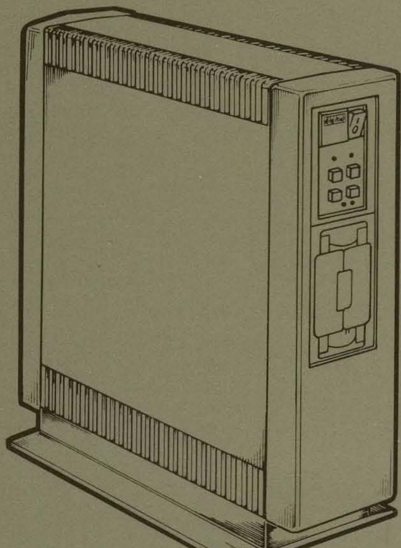
EK-MIC11-TM-002

MicroPDP-11 Systems

Technical Manual



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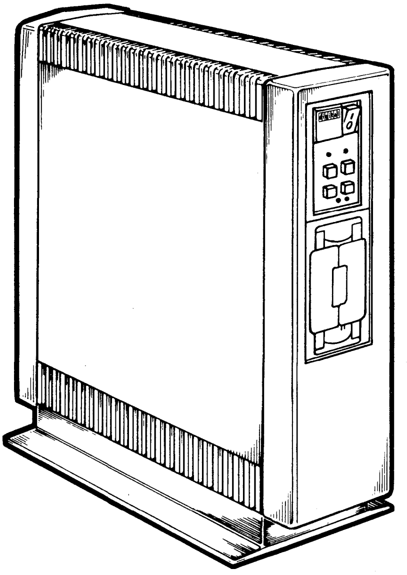

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Introduction

This manual is one of a set that describes the MicroPDP-11 systems in a BA23 enclosure and is intended for an experienced user. The *MicroPDP-11 System Owner's Manual* (EK-MIC11-OM) describes the unpacking, installation, checkout, and normal operation of the MicroPDP-11 systems.

The *KDJ11-BC CPU User's Guide* (EK-KDJEB-UG) describes the use and operation of the KDJ11-B CPU module. The *KDF11-BA CPU User's Guide* (EK-KDFEB-UG) describes the use and operation of the KDF11-B CPU module. The *MicroPDP-11 System Illustrated Parts Breakdown* (EK-OLCP5-IP) shows the mechanical breakdown of the MicroPDP-11 in the BA23 mounting enclosure. The *MicroPDP-11 Systems Service Maintenance Guide* (EK-MIC11-SG) provides instructions on field service maintenance and on how to troubleshoot down to the field replaceable unit (FRU) level.

Notes, Cautions, and Warnings

Any notes, cautions, and warnings that appear in this manual are defined as:

- NOTE – contains general information.
- CAUTION – contains information to prevent damage to equipment.
- WARNING – contains information to prevent personal injury.

Related Documents*

MicroPDP-11 Systems Owner's Manual	EK-MIC11-OM
MicroPDP-11 Systems Service Maintenance Guide	EK-MIC11-SG
MicroPDP-11 System Illustrated Parts Breakdown	EK-OLCP5-IP
KDJ11-BC CPU User's Guide	EK-KDJ1B-UG
KDF11-BA CPU User's Guide	EK-KDFEB-UG
RQDX1 Controller Module User's Guide	EK-RQDX1-UG
Microcomputer Interfaces Handbook	EB-20175-20
Microcomputer and Memories Handbook	EB-18451-20

* The text of this document contains additional references to Digital documents.

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Glossary Location

Glossary references are located in the glossary of common computing terms found in your owner's manual for your system. This glossary contains some, but not all, of the following acronyms.

Acronyms Used in this Document

Note that

- Signal names
- Acronyms displayed in messages
- Acronyms used by diagnostic programs

are not included in the following list.

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange (a standard code of 7- or 8-bit coded characters used in the transmission of data for processing)
APC	Assembled program count
BCSR	Boot control and status register
BOT	Beginning of tape
CCITT	Comité Consultatif Internationale de Téléphonie et Télégraphie (International Telephone and Telegraph Consultative Committee)
CIS	Commercial instruction set
CPU	Central processing unit
CSR	Control status register
CSRA	Control status register address
DDCMP	Digital data communication message protocol
DIP	Dual in-line package
DMA	Direct memory access
DMSCP	Disk mass storage control protocol
DU	Disk unit
DUP	Diagnostic utilities protocol
ECC	Error correction code
EEPROM	Electrically erasable programmable read only memory

EIA	Electronic Industries Association
EIS	Extended instruction set
EOT	End of tape
EPROM	Erasable programmable read only memory
ERR	Error
FP	Floating-point
FPP	Floating-point processor
FRU	Field replaceable unit
I/O	Input/output
IP	Initialize polling (usually refers to an address in the CSR)
LED	Light emitting diode
LOE	Loop-on-error
LSB	Least significant bit
LSI	Large-scale integration
LTC	Line time clock
LUN	Logical unit number
MMU	Memory management unit
MOS	Metallic oxide semiconductor
MPCB	Main printed circuit board
MSB	Most significant bit
MSCP	Mass storage control protocol
ODT	Octal debugging technique
PC	Printed circuit
PMG	Processor mastership grant
PMI	Private memory interconnect
PP	Purge and poll (refers to a diagnostic procedure)
PROM	Programmable read only memory
PSW	Processor status word
RAM	Random access memory
RDY	Ready
ROM	Read only memory
SA	Starting address (refers here to a location within the CSR)
SDLC	Synchronous data-link control
SLU	Serial line unit (associated here with a CPU module)
SYS ERR	System error
TMSCP	Tape mass storage control protocol
UART	Universal asynchronous receiver/transmitter (refers to a device that performs parallel-to-serial and serial-to-parallel conversion)
UQSSP	U/Q-Bus storage systems protocol
VOLT SEL	Voltage select
WR	Wrap (refers to a bit in the control status register)
WRT PROT	Write-protect

1.1 INTRODUCTION

The BA23 micro systems enclosure (Figure 1-1) supports the MicroPDP-11 computer systems and a wide variety of hardware options. The fan-cooled enclosure operates in an open office environment and includes the following major components:

- BA23-A frame
- Front control panel
- Mass storage area
- Backplane
- Power supply and fans
- Rear I/O distribution panel

Chapter 2 discusses the contents of typical MicroPDP-11, MicroPDP-11/73, and MicroPDP-11/83 systems.

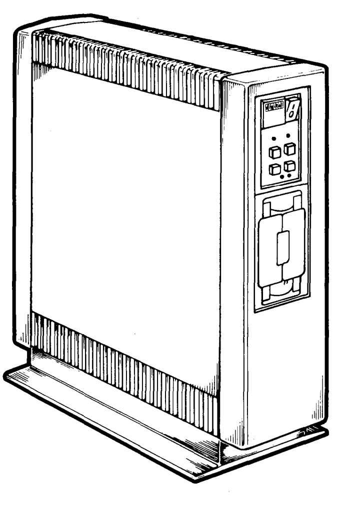


Figure 1-1 Floor-Stand BA23 Enclosure

1.2 BA23-A FRAME

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

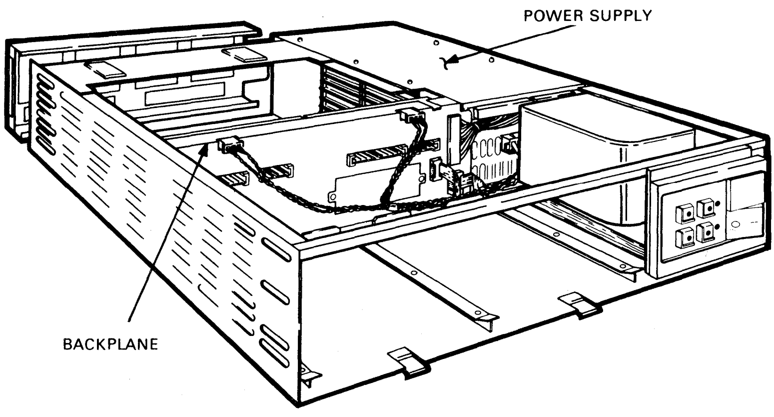


Figure 1-2 BA23-A Frame

The BA23-A frame mounts in a rack or in a floor-stand. The floor-stand model can convert to tabletop use. Table 1-1 shows the dimensions and weights of the various configurations.

Table 1-1 MicroPDP-11 Systems Dimensions and Weights

Specification	Model Floor-Stand	 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 lb)	29.5 kg (65 lb)	24 kg (53 lb)

1.2.1 BA23-A Bezels

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

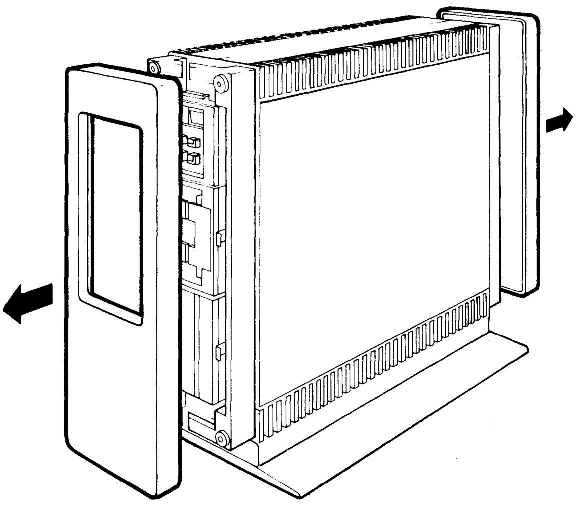


Figure 1-3 BA23 Removable Bezels

1.2.2 Air Circulation

The BA23-A frame contains two fans

- One above the control panel
- One above the power supply

which draw air from the bottom of the enclosure (Figure 1-4).

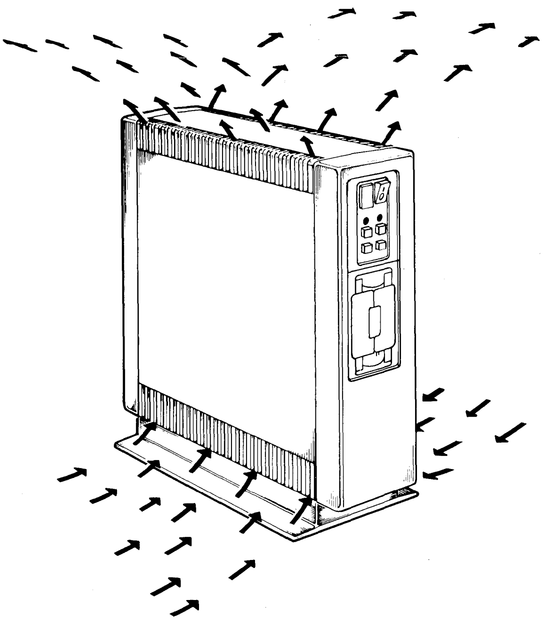


Figure 1-4 Air Flow

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 functions.

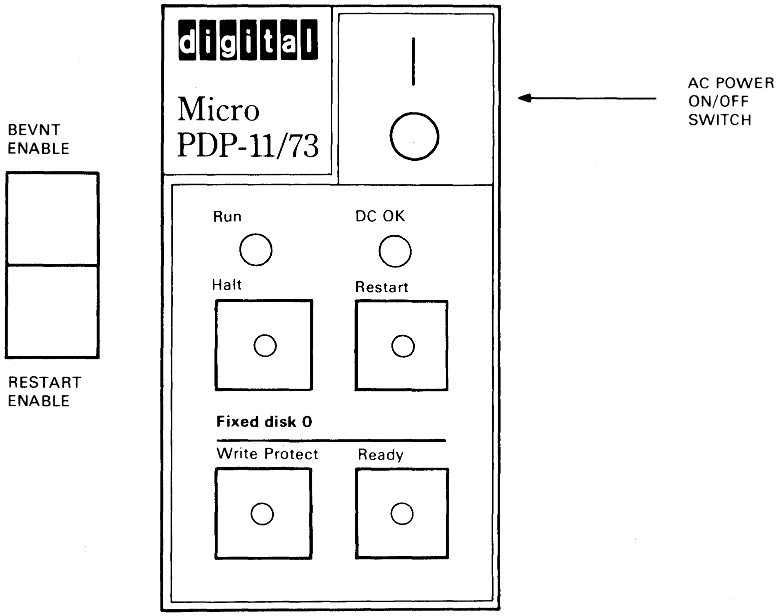


Figure 1-5 BA23 Front Control Panel

Table 1-2 Front Control Panel Controls and Indicators

Control/ Indicator	Position/ Condition	Description
I/O	In/Lit	Rocker switch with integral red indicator. Lights red when system ac power is on.
	Out/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 in console mode.

