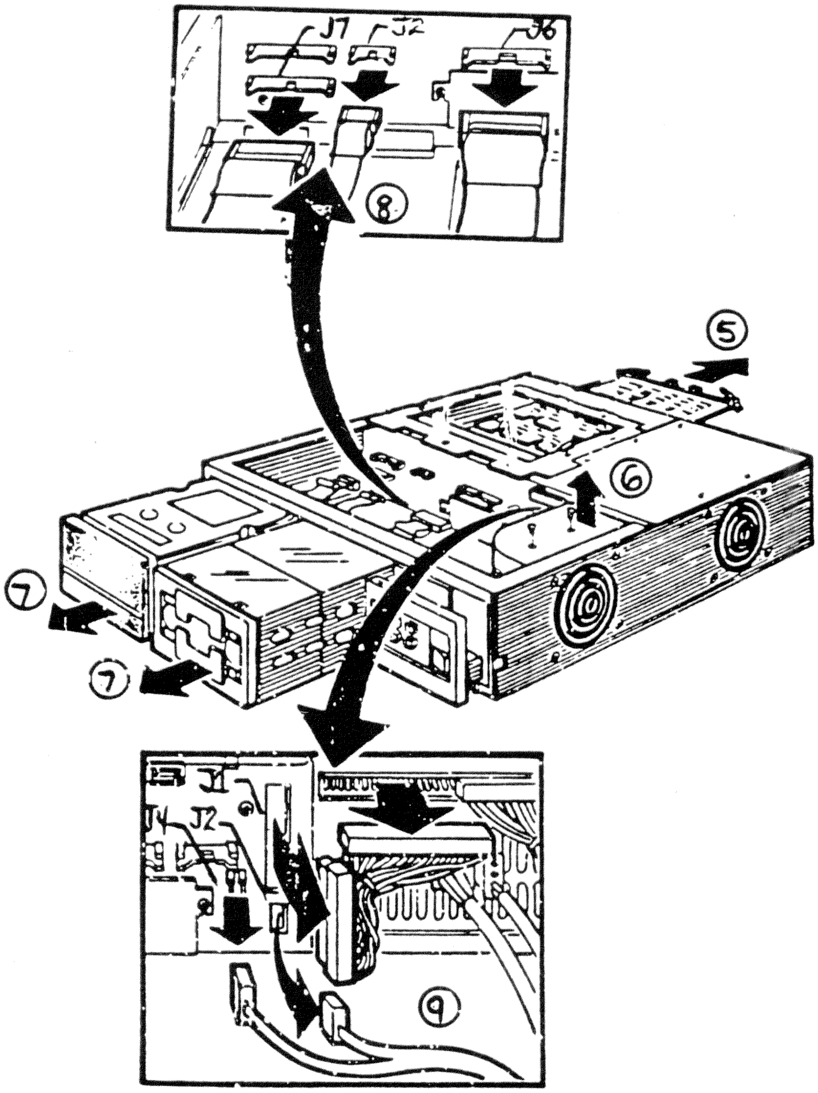
6. Remove the cowling (if present) from the front fan.

7. Remove any RX50 and RD5n disk drives that may present (see 6.3 and 6.4).

8. Remove the RX50 and RD5n disk drive signal cables from J6, J2 and J7 on the signal distribution panel.

9. Remove all power supply connectors and front control panel connectors from J1, J4 and J2 on the signal distribution panel and from J9 on the power supply.

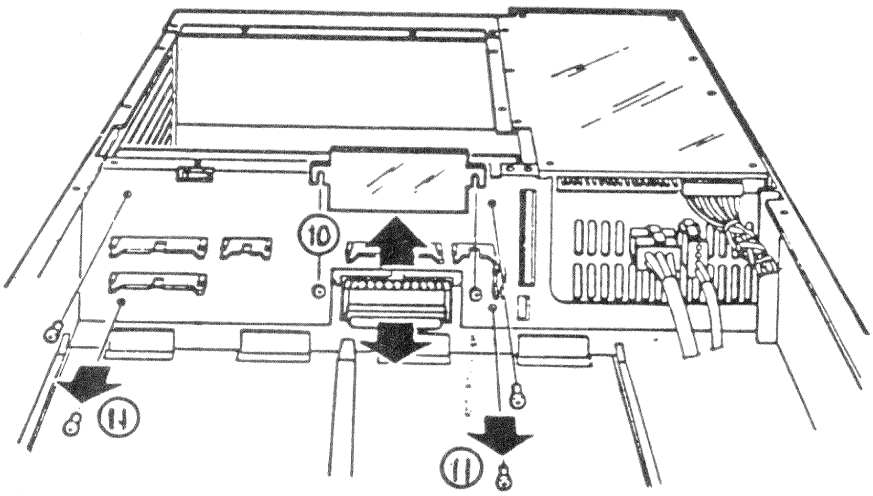
Figure 6-19   Backplane Removal Removal (2 of 4)