Table 1-2 Front Control Panel Controls and Indicators (Cont.)

Control/ Indicator	Position/ Condition	Description
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 Chapter 2, MicroPDP-11 Base Systems).
Restart		Momentary-contact pushbutton. When pressed (and enabled), causes a power-down/power-up sequence to be simulated, to restart CPU operation. Press and release the **Halt** button twice before resetting the system.
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	Out/Lit	Push-on/push-off button with integral green LED. Prevents fixed disk read and write operations.
	In/Unlit	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 +5 V and +12 V test points and to a line time clock (LTC) switch.

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 molded front panel holds the system power On/Off switch.

1.3.2 LTC DIP Switch Unit

The LTC DIP (dual in-line package) switch unit has two switches labeled 1 and 2 (Figure 1-6). Setting switch 1 to OFF enables the Q22-Bus BEVENT timing signal and allows the LTC to function under software control. Switch 1 is referred to as the BEVENT Enable switch.

Setting switch 2 (Restart/Enable) to ON allows the front control panel Restart switch to function as described in Table 1-2. Setting the Restart/Enable switch to OFF disables the front control panel Restart switch.

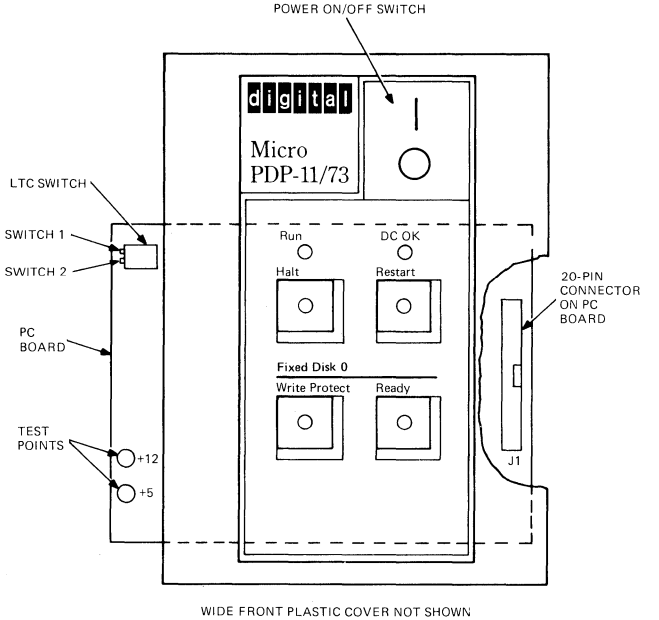


Figure 1-6 Control Panel with PC Board

1.4 MASS STORAGE

The front bezel covers two slots used for mounting standard 13.3-cm (5-1/4 in) mass storage devices. The top (or right) slot usually contains an RX50 diskette drive. This slot can also accommodate a TK50 tape drive. A fixed disk drive can also be installed in this slot (see the caution below). This slot is referred to as port 1. The bottom (or left) slot usually contains a fixed disk drive. This slot is referred to as port 0.

CAUTION
Never install more than one fixed disk drive in a BA23-A enclosure. Damage to the system could result.

1.5 BACKPLANE ASSEMBLY

The backplane assembly (Figure 1-7) consists of three major parts:

- BA23-A mass storage signal distribution panel
- Sheet metal mounting bracket
- Q22-Bus backplane

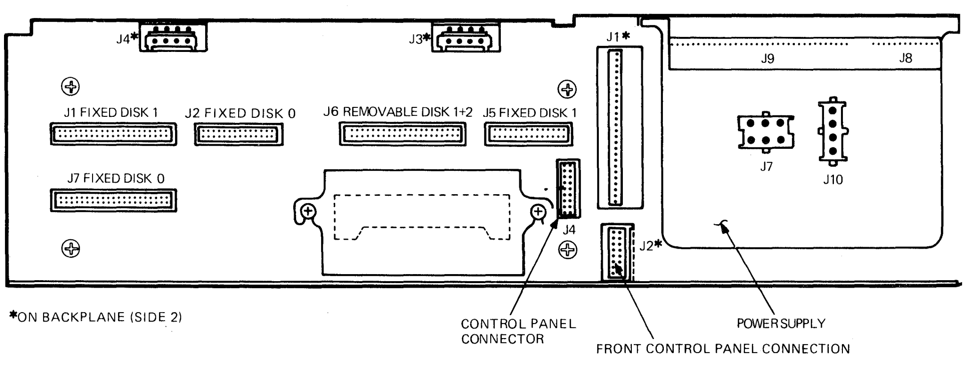


Figure 1-7 Backplane Assembly (Front View from Control Panel Side)

1.5.1 Mass Storage Signal Distribution Panel

The RX50 diskette drive and RD51, RD52, or RD53 fixed disk drive, installed in the BA23-A enclosure, connect to the mass storage signal distribution panel. Figure 1-8 shows the internal cabling setup for the BA23-A enclosure.

NOTES:
1. CONNECTORS J1 AND J2 ARE LOCATED ON THE BACKPLANE (H9278-A) ASSEMBLY.
2. IF DISK DRIVE IS NOT PRESENT, THE POWER CABLE CONNECTOR SHOULD BE PLUGGED INTO J3 ON THE DISTRIBUTION PANEL.
3. IF DISK DRIVE IS NOT PRESENT, THE POWER CABLE CONNECTOR SHOULD BE PLUGGED INTO J4 ON THE DISTRIBUTION PANEL.
4. THE REAR FAN CABLE IS AN INTEGRAL PART OF THE H7864 POWER SUPPLY.
5. THE CABLE IS AN INTEGRAL PART OF THE 7020695-01 ASSEMBLY.

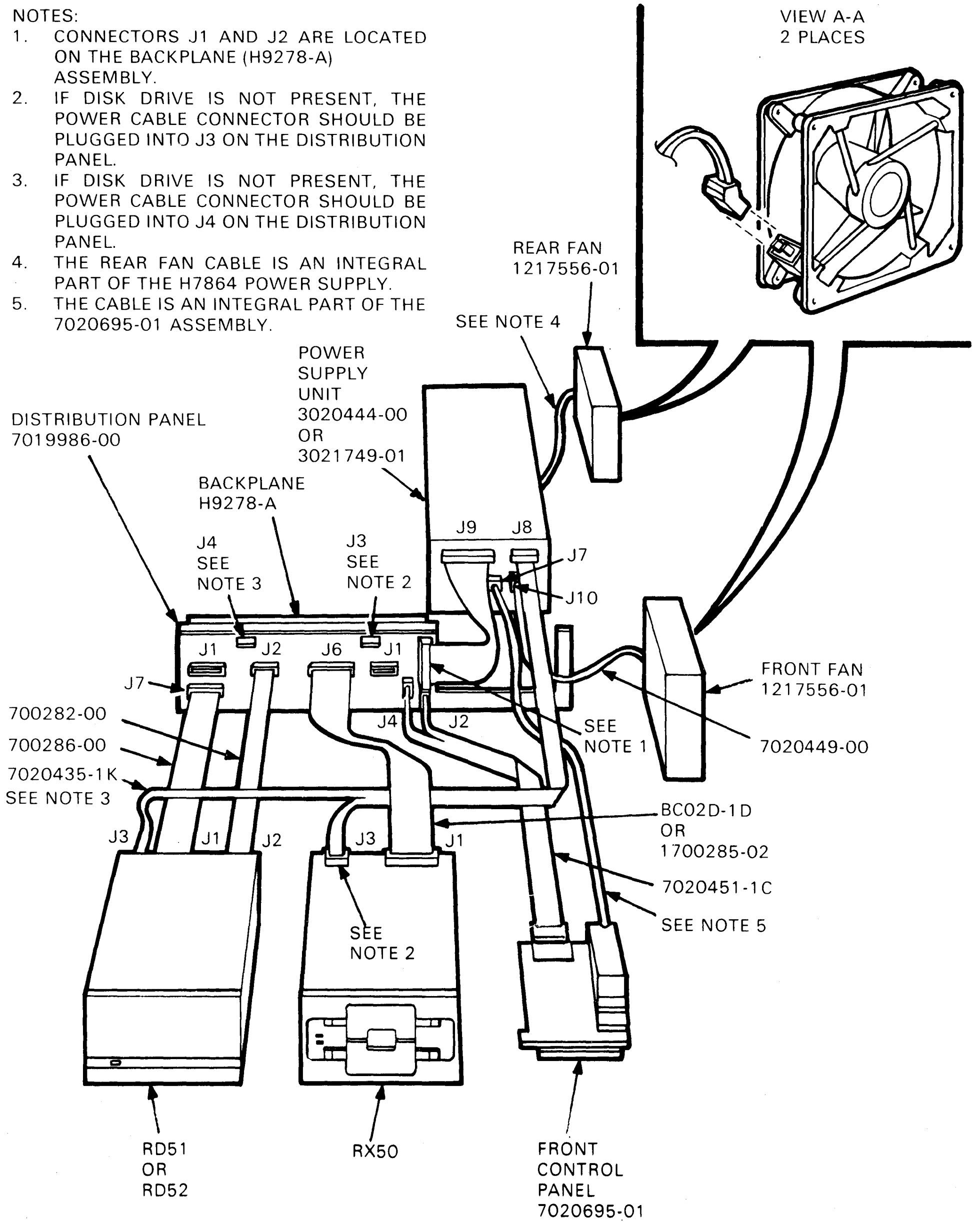


Figure 1-8 Internal Cabling in a BA23 Enclosure

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:

- J6 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 usually labels these as disk unit 1 (DU1) and disk unit 2 (DU2).
- J7 Fixed Disk 0 and J2 Fixed Disk 0 – provide the signals to a fixed disk drive installed in port 0 (left slot) of the BA23-A enclosure. This is the first fixed disk drive to be booted, and the ROM code usually labels it as disk unit 0 (DU0).
- J1 Fixed Disk 1 and J5 Fixed Disk 1 – provide the signals to a fixed disk drive installed in port 1 (right slot) of the BA23-A enclosure. This is the second fixed disk drive to be booted, and the ROM code usually labels it as disk unit 1 (DU1).

  CAUTION
  Never install more that one fixed disk drive in a BA23-A enclosure. Damage to the system could result.

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

A TK50 tape drive, installed in the BA23 enclosure, connects directly to its TQK50 controller module with a ribbon cable. This cable passes through the access door on the signal distribution panel and under the Q22-Bus backplane.

1.5.2 Q22-Bus Backplane

The backplane implements the extended LSI-11 bus, which uses 22-bit addressing to support up to 4 megabytes of main memory. This bus is commonly referred to as the Q22-Bus.

The Q22-Bus backplane supports a maximum of 38 ac loads and 20 dc loads. The ac loading is the amount of capacitance a module presents to a bus signal line; one ac load equals 9.35 picofarads (pF). The dc loading is the amount of dc leakage a module presents to a bus signal line; one dc load is approximately 105 microamperes (μA). The backplane itself presents 7 ac loads and no dc loads.

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

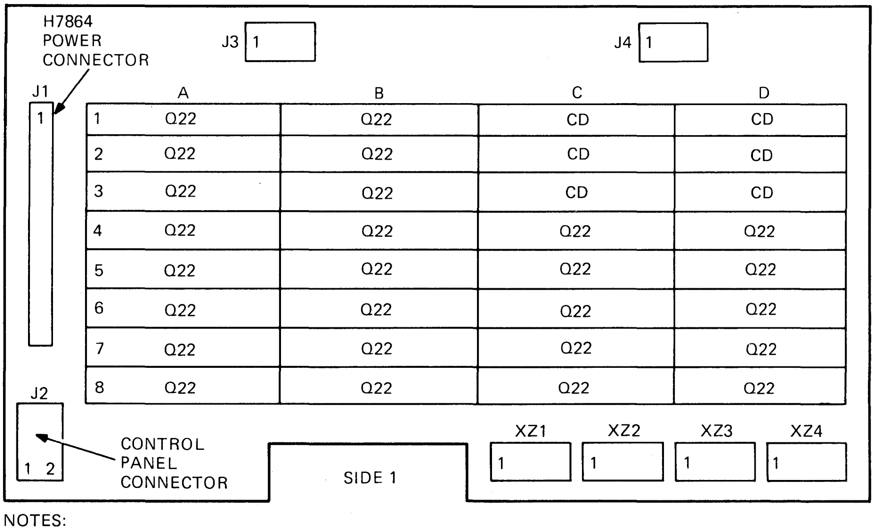
- J1 – provides the connection for the power supply backplane cable which carries the dc power and signals from the power supply.
- J2 – provides the signals to the control panel printed circuit board from an installed CPU module.
- J3 and J4 – provide for termination of the mass storage power cable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

The backplane has an eight-layer printed circuit board that is arranged as follows:

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

Chapter 4 discusses the configuration rules for the backplane. Appendix A discusses the backplane pin assignments for the most commonly used modules.

The backplane contains four rows of connectors identified as A, B, C, and D. Each row contains eight slots for inserting modules. Figure 1-9 shows the connectors that supply the Q22-Bus signal to the modules.



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.

Figure 1-9 Backplane

The C and D rows of slots 1, 2, and 3 provide an interconnection between the three slots. This interconnection is referred to as the CD bus. Any dual-height module installed in slots 1 through 3 must be inserted in rows A and B.

The backplane accommodates dual- or quad-height Q22-Bus-compatible modules. Figure 1-10 shows the grant continuity lines for the Q22-Bus interrupt. Slots 4 through 8 carry the Q22-Bus signal in rows C and D as well as rows A and B.

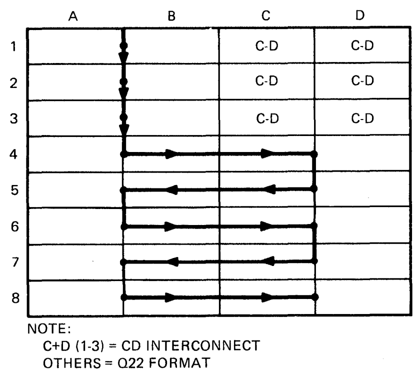


Figure 1-10 Backplane Grant Continuity

You can install two dual-height Q22-Bus modules in slots 4 through 8. If you install only one dual-height module in a slot, you must install a grant continuity card (M9047 or G7272) in the adjacent rows (A or C). The grant continuity card carries the Q22-Bus signal to the next row or slot. If you install only one dual-height module in slot 8, you must install it in rows A and B.

1.6 POWER SUPPLY AND FANS

The power supply (Figure 1-11) features protection against excess voltages, currents, and temporary fluctuations in the ac power supply.

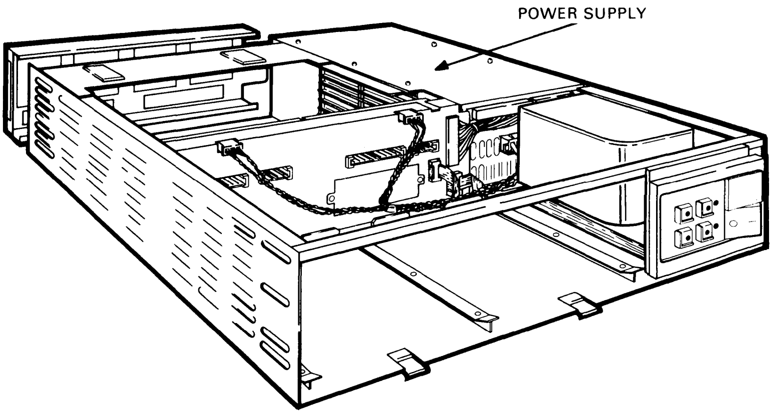


Figure 1-11 Location of Power Supply

The BA23-A enclosure has one of two possible power supplies:

- H7864 (Rev. 12), a 230-W unit that supplies +5 Vdc at 4.5 A to 36.0 A and +12 Vdc at 0.0 A to 6.0 A.
- H7864-A (Rev. 20), a 230-W unit that supplies +5 Vdc at 4.5 A to 36.0 A and +12 Vdc at 0.0 A to 7.0 A.

Both power supplies provide power to the backplane, the fixed disk drive, and the diskette 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 fan outputs (+10 Vdc at 0.45 A) for the front and rear dc fans. The fan voltages can be increased to +12 Vdc by changing a power supply jumper. However, the KDJ11-B and KDF11-B module thermal and acoustical specifications are based on the +10-V setting. The required fan power does not affect the 230-W output specification.

NOTE
MicroPDP-11/83 systems contain only the H7864-A (Rev. 20) power supply.

Older versions of the BA23 enclosure may have the H7864 power supply (Rev. 12). The difference in the +12 Vdc output current becomes important when you configure a system (see Chapter 4, Configuration). If it becomes necessary to replace a power supply, it must be replaced with an identical model (see Chapter 6, FRU Removal and Replacement Procedures).

See Table 1-3 for the specifications for the H7864-A power supply (Rev. 20 DIGITAL P.N. 30-21749-00). See Table 1-4 for the specifications for the H7684 power supply (Rev. 12 DIGITAL P.N. 30-20444-00).

The rear of the power supply contains a connector for remote power control (Figure 1-12). An ac input connector provides compatibility with international line cords. A circuit breaker protects the input power line. The voltage select (VOLT SEL) switch selects two ranges:

- 120 V = 88–128 Vac
- 240 V = 176–256 Vac

Table 1-3 H7864-A (Rev. 20) Power Supply Specifications

+5 Vdc Output	
Voltage	+5.1 Vdc ±2.5%
Current	36.0 Adc max. 4.5 Adc min.
Excess current (must trip)	37.0 A min. (averaged over 1 ms min.) 42.0 A max. (averaged over 1 ms min.)
Ripple and noise	50 MV peak-to-peak max.
+12 Vdc Output	
Voltage	+12.1 Vdc ±2.5%
Current	7.0 Adc max. 0.0 Adc min.
Normal excess current (must trip)	7.2 A min. (averaged over 1 s) 8.0 A max. (averaged over 1 s)
Startup excess current (must trip)	13.0 A for 3 s
Startup excess current (must not trip)	9.0 A for 10 s min. 10.0 A for 5 s min. 11.5 A for 1 s min.
Ripple and noise	75 MV peak-to-peak max.

Table 1-4 H7864 (Rev. 12) Power Supply Specifications

+5 Vdc Output	
Voltage	+5.1 Vdc ±2.5%
Current	36.0 Adc max. 4.5 Adc min.
Excess current (must trip)	36 A min. (averaged over 1 ms min.) 44 A max. (averaged over 1 ms min.)
Ripple and noise	50 MV peak-to-peak max.
+12 Vdc Output	
Voltage	+12.1 Vdc ±2.5%
Current	6.0 Adc max. 0.0 Adc min.
Normal excess current (must trip)	9.5 A min. (averaged over 1 s) 13.0 A max. (averaged over 1 s)
Startup excess current (must trip)	13.0 A for 3 s
Startup excess current (must not trip)	9.0 A for 10 s min. 10.0 A for 5 s min. 11.5 A for 1 s min.
Ripple and noise	75 MV peak-to-peak max.

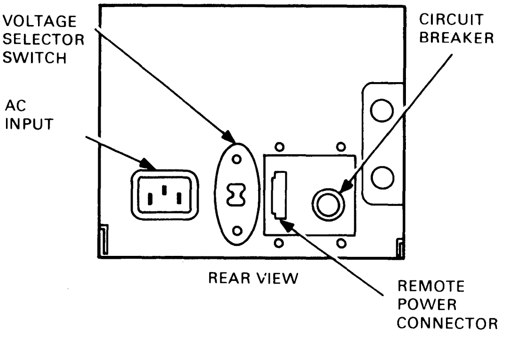


Figure 1-12 Power Supply (Rear View)

The rear fan power cable is an integral part of the H7864-A and H7864 power supplies.

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

- J7 – provides the power signal for the front control panel.
- J8 – provides the signals for the mass storage power cable. The mass storage power cable terminates in J3 on the backplane assembly if an RX50 diskette drive or TK50 tape drive is not present, and in J4 if a fixed disk is not present.
- J9 – provides the power and signals for the backplane power cable. The backplane power cable terminates in J1 of the backplane assembly.
- J10 – provides the signal for the front fan power cable.

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 and the insert panels are installed 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 1-13 shows the rear I/O distribution panel with a typical insert panel installed. It also shows the serial line unit (SLU) display panel of the KDJ11-B or KDF11-B CPU module, which is usually installed in the top (or left) cutout.

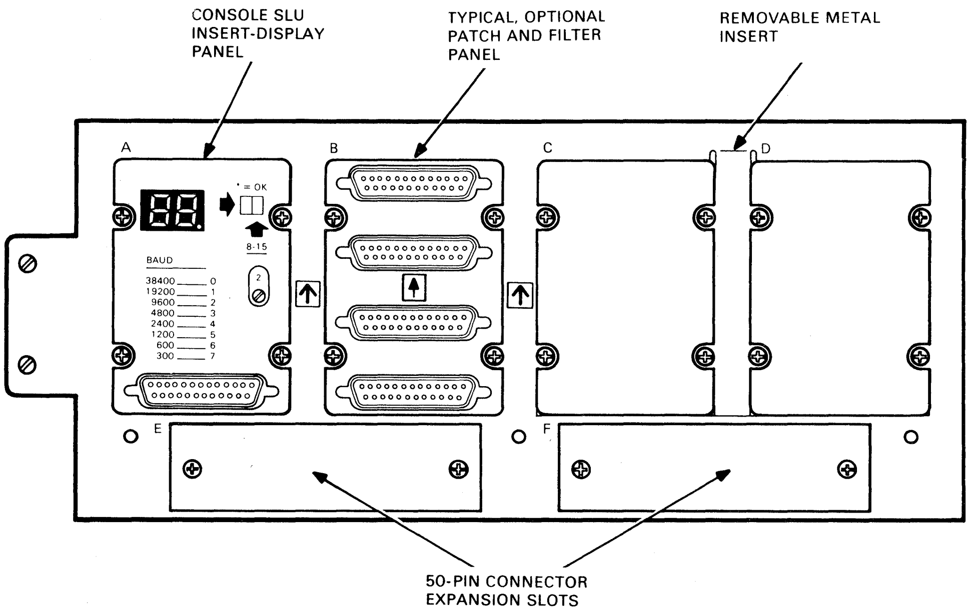


Figure 1-13 Rear I/O Distribution Panel (KDJ11-B SLU Display Panel Shown)

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

- Two of type A: 1.6 × 8.1 cm (0.6 × 3.2 in)
- Four of type B: 6.2 × 8.1 cm (2.5 × 3.2 in)

Insert panels correspond to the following I/O distribution panel cutouts:

- Type A: 2.5 × 10.1 cm (1 × 4 in)
- Type B: 6.6 × 8.2 cm (2.6 × 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 adapter plate. Figure 1-14 shows typical type A and type B insert panels and the adapter plate.