10. Loosen the two screws retaining the small access cover. Remove the cover and disconnect the cable from side two of the backplane (Figure 6-20)

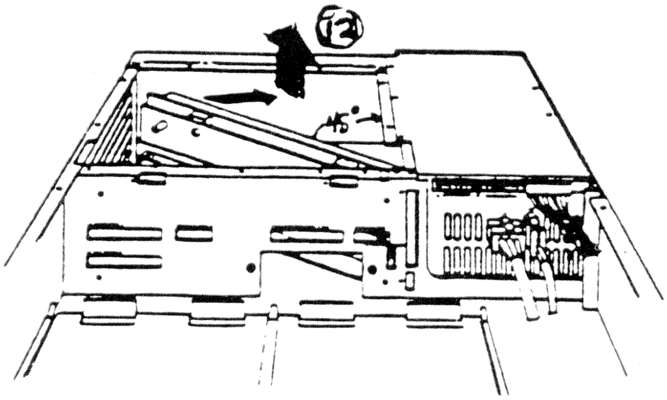
11. Remove the four screws holding the backplane assembly to the chassis.

Figure 6-20 Backplane Removal (3 of 4)



12. Pivot the CD side of the backplane assembly 45 degrees toward the rear and lift it straight up (figure 6-21).

Figure 6-21 Backplane Removal (4 of 4)



6.6 POWER SUPPLY (H7864-A) REMOVAL

Use the following procedure to remove the power supply (Figure 6-22).

NOTE
The H7864-A power suupply is not adjustable, nor does it contain replaceable printed circuit boards. The +5 Vdc and +12 Vdc regulators are fixed. Voltage tolerance is +5.1 Vdc (+/- 2.5%) for the +5 Vdc regulator, and +12.1 Vdc (+/- 2.5%) for the +12 Vdc regulator. Ripple is 50 mV peak to peak at +5 Vdc, and 75 mV peak to peak at +12 Vdc.

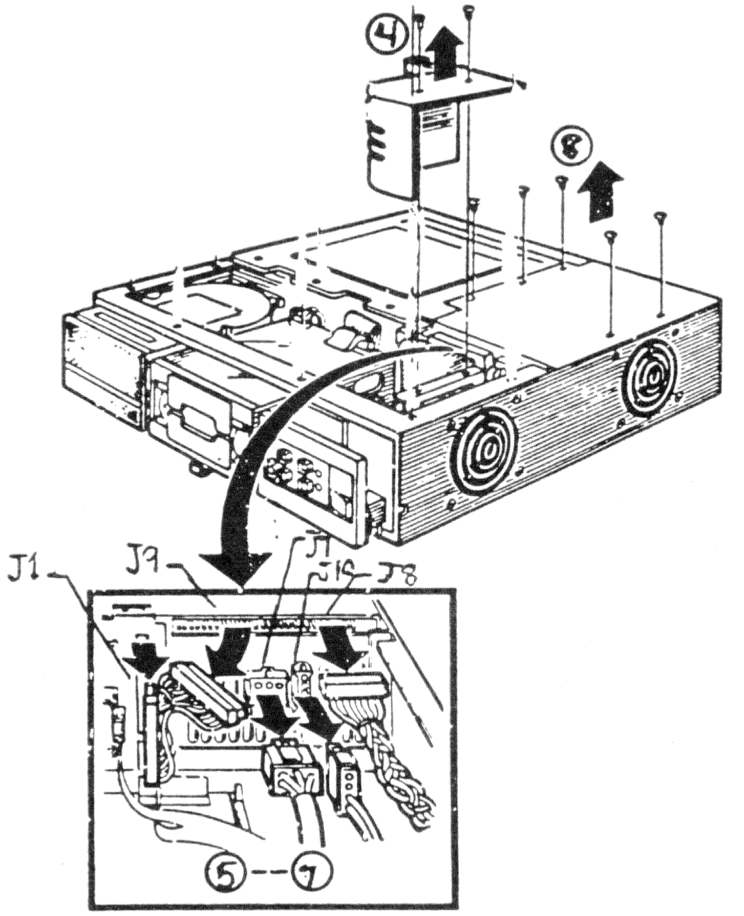
1. Remove the front and rear covers and all cables.