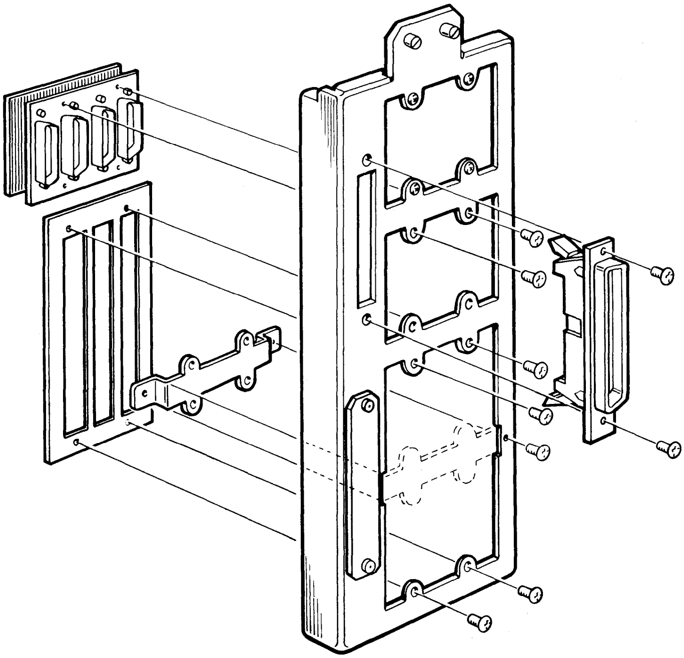


Figure 1-14 I/O Insert Panels and Adapter Plate

MicroPDP-11 Base Systems 2

2.1 INTRODUCTION

A *MicroPDP-11/73* base system contains a KDJ11-BC (M8190) or KDJ11-BB (M8190-AB) CPU module, an MSV11-P memory module, and an RQDXn controller module supporting mass storage devices. A TQK50 controller module supporting a TK50 tape drive may also be present.

A *MicroPDP-11/83* base system contains a KDJ11-BF (M8190-AE) CPU module, an MSV11-JD or MSV11-JE memory module, and an RQDXn controller module supporting mass storage devices. A TQK50 controller module supporting a TK50 tape drive may also be present.

A *MicroPDP-11/23* base system contains a KDF11-B CPU module, an MSV11-P memory module, and an RQDXn controller module supporting mass storage devices. A TQK50 controller module supporting a TK50 tape drive may also be present.

This chapter includes the following descriptions:

- KDJ11-B module*

  Baud rate select switch
  Connection to the front control panel
  Switch setting
  Jumper setting
  Features and use of KDJ11 dialog mode

- KDF11-B module*

  Baud rate select switch
  Connection to the front control panel
  Switch setting
  Jumper setting
  Features and use of KDF11 console dialog mode

---

* KDJ11-B and KDF11-B mean any version of the module.

- MSV11-P memory module

  Jumper setting
  Pin setting

- MSV11-J memory module

  Jumper setting
  Switch setting

- RQDXn controller, RQDX1-E, and RQDXE extender modules

  Jumper setting
  Switch setting

- TQK50 controller module

  Jumper setting
  Switch setting

> **NOTE**
> **Chapter 3, System Options, contains descriptions of various Q22-Bus communications, mass storage, and backup devices.**

2.2 KDJ11-B CPU MODULE

The KDJ11-B module connects to a cabinet kit (DIGITAL P.N. CK-KDJ1B-KB) containing a console serial line unit (SLU) panel (Figure 2-1) and two cables. The SLU panel is installed in the rear I/O distribution panel of the BA23 enclosure. The two cables connect the module to the SLU panel. These cables carry the signals from the module to the following:

- Baud rate select switch
- Light display
- Console terminal connector

A ribbon cable, installed in J2 on the backplane assembly, carries the CPU signals to the 20-pin connector on the front control panel. Controls and indicators on the front control panel allow you to control CPU operations. Chapter 1, BA23 Enclosure, contains a discussion of these controls and indicators. Figure 2-2 is a diagram of the KDJ11-B internal cabling installed in a BA23 enclosure.

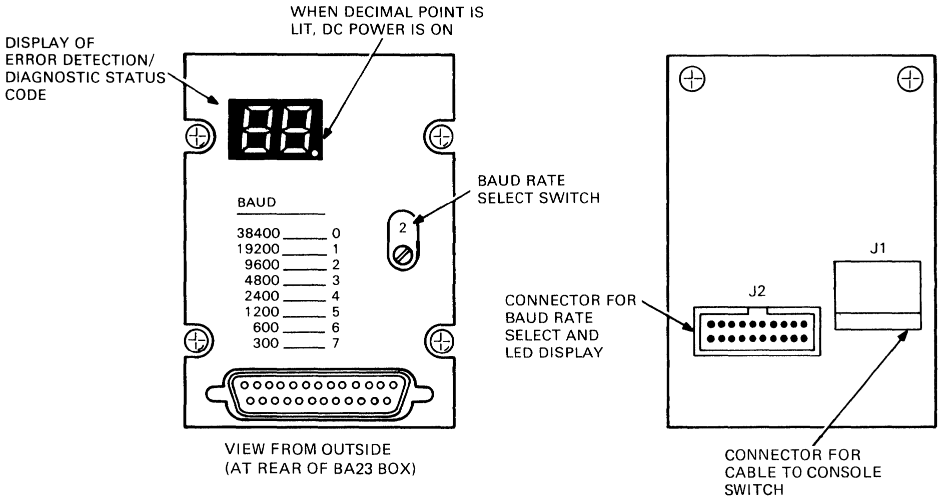


Figure 2-1 KDJ11-B SLU Display Panel

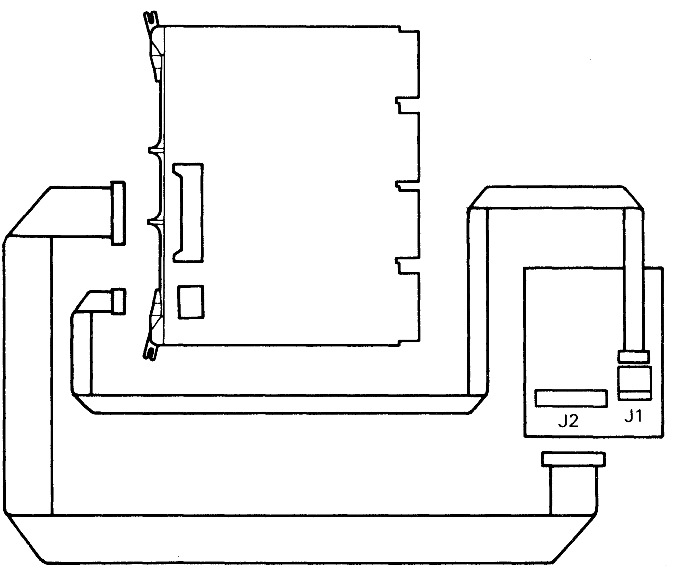


Figure 2-2 KDJ11-B Internal Cabling

The KDJ11-B is a quad-height processor module for Q22-Bus systems. The following options are available:

- KDJ11-BB: 15 MHz without FP* (FP upgrade available)
- KDJ11-BC: 15 MHz without FP (FP upgrade not available)
- KDJ11-BF: 18 MHz with FP and PMI (private memory interconnect)

The KDJ11-B CPU modules include the following features:

- PDP-11 instruction set, including extended instruction set (EIS)
- Four interrupt levels
- Memory management
- 8 Kbytes of cache memory
- 32-Kbyte boot and diagnostic facility with LED indicators
- Console SLU (serial line unit)
- Line frequency clock

The KDJ11-B CPU modules contain two EPROMs and one EEPROM (electrically erasable PROM). The EPROMs contain self-test diagnostics and boot codes. The EPROMs also contain a dialog mode program that allows selection of boot devices and other parameters from the console terminal. These settings are stored in an EEPROM so that they are not lost when the system is switched off. The general uses of the EPROMs and the EEPROM are as follows:

- EPROM (16,348 by 16 bits in 2 EPROMs)

  Power-up diagnostics for CPU and memory
  Bootstrap programs
  EEPROM setup program
- EEPROM (2,048 or 8,192 by 8 bits in 1 EEPROM)

  Hardware parameters
  Boot device selection
  Foreign language text
  Optional customer bootstrap programs

See Sections 2.4 and 2.5 for further information.

---

* FP (floating-point) instruction set

Figure 2-3 shows the location of a dual in-line package (DIP) switch, diagnostic LEDs, connectors, and jumpers on the board. The DIP switch (E83) enables the baud rate select switch on the SLU display panel (Section 2.2.2).

Table 2-1 lists the factory setting for the E83 DIP switch (Section 2.2.3) and the three jumpers. These jumpers are for manufacturing and factory test purposes only.

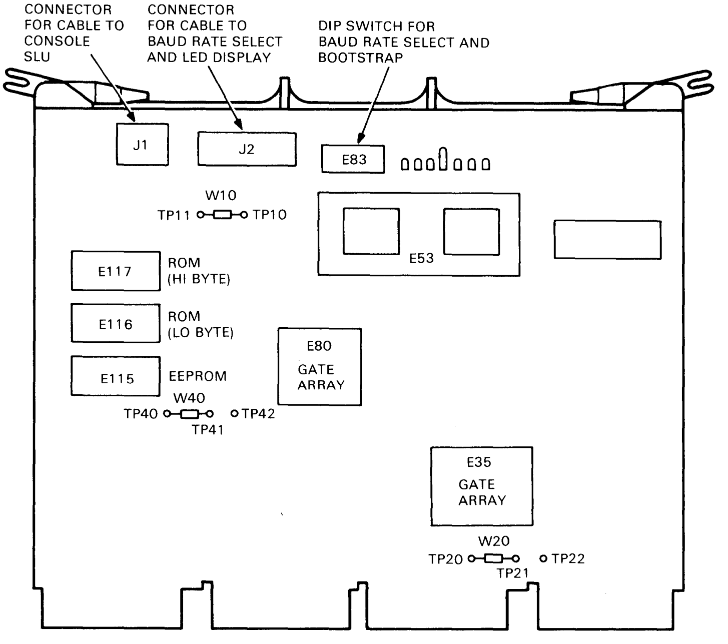


Figure 2-3 KDJ11-B Module Layout

Table 2-1 KDJ11-B Factory Setting

Switch/Jumper	Setting
E83	All off
W10	Between TP10 and TP11
W20	Between TP20 and TP21
W40	Between TP40 and TP41

2.2.1 KDJ11-B LEDs

Seven LEDs on the KDJ11-B provide status information. The green LED indicates the presence of +5 Vdc and +12 Vdc. The six red LEDs show error detection and diagnostic status codes. These codes are also shown in octal format on the SLU display panel. Refer to Chapter 5, Section 5.3, for definitions of the codes and detailed diagnostic information.

2.2.2 KDJ11-B Baud Rate Select Switch

The baud rate select switch on the SLU display panel has 15 positions (Figure 2-1). It performs the following operations:

- Displays the settings (numbers 0–15) above the switch.
- Selects a baud rate (positions 0–7) and causes the system to boot as specified by the settings in the EEPROM (Section 2.3).
- Selects (positions 8–15) the same baud rate as positions 0–7, but puts the system into dialog mode (Section 2.4).

Table 2-2 lists the switch settings, baud rate, and display mode.

Table 2-2 Baud Rate/Mode Select Switch

Switch Settings EEPROM Selects Baud Rate	Automatic Boot Mode	Dialog Mode
38400	0	8
19200	1	9
9600	2*	10
4800	3†	11
2400	4	12
1200	5	13
600	6	14
300	7	15

* Factory setting

† Most Digital Equipment Corporation terminals are set to 4800 baud.

2.2.3 KDJ11-B DIP Switch

Figure 2-3 shows the location of the DIP (dual in-line package) switch. It contains eight switches that can be used to:

- Set the SLU baud rate.
- Set the boot device.

The normal setting for all eight switches is off. The SLU baud rate switch and the dialog mode settings stored in the EEPROM control these functions.

Setting switch 1 to ON disables the console terminal. This setting is for factory use only.*

Switches 2, 3, and 4 select the boot device. The dialog mode features described in Section 2.5.6 allow you to define a boot device for different combinations of these switch settings. Table 2-3 lists the KDJ11 settings for switches 2, 3, and 4 and their functions.

Table 2-3 KDJ11 Settings for Switches 2, 3, and 4

Switch 2	3	4	Function
Off	Off	Off	Boot automatically according to the dialog mode settings.
Off	Off	On	Boot device 1.
Off	On	Off	Boot device 2.
Off	On	On	Boot device 3.
On	Off	Off	Boot device 4.
On	Off	On	Boot device 5.
On	On	Off	Boot device 6.
On	On	On	If switch 1 is off, power-up to ODT. If switch 1 is on, run self-test diagnostics in a loop.

When switch 5 is off, the system enters dialog mode on power-up. Use switches 5 through 8 to set the baud rate if no SLU display panel is present.

Use switches 6, 7, and 8 to set the baud rate when the baud rate rotary switch is disconnected from the CPU module. When the rotary switch is connected, it interferes with the operation of these switches unless it is set to 7 or 15. Likewise, these three DIP switches interfere with the proper operation of the rotary switch unless they are all set to OFF.

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* This feature is not implemented at this time.

Table 2-4 shows the switch settings for switches 6, 7, and 8 and their corresponding baud rates.

Table 2-4 Switch Settings for Switches 6, 7, and 8

Switch 6	7	8	Baud Rate
On	On	On	38400
On	On	Off	19200
On	Off	On	9600
On	Off	Off	4800
Off	On	On	2400
Off	On	Off	1200
Off	Off	On	600
Off	Off	Off	300

2.2.4 KDJ11-B Location in MicroPDP-11/73 and MicroPDP-11/83 Systems

A *MicroPDP-11/73* system uses the KDJ11-BC or KDJ11-BB CPU module and one or more MSV11-P memory modules (Section 2.6). Data transfers between the CPU and memory use the Q-Bus protocol.

Always install the KDJ11-BC or KDJ11-BB CPU module in the first slot of the backplane assembly. The MSV11-P memory module(s) must be installed in the slot(s) immediately following the CPU module.

A *MicroPDP-11/83* system uses the KDJ11-BF CPU module and one or more MSV11-JD or MSV11-JE memory modules (Section 2.7). Data transfers between the CPU and memory use the private memory interconnect (PMI) protocol resident on the KDJ11-BF CPU. All other communications, whether originated by the CPU or other bus masters, use the Q-Bus protocol. PMI is implemented through the CD Bus on the backplane.

Always install the KDJ11-BF CPU in slot 2 or 3 of a BA23 enclosure backplane. The MSV11-JD or MSV11-JE memory module(s) **MUST** be installed immediately in front (lower slot number) of the CPU. There can be no open slot between the CPU and memory, nor can there be an open slot preceding the memory module. No other boards can be inserted in the CD rows of slots 1 through 3 in a BA23-A enclosure. If the MSV11-JD or -JE memory is installed following the KDJ11-BF CPU, the CPU and memory communicate using the Q-Bus protocol.

2.3 KDJ11-B AUTOMATIC BOOT MODE

When set to the factory configuration, the KDJ11-B automatically runs the diagnostic self-test every time the system is turned on or restarted.

Typing **<CTRL> C** during self-test stops the test and causes the system to attempt to boot as if the self-test had completed successfully.

After successful completion of the startup self-test (described in Section 5.2), the ROM code loads the first 105 bytes of the EEPROM into memory beginning at location 2000. This area in memory is referred to as the setup table. The factory setting of the setup table (Section 2.5.2) initiates automatic boot mode, which then directs the system to take one of the following actions:

- Boot from one or more of the previously selected devices.
- Enter dialog mode (Section 2.4).
- Enter console emulator mode (sometimes called halt mode). (See Section 5.5.)

The factory setting of the EEPROM code searches for and identifies available mass storage control protocol (MSCP) devices (units 0–7) and other available devices. It attempts to boot from the available devices in the following order:

- MSCP devices with removable media (RX50)
- MSCP devices with fixed media (RD5X)
- RL01/RL02
- TSV05/TK25

NOTE
You can change this sequence of devices with the automatic boot setup command (described in Section 2.5.4).

If no bootable medium is found, the system displays a message like this:

```
Testing in progress - Please wait
1 2 3 4 5 6 7 8 9
Waiting for media to be loaded, or drive to go ready
Press the RETURN key when ready to continue
```

This message indicates that the system has entered dialog mode and is waiting for user input.

If you load bootable media and press the **Return** key, the system returns to automatic boot mode and boots the appropriate device.

Typing **<CTRL> P** while the system is booting causes the system to stop the boot process and enter dialog mode.

If you press the **Return** key (without first loading media), the system displays the following message:

```
Message 07
None of the selected devices were bootable
Press the RETURN key when ready to continue or to
list boot messages:
```

2.4 KDJ11-B DIALOG MODE

Dialog mode allows you to perform the following operations:

- Change CPU parameters.
- Select the boot source.
- Display a listing of all boot programs.
- Enter a bootstrap program.
- List all memory and occupied register locations in the system.
- Cause the startup self-test to run in a loop.
- Enter ROM ODT.

2.4.1 Entering Dialog Mode

The system enters dialog mode if:

- No bootable medium is available, and you follow the steps in Section 2.3.
- You type **<CTRL> P** or **<CTRL> C** during the startup self-test.
- The EEPROM is programmed to enter dialog mode.
- The baud rate select switch is set to a position from 8 to 15.

2.4.2 Dialog Commands

Dialog mode has the six commands HELP, BOOT, LIST, SETUP, MAP, and TEST. Three other functions are present: <CTRL> R (redisplay current input line), <CTRL> U (clear current input line), and delete.

Select a command by typing the first letter of the command.

HELP – Displays a one-screen help file that briefly describes each command.

BOOT – Allows you to select the boot source. To select the source, enter the device mnemonic followed by a unit number (for example, DU1). The program assumes decimal unit numbers. To specify the unit number as an octal value, type **/O** after the unit number (DU1/O). You can also assign a nonstandard CSR address by typing **/A** after the unit number (DU1/A). When you use both of these switches, do not repeat the slash; for example, type **DU1/OA.**

> **NOTE**
> **Typing B immediately followed by pressing the Return key causes the ROM code to check for an off-board ROM at address 17773000. When an off-board ROM exists and its first location is not zero, the ROM code disables the internal code and jumps to address 17773000 of the off-board ROM.**

LIST – Displays a list of all the boot programs available in the ROM and EEPROM. The list includes the device name, unit number range, source of the program, and device type.

SETUP – Causes the system to enter setup mode. This mode allows you to access and change the operating parameter settings and any bootstrap programs stored in the EEPROM. Setup mode consists of 15 commands (Table 2-5). (See Sections 2.5.1 through 2.5.15 for a description of each command.)

MAP – Searches for, identifies, and lists all memory in the system and all occupied register locations in the system I/O page.

TEST – Causes the ROM code startup self-test to run continuously in a loop. Use this command for troubleshooting and analyzing intermittent CPU problems. **<CTRL> C** exits the loop.

2.5 KDJ11-B SETUP MODE

Table 2-5 lists the setup mode commands. A discussion of the features of each setup command follows the table. Refer to the *KDJ11-BC CPU User's Guide* for more information. Enter these commands by using the command numbers.

Table 2-5 Setup Mode Commands

Command	Description
1	Exit.
2	List/change parameters in setup table.
3	List/change boot translation in setup table.
4	List/change terminal setup message in setup table.
5	Reserved.
6	List/change switch boot selection in setup table.
7	List boot programs.
8	Initialize setup table.
9	Save setup table into EEPROM.
10	Load EEPROM data into setup table.
11	Delete EEPROM boot.
12	Load an EEPROM boot into memory.
13	Edit/create an EEPROM boot.
14	Save boot into EEPROM.
15	Enter ROM ODT.

NOTE
ROM ODT is different from J11 micro ODT. (See Section 5.6 for a discussion and listing of J11 micro ODT hardware commands.)

2.5.1 Setup Command 1: Exit

This command returns you to dialog mode; same as **<CTRL> C.**

2.5.2 Setup Command 2: List/Change Parameters in Setup Table

During system power-up, the ROM program code copies the setup parameters into memory starting at address 2000. This area in memory is called the setup table. You can use this table to set 15 CPU parameters (letters A–O). The ROM code prints out the current status of all parameters, repeats the first parameter, and then prompts you for input.

To advance to a parameter you want to change, keep pressing the **Return** key until you reach the parameter you want, or go directly to the parameter by typing the letter shown in the setup table menu. To change a parameter, type in the new value and press the **Return** key. Type ^ or – to back up to the previous parameter. If there is no change, press the **Return** key to advance to the next selection. Use **<CTRL> Z** to exit.

This command does not save these values in the setup table in the EEPROM. Use setup command 9 to save the setup table into the EEPROM. Table 2-6 shows the default values of the parameters.

Table 2-6 KDJ11-B Setup Default Parameter Values

		Values		Default
A:	Enable halt on break	0 = No	1 = Yes	= 0
B:	Disable user-friendly format	0 = No	1 = Yes	= 1
C:	ANSI video terminal (1)	0 = No	1 = Yes	= 1
D:	Power-up 0 = Dialog 1 = Automatic	2 = ODT	3 = 24	= 1
E:	Restart 0 = Dialog 1 = Automatic	2 = ODT	3 = 24	= 1
F:	Ignore battery	0 = No	1 = Yes	= 0
G:	PMG count		(0–7)	= 7
H:	Disable clock CSR	0 = No	1 = Yes	= 0
I:	Force clock interrupts	0 = No	1 = Yes	= 0
J:	Clock 0 = Power supply 1 = 50 Hz	2 = 60 Hz	3 = 80 Hz	= 0
K:	Enable ECC test	0 = No	1 = Yes	= 1
L:	Disable long memory test	0 = No	1 = Yes	= 0
M:	Disable ROM 0 = No 1 = Dis 165	2 = Dis 173	3 = Both	= 0
N:	Enable trap on halt	0 = No	1 = Yes	= 0
O:	Allow alternate boot block	0 = No	1 = Yes	= 0

A: Enable halt on break – When this parameter is set to 0 (the default setting), a break condition from the console terminal is ignored. When set to 1, the processor halts when you press the break key on the console terminal.

B: Disable user-friendly format – When this parameter is set to 0 (the default setting), it sends user-friendly messages to the console terminal. This parameter is ordinarily used with automatic boot mode.

C: ANSI video terminal – This parameter is set to 1 (the default setting) when the console terminal is an ANSI video terminal such as a VT220. The **delete** key erases the previous character on the screen. For a hard-copy console or a non-ANSI video terminal such as the VT52, this parameter is set to 0. The **delete** key enters a slash character (/).

D: Power-up mode and E: restart mode – (Two separate parameters) When the ROM code starts, it determines if the Power-Up or the Restart switch was activated. In either case, the ROM code selects the mode as shown in Table 2-7.

Table 2-7 ROM Code Mode Selections

Value	Mode
0	Enters dialog mode at completion of the diagnostics.
1	Enters automatic boot mode at completion of diagnostics and tries to boot a previously selected device (default setting).
2	Enters on-line debugging technique (ODT) mode at completion of a limited set of tests. The ROM code executes a halt instruction and passes control to J11 micro ODT (see Section 5.6).
3	Enters 24 mode. The ROM code loads the processor status word (PSW) with the contents of location 26 and then jumps (passes control) to the address stored in location 24. You can use this mode to recover from a power failure when battery backup memory or nonvolatile memory is present.

F: Ignore battery – The ROM program uses this parameter only when power-up or restart mode (see D and E) is set to 3 (24 mode). When this parameter is set to 0 (the default setting), the memory battery OK signal must be present to execute 24 mode. You can set this parameter to 1 to ignore the memory battery OK signal if you have nonvolatile memory.

G: Processor mastership grant (PMG) count – You must change the default setting (0) of this parameter to 7 for normal operation. Do not set this parameter to 0.

This parameter sets the PMG count in the boot control and status register (BCSR). The PMG count allows the processor to perform a memory transfer and thus execute instructions periodically during DMA transfers. Table 2-8 shows how often the processor can perform a memory transfer during a DMA.