2. Remove the rear chassis retaining bracket and slide the subsystem completely out through the back.

3. Remove the subsystem storage cover.

4. Remove the fan cowling and cowling holder (if present).

Figure 6-22 Power Supply Removal



5. Disconnect the backplane power connector from J9 on the power supply and J1 on the signal distribution panel.

6. Disconnect the mass storage power connector from J8.

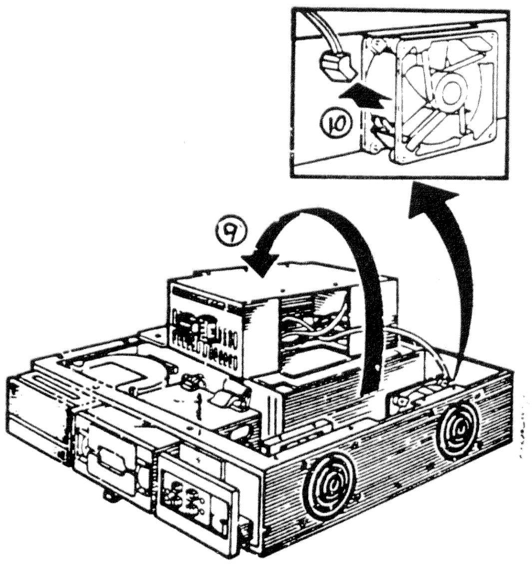
7. Disconnect the front fan power connector, and the front control panel power connector, from J10 and J7. These connectors are keyed and have a locking assembly.

8. Remove the five screws holding the power supply to the chassis.

9. Lift the power supply assembly out of the chassis and rest it on top of the Q22 bus modules cover (Figure 6-23).

10. Disconnect the power connector from the rear cooling fan.

Figure 6-23 Remove Power Supply and Fan Connector

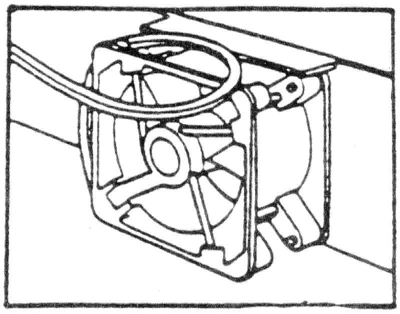


TO INSTALL A REPLACEMENT POWER SUPPLY

1. Place the replacement power supply on top of the Q22 bus module cover and connect the rear fan power cable.

CAUTION
The rear fan power cable is not keyed. Observe the polarity of the connector. The curve of the connector must match the curve of the fan housing (Figure 6-24).

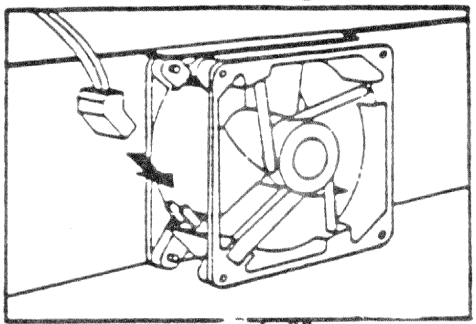
Figure 6-24 Install Rear Fan Power Cable



2. Place the power supply in position. Make sure you route the rear fan cable over the top of the rear fan (Figure 6-25).

3. Reverse steps 1 through 8 of the removal procedure to finish installing the power supply.

Figure 6-25 Rear Cooling Fan Power Cable Position



6.7 REAR COOLING FAN REMOVAL

Use the following procedure to remove the rear cooling fan (Figure 6-26).