Table 2-8 PMG Count Settings

Value	Time for Counter to Overflow
0	Disabled
1	0.4 μs
2	0.8 μs
3	1.6 μs
4	3.2 μs
5	6.4 μs
6	12.8 μs
7	25.6 μs

H: Disable clock CSR – When this parameter is set to 0 (the default setting), the clock CSR can interrupt the system. When the parameter is set to 1, the clock CSR is disabled at address 17777546.

I: Force clock interrupts – When this parameter is set to 0 (the default setting), the clock requests interrupts only when the clock CSR is enabled (see default value H). If you set this parameter to 1, the clock unconditionally requests interrupts when the processor priority is 5 or less. Whenever you change the setting to 1, you must always disable the clock CSR.

J: Clock select – This parameter determines the source of the clock signal as shown in Table 2-9.

Table 2-9 Clock Signal Sources

Value	Source
0	Clock signal from backplane pin BR1 (power supply normally drives this signal at 50 Hz or at 60 Hz, the default setting).
1	Clock signal generated internally at 50 Hz.
2	Clock signal generated internally at 60 Hz.
3	Clock signal generated internally at 800 Hz.

K: Enable ECC test – When this parameter is set to 1 (the default setting), the power-up and self-test run the error correction code (ECC) memory test if the memory is of the ECC type (bit 4 or the memory CSR is a read/write bit). When this parameter is set to 0, the ROM code bypasses the ECC test. This parameter is reserved for future use.

L: Disable long memory test – When this parameter is set to 0 (the default setting), it runs a memory address shorts data test on all available memory. When this parameter is set to 1, it bypasses the memory address shorts data test for all memory above 256 Kbytes.

M: Disable ROM – The boot ROM occupies two 256-word blocks in the I/O address space. This parameter allows you to disable the ROM after a device boots, and to free this address space for use by special-purpose peripheral devices. Table 2-10 lists the ROM addresses that can be disabled.

Table 2-10 ROM Addresses Disabled

Parameter Value	ROM Addresses Disabled
0*	None
1	17765000–17765777
2	17773000–17773777
3	17765000–17765777 and 17773000–17773777

* Default setting

N: Enable trap on halt – When this parameter is set to 0 (the default setting), the processor enters micro ODT if it executes a halt instruction while in kernel mode. When this parameter is set to 1, the processor jumps to location 4 if it executes a halt instruction while in kernel mode.

O: Allow alternate boot block – The boot ROM code checks for bootable media on a device by loading the boot block from the device into memory and testing it. When this parameter is set to 0 (the default setting), the ROM code considers the medium bootable if the word at location 0 is between 240 and 277, and the word at location 2 is between 400 and 777. If the medium is bootable, the ROM code jumps to location 0 of the boot block.

When set to 1, the ROM code considers the medium bootable if the word at location 0 is any nonzero number. Some non-Digital Equipment Corporation operating systems may require a setting of 1 to boot properly.

2.5.3 Setup Command 3: List/Change Boot Translation in Setup Table

This command lists the contents of the translation table and allows you to specify nonstandard addresses for boot devices. It provides the following functions:

- Allows devices to be booted using nonstandard addresses.
- Allows CSR address changes when two or more devices share the same address.
- Allows multiple MSCP devices with different controllers to boot.
- Handles multiple controllers of the same type.

When the boot ROM code attempts to boot from a device, it uses the standard CSR address for that device unless a different address has been specified.

The following example shows a system with these devices:

- RD52 fixed disk drive
- RX50 dual diskette drive
- RC25 fixed and removable disk drives

To change an entry, type the device name, the unit number, and the CSR address. Press the **Return** key to proceed to the next entry. Type **<CTRL> Z** to return to the setup mode prompt.

The RX50 and RD52 use an RQDX controller module at the standard CSR address of 17772150. The RC25 controller module also uses a standard CSR address of 17772150. Since two devices cannot use the same CSR address, the CSR jumpers on one module must be changed (Section 3.1.2). In such a case, the RC25 controller is set to respond to a nonstandard address of 177760500.

The RD52 is unit 0 and the RX50 is units 1 and 2. The RC25 contains two drives, so it has two unit numbers. On its front panel, the RC25 has a unit number select plug that is set for units 4 and 5 (the first unit number of an RC25 is always an even number). Since the RC25 has two unit numbers, the translation table has two entries:

TT1	blank	
Device name		= DU
Unit number		= 4
CSR address		= 17760500
TT1	DU4 address	17760500
TT2	blank	
Device name		= DU
Unit number		= 5
CSR address		= 17760500
TT2	DU5 address	17760500
TT3	blank	
Device name		= Press the **Return** key for no change

2.5.4 Setup Command 4: List/Change Automatic Boot Selection in Setup Table

This command allows you to select the devices to be tried by the automatic boot sequence. The table allows up to six entries. For each entry, you specify the device mnemonic, the unit number, and the order to try to boot the devices. There are three special single-letter device names:

A: MCSP automatic boot. Causes the ROM code to find up to eight MSCP devices (units 0–7) at the standard CSR address. The ROM code first tries each removable medium device in turn and then tries each fixed medium device.

You must select MSCP devices with nonstandard CSR addresses (setup command 3) individually.

B: An off-board boot. Causes the ROM code to boot from an off-board ROM at address 17773000. The code checks that the ROM exists and that the first word is not zero. Then it disables the internal code and jumps to address 17773000 of the off-board ROM.

> **NOTE**
> **Device name B implements a method of supporting non-Digital Equipment Corporation boot devices on the Q22-Bus.**

E: Exit automatic boot. Signals the ROM code that there are no other devices to try. Follow the last device to be tried with this entry when fewer than six devices exist.

2.5.5 Setup Command 5: Reserved

This command is reserved for future use.

2.5.6 Setup Command 6: List/Change Switch Boot Selection in Setup Table

This command allows you to define the value of switches 2, 3, and 4 of the E83 DIP switch in order to select a specific boot device. You can use this command to specify boot devices for six combinations of these switches. When these three switches are set to OFF (the default setting), the EEPROM selects the boot device.

When switch 5 is set to OFF and the baud rate select switch is set to 8 or greater, the ROM code overrides any settings for switches 2, 3, and 4, and it enters dialog mode.

2.5.7 Setup Command 7: List Boot Programs

This command displays a list of all the boot programs in the two EPROMs and the EEPROM. It displays the device mnemonic, unit number range, source of the program (EPROM or EEPROM), and a short device description. (Same as the dialog mode's LIST command.)

2.5.8 Setup Command 8: Initialize the Setup Table

This command sets the current parameters of the setup table in memory to the default values. It does not affect the contents of the EEPROM itself. To save these values in the EEPROM you must execute the save command (setup command 9).

2.5.9 Setup Command 9: Save Setup Table into EEPROM

This command copies the parameter values of the setup table in memory to the EEPROM. This is the only command that actually writes anything into the first 105 bytes of the EEPROM.

2.5.10 Setup Command 10: Load EEPROM Data into Setup Table

This command restores the setup table in memory with the values actually stored in the EEPROM.

2.5.11 Setup Command 11: Delete EEPROM Boot

This command allows you to delete custom boot programs that you have stored in the EEPROM. It prompts you for the device name of the EEPROM boot to be deleted. The ROM code then searches for the first boot program in the EEPROM. If the ROM code finds the boot program, it deletes the program and moves all of the following boot programs up to use the space made available by the deleted program.

2.5.12 Setup Command 12: Load an EEPROM Boot into Memory

This command allows you to load an EEPROM boot program into memory to examine or edit it. The ROM code prompts you for the device name of the EEPROM boot.

2.5.13 Setup Command 13: Edit/Create an EEPROM Boot

This command allows you to create a new EEPROM boot program or to edit a program previously loaded with setup command 12. Use this command to change the following:

- **Device name:** Designated by the firmware for the device; for example, disk unit (DU).
- **Device description:** Usually the physical name of the device. The maximum length allowed for this description is 11 characters and spaces.
- **Allowable unit number range:** The highest unit number defines the allowable range of valid unit numbers for the device.
- **Beginning address of the program in memory:** First location of the program in memory.
- **Ending address of the program in memory:** The address of the last byte of code used in memory.
- **Starting address of the program:** The address to which the ROM code passes control.

The command lists the available space in the EEPROM for boots and prompts for entries. After you have made all changes, the ROM code then enters ROM ODT to allow you to enter the boot program (see setup command 15). You must use setup command 14 to save any changes you have made.

2.5.14 Setup Command 14: Save Boot into EEPROM

This is the only command that actually writes a boot from memory into the EEPROM. Other commands only change a copy of the boot program that resides in memory. When saving a boot program into EEPROM, the device name of the program must not match the name of a program already existing in the EEPROM. If two or more programs are written into the EEPROM with the same name, only the first one is bootable.

2.5.15 Setup Command 15: Enter ROM ODT

This command puts you into ROM ODT. The ROM code opens the address defined by the beginning address of the program. ROM ODT is not the same as J11 micro ODT.

The only allowable addresses in ROM ODT are the addresses of memory from 0–28 Kbytes (0–00157776). You cannot access any other addresses or the I/O page from ROM ODT. Table 2-11 provides the ROM ODT commands. (Refer to the *KDJ11-BC CPU User's Guide* for further information.)

Table 2-11 ROM ODT Commands

Command	Symbol	Use
Slash	/	Prints contents of specified address location or prints contents of last opened location. If opened location is an odd number, prints only the contents of the byte. If location is even, mode is even. If location is odd, mode is byte. Assumes leading zeros. Uses only the last six octal digits.

Examples:

```
ROM ODT > 200/1000000              ; Open location 200
ROM ODT > 1001/240                 ; Open byte location 1001
ROM ODT > 77777750020/100000       ; Open location 00150020
ROM ODT > 77770000/                ; Illegal location > 157776
ROM ODT >
```

Table 2-11 ROM ODT Commands (Cont.)

Command	Symbol	Use
RETURN	<CR>	Closes an open location.
LINE FEED	<LF>	Closes an open location and then opens the next location. If in word mode, increment by 2; if in byte mode, increment by 1.
Period	.	Alternate character for line feed. This command is useful when the terminal is a VT220.
Up arrow	^	Closes an open location and then opens the previous location. If in word mode, decrement by 2; if in byte mode, decrement by 1.
Minus	–	Alternate character for up arrow. Useful when the terminal is a VT200.
Delete	DELETE	Deletes the previous character typed.
CTRL Z	^Z	Exit ROM ODT and return to setup mode.

2.6 KDF11-BE CPU AND KDF11-BF CPU ASSEMBLIES

The KDF11-BE and KDF11-BF CPU modules connect to a cabinet kit containing a console serial line unit (SLU) panel and two cables (Figure 2-4). The SLU is installed in the rear I/O distribution panel of the BA23 enclosure. The two cables carry the signals from the module to the following:

- Baud rate select switch
- Console terminal connector (A0 console)
- Additional device connector (A1)

A ribbon cable, installed in J2 on the backplane assembly, carries the CPU signals to the 20-pin connector on the front control panel. Controls and indicators on the front control panel allow you to control CPU operations. (Chapter 1 discusses these controls and indicators.)

A discussion of the KDF11-BE CPU module follows. For a discussion of the KDF11-B modules, refer to the *KDF11-BA CPU User's Guide.*

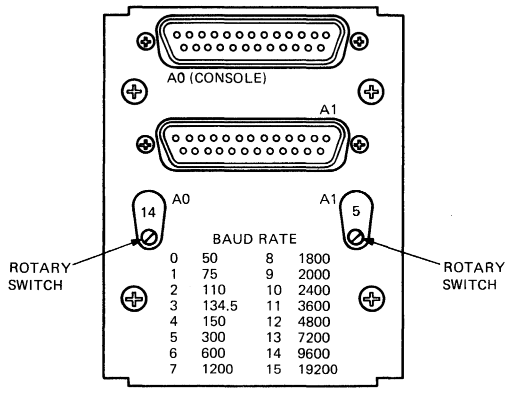


Figure 2-4 KDF11-BE SLU Panel

2.6.1 KDF11-BE

The KDF11-BE module is a quad-height processor module for Q22-Bus systems. It includes the following features:

- Four interrupt levels
- Memory management unit (MMU) chip
- Socketed (removable) boot/diagnostic ROMs
- Line frequency clock
- Two 40-pin chip sockets for installing an optional floating-point processor (FPP) chip and/or a commercial instruction set (CIS) chip
- Five LEDs for power and diagnostic status

The KDF11-BE module contains numerous jumpers and two dual in-line package (DIP) switch units, S1 (E102) and S2 (E114). The jumpers and switches allow you to select various module features. Figure 2-5 shows the location of these jumpers and switches, as well as the chip socket and LED locations.