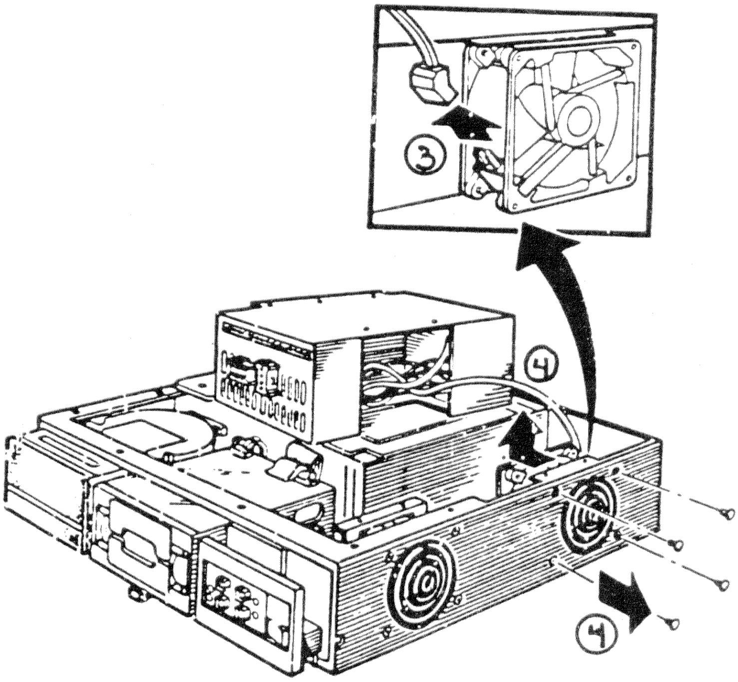
1. Remove the front and rear covers and all cables.

2. Remove the rear retaining bracket and remove the subsystem from the enclosure.

3. Remove the power supply unit and disconnect the rear fan power connector (refer to section 6.6).

4. Remove the four screws and spacers that hold the fan to the chassis and remove the fan.

Figure 6-26 Remove the Fan from the Chassis



TO INSTALL A REAR REPLACEMENT FAN.

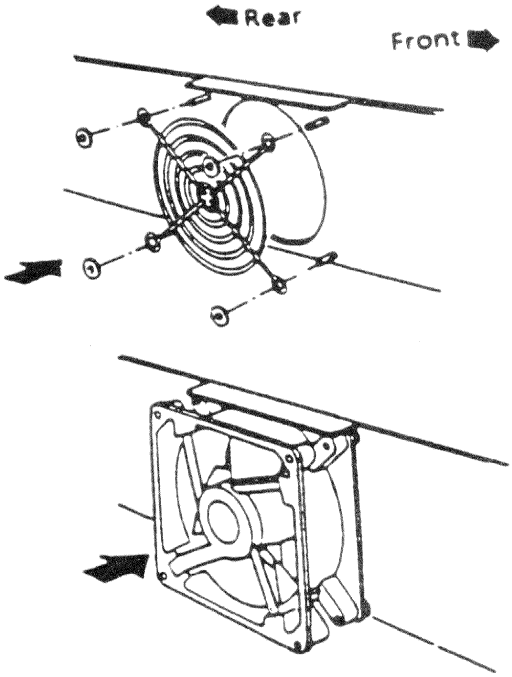
1. Relocate the four screws and place the fan guard on the screws. Make sure the cross members of the fan guard face the inside of the unit (figure 6-27).

2. Place the spacers on the screws and secure the fan. Make sure the fan is oriented as shown. The airflow must be away from the power supply.

3. Reverse steps 1 through 3 of the removal procedure.

CAUTION
The rear fan power cable is not keyed. Observe the polarity of the connector. The curve of the connector must match the curve of the fan housing as shown in Figure 6-24.

Figure 6-27 Install the Rear Fan.



6.8 FRONT FAN REMOVAL

Use the following procedure to remove the front fan (Figure 6-28).