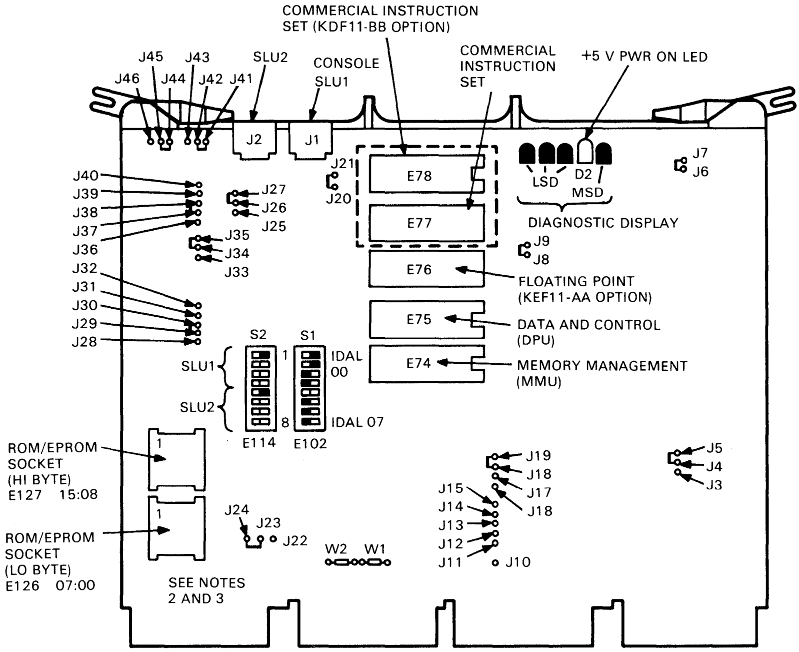
The KDF11-BE CPU module is installed in the first slot of the BA23 backplane.

Five LEDs on the KDF11-BE module provide status information. The single green LED indicates the presence of +5 Vdc. The red LEDs show error detection and diagnostic status codes. (Refer to Section 5.4.2 for a description of these four diagnostic LEDs.)

Table 2-12 shows the factory configuration of the jumpers. Table 2-13 shows the factory configuration for the two switch packs.

When a KDF11-BA is upgraded in the field (new ROMs installed) to a KDF11-BE or BF CPU, the second switch (E114) controls the SLU baud rate as shown in Table 2-12.

The input control for the diagnostic/boot ROM is the eight DIP switches S1-1 through S1-8 (E102). All unimplemented switch configurations cause a message to be printed and control passes to the console dialog routine. Table 2-14 shows the bootstrap switch settings.



NOTES:
1. INSTALLED JUMPERS SHOW THE MicroPDP-11 CONFIGURATION. .
2. WHEN 8 K EPROMS OR 8 K MASKED ROMS ARE USED, J23 IS CONNECTED TO J24.
3. WHEN 2 K EPROMS ARE USED, J23 IS CONNECTED TO J22. WHEN 2 K MASKED ROMS ARE USED, J23 IS CONNECTED TO J24.

Figure 2-5 KDF11-BE CPU Module

The XXDP diagnostic monitor boots only from the standard CSR address (772150) at this time.

Table 2-12 KDF11-BE Module Factory Jumper Configuration

Jumpers	State	Function
J4–J5	In	Disables the CPU halt feature from the console serial line unit (SLU) Break key on the terminal.
J6–J7	In	(For manufacturing use only.)
J8–J9	In	(For manufacturing use only.)
J18–J19	In	Enables CPU power-up mode: bootstrap from location 773000.
J20–J21	In	(For manufacturing use only.)
J23–J24*	In	Is used with 8 K masked ROMs or 8 K EPROMs (J22–J23 must be removed).
J26–J27	In	Connects output of console serial line drive to the serial line.
J29–J30	In	(One-stop bit for console SLU port.)
J34–J35	In	Connects LINMF(1)H to the SLU UART reset input.
J37–J38	In	(One-stop bit for second SLU port.)
J41–J42*	In	Disables DIP switches S2-1 to S2-4; enables baud rate rotary switches to select console SLU baud rate.
J44–J42*	In	Disables DIP switches S2-5 to S2-8; enables baud rate rotary switches to select second SLU baud rate.
W1	In	Provides bus grant continuity for the BIAK signal.
W2	In	Provides bus grant continuity for the BDMG signal.

* These jumpers are out for a KDF11-BA module (PDP-11/23 PLUS). All other jumpers are in.

Table 2-13 KDF11-BE Module Factory Switch Configuration

Switch	State	Function
S1-8	On	ANSI mode console terminal.
S1-7	On	Do quick verify memory diagnostic.
S1-6	Off	
S1-5	Off	
S1-4	On	Select MSCP automatic boot.
S1-3	On	
S1-2	On	
S1-1	On	

The factory configuration of J41 to J42 In and of J44 to J45 In disables the S2 switch pack SLU baud rate. When S2 is disabled, use the two 16-position baud rate select switches on the SLU panel to select the baud rate. The factory setting for S2 follows.

S2-8	Off	
S2-7	Off	
S2-6	Off	
S2-5	On	Second SLU set for 9600 baud.
S2-4	Off	
S2-3	Off	
S2-2	Off	
S2-1	On	Console SLU set for 9600 baud.

Table 2-14 KDF11-BE Diagnostic/Bootstrap Switch Settings

Switch Setting 8	7	6	5	4	3	2	1	Function
1	1	0	0	1	1	1	1	Factory setting.
X	X	0	0	0	0	0	0	Inhibit power-on automatic boot.
0	X	X	X	X	X	X	X	Console terminal is not an ANSI mode SCOPE.
1	X	X	X	X	X	X	X*	Console terminal is an ANSI mode SCOPE.
X	0	X	X	X	X	X	X	Inhibit QUICK VERIFY MEMORY DIAGNOSTICS.
X	1	X	X	X	X	X	X*	Execute QUICK VERIFY MEMORY DIAGNOSTICS.
X	X	0	0	0	0	0	1†	Select TS05 drive 0 or TK25.
X	X	0	0	0	0	1	0	Select TU58 drive 0.

Table 2-14 KDF11-BE Diagnostic/Bootstrap Switch Settings (Cont.)

Switch Setting 8	7	6	5	4	3	2	1	Function	
X	X	0	0	0	0	1	1	Select TU58 drive 1.	
X	X	0	0	0	1	0	0	Select RX01 drive 0.	
X	X	0	0	0	1	0	1	Select RX01 drive 1.	
X	X	0	0	0	1	1	0	Select RX02 drive 0.	
X	X	0	0	0	1	1	1	Select RX02 drive 1.	
X	X	0	0	1	0	0	0	Select MSCP drive 0.	
X	X	0	0	1	0	0	1	Select MSCP drive 1.	
X	X	0	0	1	0	1	0	Select MSCP drive 2.	
X	X	0	0	1	0	1	1	Select MSCP drive 3.	Includes RD51,
X	X	0	0	1	1	0	0	Select MSCP drive 4.	RD52, and RC25.
X	X	0	0	1	1	0	1	Select MSCP drive 5.	
X	X	0	0	1	1	1	0	Select MSCP drive 6.	
X	X	0	0	1	1	1	1*	Select MSCP autoboot.	
X	X	0	1	0	0	0	0	Select RL01/RL02 drive 0.	
X	X	0	1	0	0	0	1	Select RL01/RL02 drive 1.	
X	X	0	1	0	0	1	0	Select RL01/RL02 drive 2.	
X	X	0	1	0	0	1	1	Select RL01/RL02 drive 3.	
X	X	0	1	0	1	0	0†	Select DEQNA unit 0.	
X	X	0	1	0	1	0	1†	Select DEQNA unit 1.	
X	X	0	1	1	1	1	0	(Reserved for future devices.)	
–								(Reserved for future devices.)	
–								(Reserved for future devices.)	
X	X	1	1	0	1	1	1		
X	X	1	1	1	0	0	0	Select DECnet DUV11.	
X	X	1	1	1	0	0	1	Select DECnet DLV11-E.	
X	X	1	1	1	0	1	0	Select DECnet DLV11-F.	
X	X	1	1	1	0	1	1	Unused.	
X	X	1	1	1	1	0	0	Unused.	
X	X	1	1	1	1	0	1	Unused.	
X	X	1	1	1	1	1	0	Unused.	
X	0	1	1	1	1	1	1	Loop self-test but do not execute memory diagnostic.	
X	1	1	1	1	1	1	1	Loop self-test and memory diagnostic.	

0 = Off
1 = On
X = Does not matter

* Factory configuration
† For KDF11-BF only

2.6.2 KDF11-B Baud Rate Select Switches

The baud rate select switches on the SLU insert panel have the following features:

- Have 16 positions each (Figure 2-4).
- Display the setting (numbers 0–15) above the switches.
- Select a baud rate (positions 0–15) and cause the system to be in automatic boot mode.

Table 2-15 shows the switch setting and corresponding baud rate.

Table 2-15 KDF11-B Baud Rate Switch Settings

Switch Setting	Baud Rate	Switch Setting	Baud Rate
0	50	8	1800
1	75	9	2000
2	110	10	2400
3	134.5	11	3600
4	150	12	4800
5	300	13	7200
6	600	14	9600
7	1200	15	19200

2.6.3 KDF11-B Location in a MicroPDP-11/23 System

A MicroPDP-11/23 system uses the KDF11-B CPU module and one or more MSV11-P memory modules (Section 2.9). Data transfers between the CPU and memory use the Q-Bus protocol.

Always install the KDF11-B module in the first slot of the backplane assembly. The MSV11-P memory module(s) must be installed in the slot(s) immediately following the CPU module.

2.7 KDF11-B AUTOMATIC BOOT MODE

When set to the factory configuration, the KDF11-BE and the KDF11-BF automatically run diagnostic self-tests (described in Section 5.2). These tests run every time the system is turned on or restarted.

Typing **<CTRL> C** during the self-test stops the self-test and causes the system to attempt to boot as if the self-test had completed successfully.

After successful completion of the startup self-test, the ROM code directs the system to take one of the following actions:

- Boot from one or more previously selected devices.
- Enter console dialog mode (Section 2.8).
- Enter console emulator mode (Section 5.5).

The ROM code searches for and identifies available mass storage control protocol (MSCP) devices (units 0–7) and other available devices. It attempts to boot from the available devices in the following order:

- MSCP devices with removable media (RX50)
- MSCP devices with fixed media (RD5n)
- Other devices

The system boots when a bootable medium is found. If no bootable medium is found, the system displays a message similar to the following:

```
ERROR UNIT DU0
ERR 16 NOT BOOTABLE
WISH TO REBOOT [Y,(N)]?
```

This message indicates that the system has entered dialog mode and is waiting for user input.

If you load bootable media, type **Y,** and press the **Return** key, the system returns to automatic boot mode and boots the appropriate device.

Typing **<CTRL> P** while the system is booting causes the system to stop the boot process and enter console dialog mode.

If you respond to the message above by typing **N** and pressing the **Return** key, or by entering a **<CTRL> P,** the system displays the console dialog mode menu as follows:

```
128 KW MEMORY     KDF11B-BE ROM V06X     CLOCK ENABLED

BOOT
HELP
MAP
DIAGNOSE

Press RETURN to select BOOT
Use cursor controls "UP ARROW" or "DOWN ARROW" to select function
Use CTRL/W to reset menu
```

2.8 KDF11-B CONSOLE DIALOG MODE

The system enters console dialog mode if the following conditions exist:

- The system fails to find a bootable device.
- You enter **<CTRL> P** while the system is booting.