1. Disconnect the ac power cable and remove the front cover.

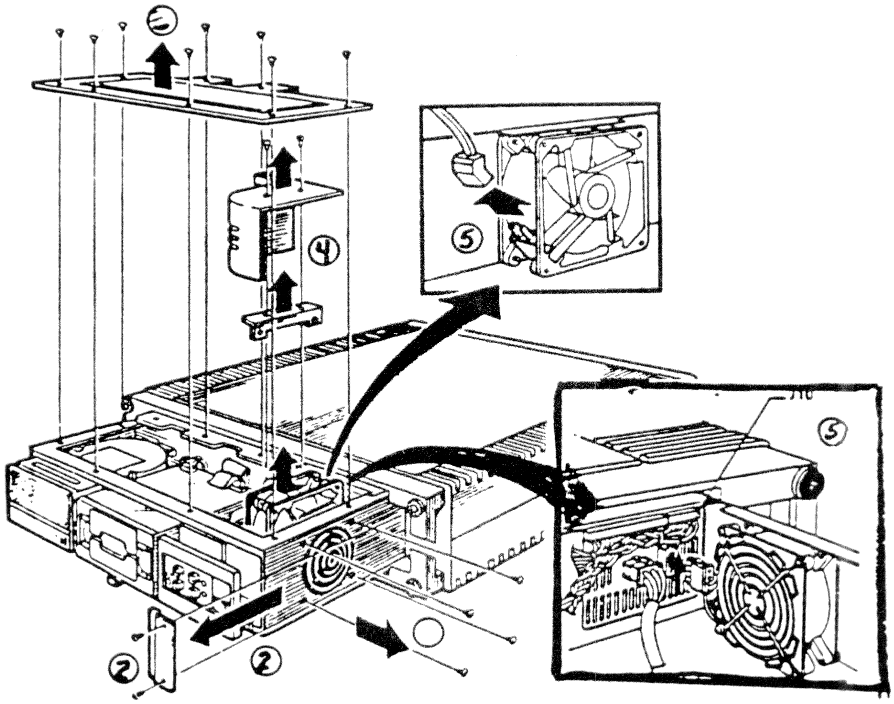
2. Remove the front retaining brack and push the subsystem forward.

3. Remove the subsystem storage cover.

4. Remove the front fan cowling (if present).

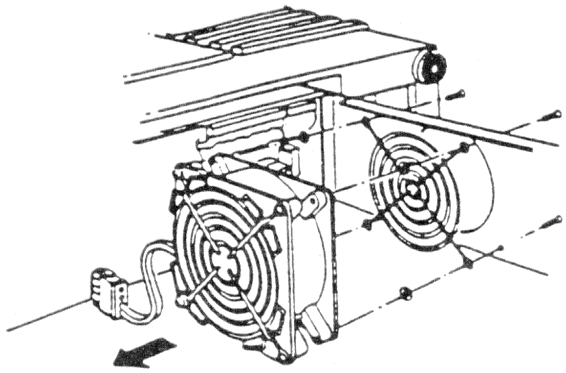
5. Disconnect the front fan power cord from J10 on the power supply and from the fan.

Figure 6-28 Disconnect the Front Cooling Fan



7. Remove the four screws and spacers that hold the fan and fan guard to the chassis and remove the fan (Figure 6-29).

Figure 6-29 Remove the Front Cooling Fan

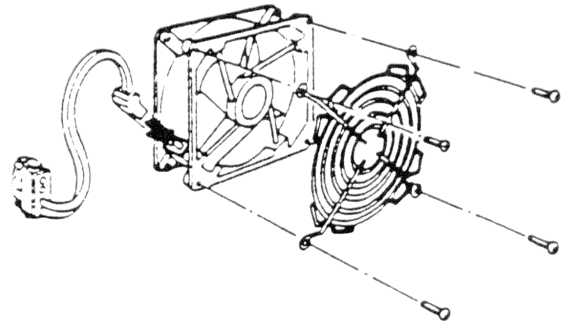


TO INSTALL A REPLACEMENT FRONT FAN

1. Remove the power cable and fan guard (if present) from the intake side of the old fan and fit them to the replacement fan (Figure 6-30).

CAUTION
The front fan power cable is not keyed. Observe the polarity of the connector. The curve of the connector must match the curve of the fan housing as shown in Figure 6-30.

Figure 6-30 Connect Front Fan Power Cable and Fan Guard

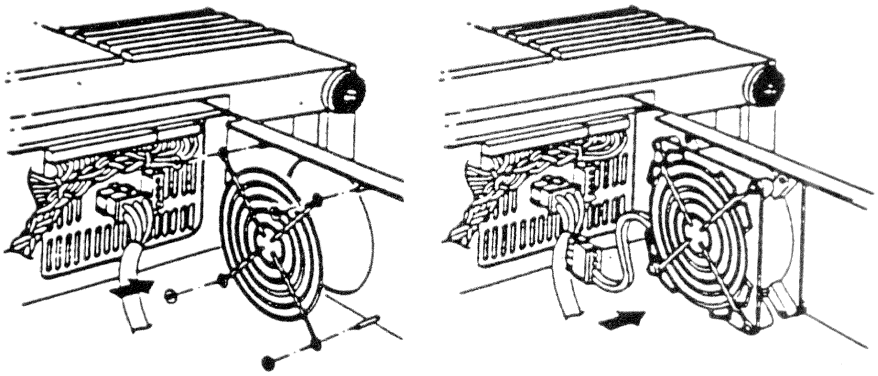


2. Relocate the four screws and place the fan guard on the screws. Make sure the cross members of the fan guard face the inside of the unit (Figure 6-31).

3. Place the spacers on the screws and secure the fan. Make sure the fan is oriented as shown. The airflow must be away from the mass storage area.

4. Reverse steps 1 through 6 of the removal procedure to finish installing the front cooling fan.

Figure 6-31 Install Replacement Fan



6.9 MODULE REMOVAL

Use the following procedure to remove modules from the BA23 enclosure (Figure 6-32).

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

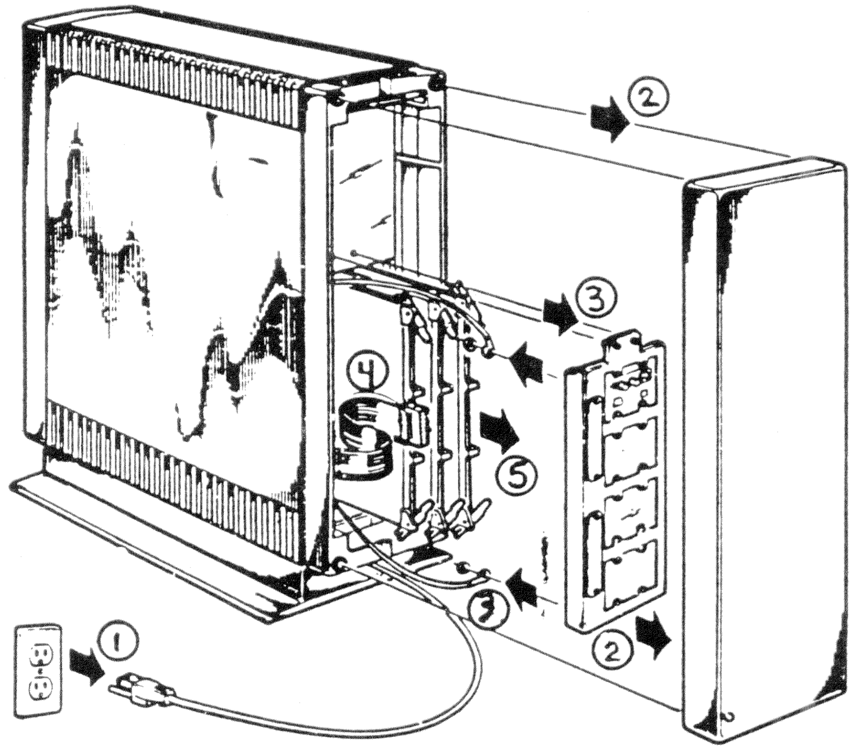
CAUTION
Remove and install modules carefully to prevent damage to module components, other modules, or possibly changing the switch settings.

NOTE
Replacement modules come wraped 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.

NOTE
If you install dual-height Q22-bus modules in slots 1, 2 or 3 of the BA23 backplane, you must install them in rows A and B. MS630-AA modules, if present, must be installed in rows C and D.

If you install dual height modules in slots 4 through 8 of the BA23 backplane, you must install a grant continuity card (M9407) in rows A or C if a second dual height module is not installed in the same slot.

Figure 6-32   Module Removal



1. Remove the ac power cable from the wall outlet.

2. Remove the rear cover and all cables. Label all cables for reinstallation later.

3. Loosen the two screws retaining the rear I/O panel assembly. Swing the assembly open and remove the ground strap screws.

4. Disconnect any cables attached to the back of the I/O panel assembly. Note their specific location and the orientation of the red strip on each cable.

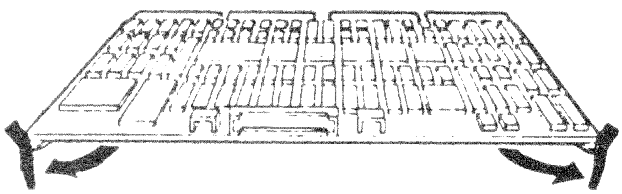
5. Slide the modules partially out of the backplane and remove any cables that are present. Note the orientation of the red strip on each cable.

6. Remove the module from the chassis.

NOTE: Document the location of each module as it is being removed to help ensure correct reinstallation.

NOTE
Q22 bus quad height modules have levers at each end used to lock the module in place and to assit in releasing the module from the backplane. Figure 6-33 shows the operation of these ejector levers.

Figure 6-33 Quad Module Ejector Levers



TO INSTALL MODULES

1. Make sure you set the jumper and switch configuration of replacement modules correctly. Check the setting against the old module or refer to the users or installation guide supplied with the new module.

2. Reverse step 1 through 6 of the removal procedure.

3. Retest the system to confirm that the system is working correctly. Refer to Chapter 3, Troublshooting of your system owner's manual for instructions.

6.10 REAR I/O INSERT PANEL REMOVAL

Use the following procedure to remove a rear 1/0 insert panel (Figure 6-34).

1. Remove the ac power cord for the wall outlet.

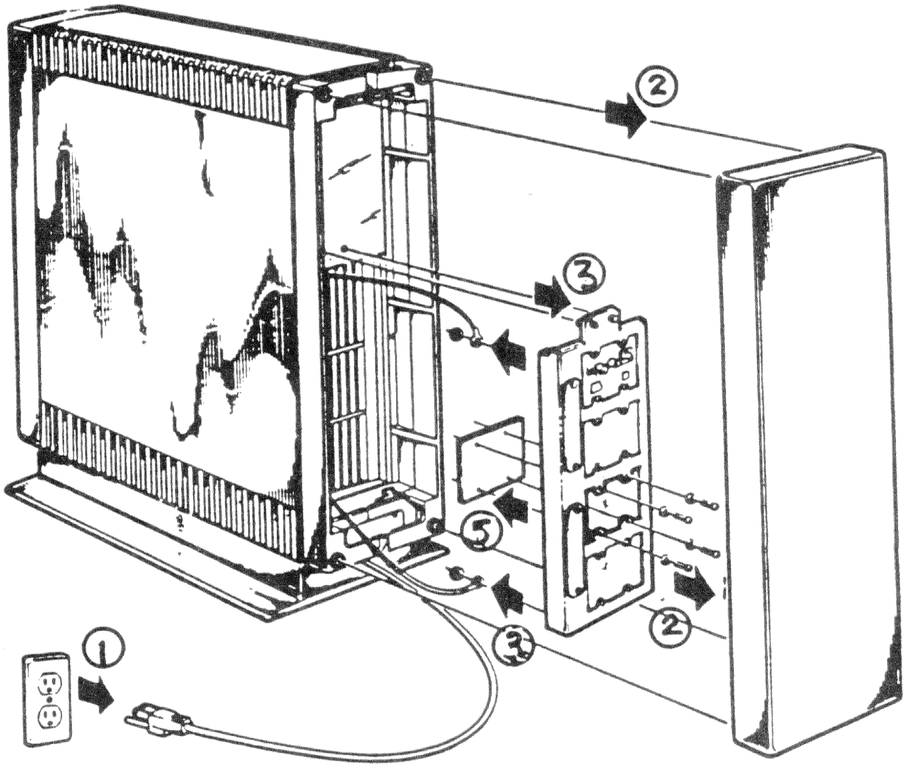
2. Remove the rear cover and all cables attached to the insert that is to be removed. Label the cables for reinstallation later.

3. Loosen the two screws retaining the rear I/O panel assembly. Swing the assembly open and remove the ground strap screws.

4. Disconnect any cables attached to the patch panel insert. Note the orientation of the red strip on each cable.

5. Remove the four screws holding the panel insert to the rear I/O panel assembly and remove the insert.

Figure 6-34 Rear I/O Insert Panel Removal



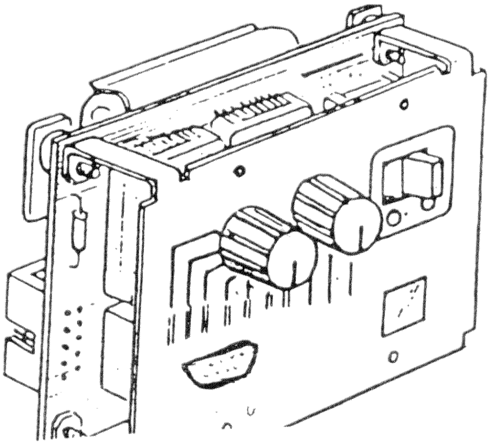
6.11 TIME OF YEAR CLOCK BATTERY BACKUP REMOVAL

Use the following procedure to remove the battery backup unit for the time of year (TOY) clock.

1. Remove the ac power cord from the wall outlet.

2. Remove the rear cover and the console terminal cable from the rear I/O CPU insert panel (Figure 6-35)

figure 6-35 rear I/O Distribution insert (front view)



3. Loosen the two screws retaining the rear I/O panel assembly. Swing the assembly open and remove the ground strap screws.

4. Disconnect any CPU module cables from the insert panel. Note the orientation of the red strip on each cable removed.

5. Remove the four screws holding the CPU panel insert to the rear I/O panel assembly and remove the insert.

6. Disconnect the battery backup unit (BBU) from the CPU panel insert (Figure 6-36).

7. Carefully spread the plastic BBU holder and pop the battery back up unit out (figure 6-37).

Figure 6-36 Disconnect the BBU

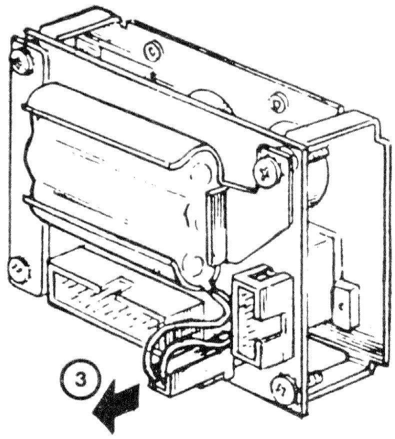
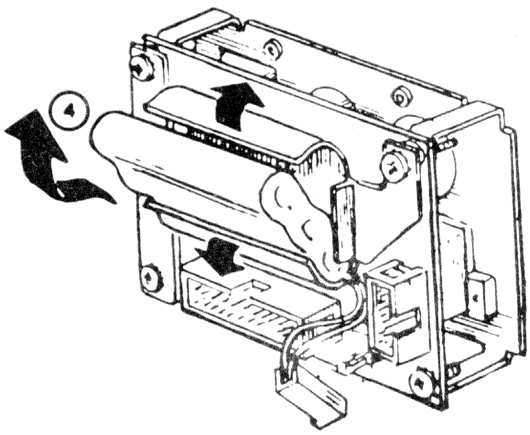


Figure 6-37 BBU Removal



APPENDIX A

CONSOLE COMMANDS

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 become operative only then. References to processor memory are handled normally except where noted below.

Normally, 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 normally 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 command may not reference the console scratch page.

A.3 CONSOLE COMMANDS

A.3.1 BINARY LOAD AND UNLOAD

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 the command is a load (bit 31 of the count is clear), the console responds with the input prompt, then accepts the specified number of bytes of data 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 are in error, and the console responds with an error message.

If the command is a binary unload (bit 31 of the count is set), 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 (control-C, control-S, control-O, etc.) during a binary unload. It is not possible during a binary load, 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 4K bytes of data in a single 'X' command.

A.3.2 BOOT

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. (See the section on System Bootstrapping.) 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> will also be recognized to have the same result.)

A.3.3 COMMENT

! <comment>

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

A.3.4 CONTINUE

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

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

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. 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. 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 addressed referenced minus one.

- '*' - the location last referenced in an examine or deposit.

- '@' - the location addressed by the last location referenced in an examine or deposit.

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 occur. 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.

For example:

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, clear 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

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 DEPOSIT.

Qualifiers:

The same qualifiers may be used on EXAMINE as may be used on DEPOSIT.

RESPONSE: <tab><address space identifier> <address> <tab> <data>

The address space identifier can be:

- o P - physical memory. Note that when virtual memory is examined, the address space and address in the response are the translated physical address.
- o G - general register.

- I - internal processor register.
- M - machine dependent (used only for display of the PSL).

A.3.7 FIND

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:

1. /MEMORY - search 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.

2. /RPB - search memory for a restart parameter block. The search leaves the contents of memory unchanged.

A.3.8 INITIALIZE

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

HALT

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

A.3.10 REPEAT

REPEAT <command>

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

A.3.11 START

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. No INITIALIZE is performed.

A.3.12 TEST

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

An I/O bus reset is performed.

APPENDIX B--CONSOLE ERROR MESSAGES AND EXPLANATIONS

HEX VALUE	MESSAGE	EXPLANATION
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.

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 can not 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 an 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.
21	FND ERR	A FIND command failed either to find the RPB or 64 kb 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	NOSHUCHFILE	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.
52	NOSUCHNODE	No response from load server.
53	INSFMAPREG	Invalid memory configuration.
54	RETRY	No devices bootable, retrying.

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