The console dialog mode and menu include the following commands:

BOOT – Allows you to select the boot source. To select a boot source, use a device name and unit number mnemonic (DU0), an octal unit number (you must enter the **/O** switch) or a nonstandard CSR address (you must enter the **/A** switch).

HELP – Displays a one-screen help file that provides a brief description of each command.

MAP – Lists CPU options installed on the module. Also searches for, identifies, and lists all memory in the system, and all occupied register locations in the system I/O page.

DIAGNOSE – Executes an extended memory test that takes approximately 25 minutes for 128 Kbytes words of memory.

LIST – Displays (only on non-ANSI terminals) a listing of all bootable devices present on the system. The listing includes the device name, unit number range, source of the program, and a very short device description. (This list function is part of the BOOT command on ANSI terminals.)

2.9 MSV11-P MEMORY MODULE (-PK, -PL)

The MSV11-P memory is a quad-height module that occupies the slot adjacent to the CPU. This module contains 64 K MOS chips that provide storage for 18-bit words (16 data bits and 2 parity bits). It also contains parity control circuitry and a control status register (CSR). Table 2-16 shows the memory modules and their storage capacity.

Table 2-16 MSV11 Memory Modules

Model	Module Number	Memory Capacity
MSV11-PK	M8067-K	256 Kbytes
MSV11-PL	M8067-L	512.9 Kbytes

The MSV11-P memory module is configured by means of jumpers and wire-wrap pins. The -PK and -PL models have the same factory configuration. Figure 2-6 shows the location of jumpers and wire-wrap pins and Table 2-17 describes their functions.

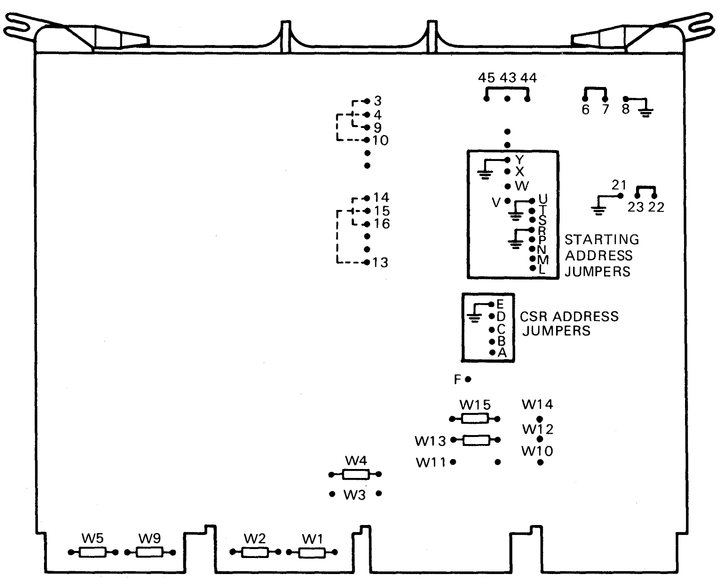


Figure 2-6 MSV11-P Module Layout

Two LEDs indicate module status. When lit, a green LED indicates +5 Vdc present on the module; when lit, a red LED indicates the detection of a parity error.

Table 2-17 MSV11-P Factory Jumper Configuration

Jumpers	State	Jumpered Pins	State*
W1	I	2 to Y	R
W2	I	3 to 9	I
W3	R	4 to 10	I
W4	I	6 to 7	I
W5	I	13 to 15	I
		14 to 16	I
W9	I	22 to 23	I
W10	R	44 to 45	I
W11	R		
W12	R	A to E	R
W13	I	B to E	R
W14	R	C to E	R
W15	R	D to E	R
Ground pins		L to R	R
		M to R	R
8		N to R	R
21		P to R	R
E			
R		V to Y	R
U		W to Y	R
Y		X to Y	R

* I = Inserted
R = Removed

2.9.1 Expansion (CSR and Starting Addresses)

Additional MSV11-P modules can be added for system expansion. Each memory module added to a system requires a specific configuration. This is done by repositioning jumpers on the module's wire-wrap pins.

Each memory module added to the Q22-Bus must be configured to provide two addresses:

- CSR address
- Starting address

2.9.1.1 CSR Address – Figure 2-6 shows the CSR address jumpers on the MSV11-P. Table 2-18 lists the CSR address and corresponding jumper configurations for each memory module added to the system. The table is applicable to both the -PK and the -PL models.

2.9.1.2 Starting Address – The starting address depends on the amount of memory already in the system. Table 2-19 lists the jumper configuration for additional MSV11-P modules. For further information, refer to the *MSV11-P User's Guide* (EK-MSVOP-UG-001).

Table 2-18 MSV11-P CSR Configuration

Board No. in System	Pins to Wire-Wrap	CSR Address (x = 177721)
1	None	x00
2	A to E	x02
3	B to E	x04
4	A to B, B to E	x06
5	C to E	x10
6	A to C, C to E	x12
7	B to C, C to E	x14
8	A to B, B to C, C to E	x16

Table 2-19 MSV11-P Starting Address Configuration

MSV11-PL (512-Kbyte increments)	
Board No. in System	**Pins to Wire-Wrap**
1	None
2	V to Y
3	W to Y
4	V to Y, W to Y
5	X to Y
6	X to Y, V to Y
7	X to Y, W to Y
8	X to Y, W to Y, V to Y
MSV11-PK (256-Kbyte increments)	
1	None
2	P to R
3	V to Y
4	V to Y, P to R
5	W to Y
6	W to Y, P to R
7	W to Y, V to Y
8	W to Y, V to Y, P to R

2.10 MSV11-JD (M8637-D) AND MSV11-JE (M8637-E) MEMORY MODULES

The MSV11-JD, -JE (Figure 2-7) is a metal oxide semiconductor (MOS), random access memory (RAM). The module has:

- Error detection and correction (ECC) to increase reliability
- A control and status register (CSR) to store status and error information
- Battery backup, available by resetting a jumper on the module
- Support for private memory interconnect (PMI) protocol and normal Q22-Bus protocol
- Four jumpers and two switch packs
- Starting addresses on 8 KW boundaries
- Two LEDs

The board can be configured half or fully populated with 256 K dynamic RAMs. Maximum memory capacity is 2 MB using 256 K RAMs.

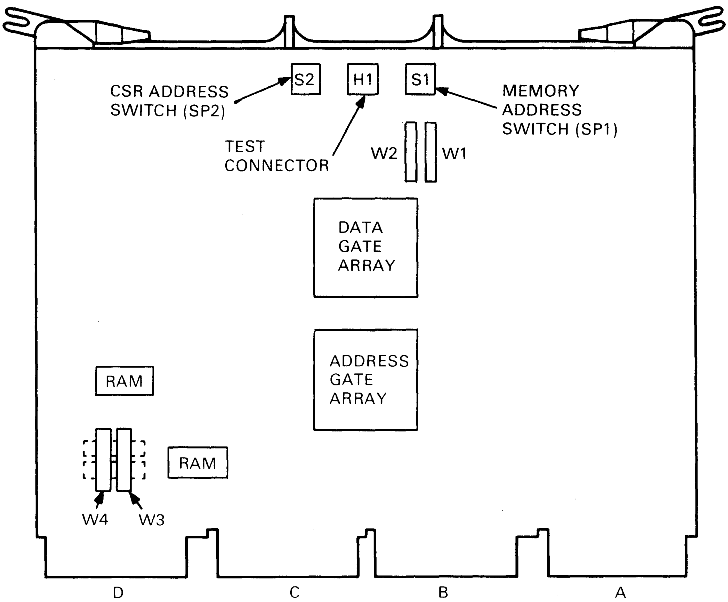


Figure 2-7 MSV11-JD, -JE Memory Module

The MSV11-JD and MSV11-JE memories are quad-height Q22-Bus modules that occupy the slot(s) immediately prior to the KDJ11-BF CPU in the backplane assembly. They are available in the factory configuration shown in Table 2-20.

Table 2-20 MSV11-JD, -JE Memory Modules*

Option Number	Module Designation	Description
MSV11-JD	M8637-D	1 MB ECC using 256 K dynamic RAMs
MSV11-JE	M8637-E	2 MB ECC using 256 K dynamic RAMs

* MSV11-JB, -JC modules are used on MicroPDP-11/84 Unibus systems only. They cannot be used on Q22-Bus systems.

The memory starting address can be set in any 8 KW boundary within the 2048 KW extended address space. The extended address space contains 22 address lines.

2.10.1 Error Correction

The MSV11-JD, -JE contains ECC logic which detects and corrects single-bit errors and detects double-bit errors. Detecting and correcting single-bit errors is transparent to the master device accessing the memory.

2.10.2 Battery Backup

The MSV11-JD, -JE memory module has input for two sources of +5 V power. These inputs are designated +5 VBB (on battery-backup power systems) and +5 V (on non-battery-backup power systems).

NOTE
The BA23 enclosure does not support battery backup.

In battery support mode, power is used only to refresh the MOS storage array so that battery backup and data retention time is maximized. A green LED on the module stays on as long as a +5 VBB is available. Modules are shipped in a non-battery-backup configuration (Figure 2-8). Figure 2-9 shows the jumper connection that supports battery backup.

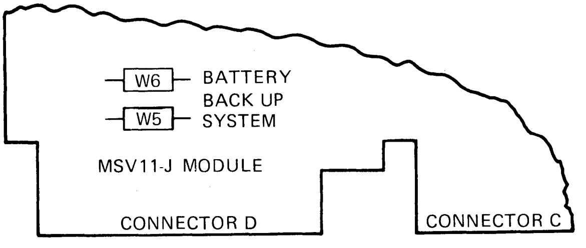


Figure 2-8 +5 V Jumper Connections

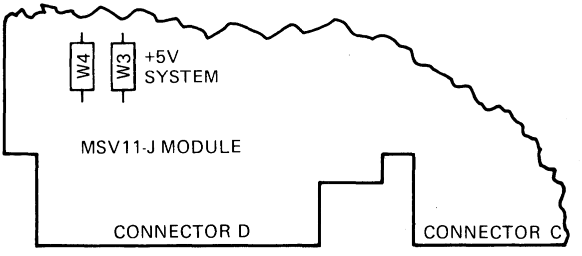


Figure 2-9 +5 VBB Battery Backup Jumper Connections

2.10.3 Private Memory Interconnect (PMI)

The MSV11-JD, -JE memories are designed for Q22-Bus systems and support the PMI protocol of the KDJ11-BF processor. The PMI bus is specifically designed for and used in MicroPDP-11/83 Q22-Bus systems.

The MicroPDP-11/83 systems use the KDJ11-BF CPU module, one or more MSV11-JD or MSV11-JE memory modules, and a selection of Q22-Bus compatible devices. Data transfers between the KDJ11-BF CPU and the MSV11-JD or -JE memory using the PMI protocol resident on the CPU. All other communications, whether originated by the CPU or other bus masters, use the Q22-Bus protocol.

2.10.4 Location of the MSV11-JD, -JE Memory

The location of the MSV11-JD, -JE in the BA23 backplane determines the protocol used between the KDJ11-BF processor and the memory module (Figure 2-10). To use the PMI protocol, the MSV11-JD, -JE must be located immediately in front (lower slot number) of the CPU; otherwise, the memory and CPU communicate with the Q22-Bus protocol. There must be no open slot between memory and the CPU.

CAUTION
Static charges can damage the MOS memory chips. Be careful how you handle the module and where you lay it down.

When you install or remove the memory module, make sure there is no dc voltage applied to the module.

If the green LED is on, the module is receiving +5 V or +5 VBB power. The power source must be off before you remove or replace a memory module.

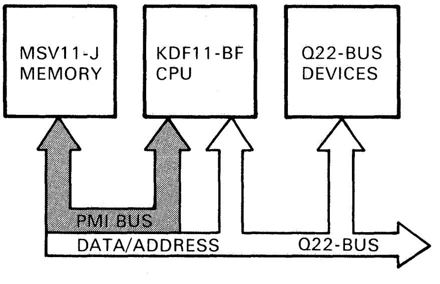


Figure 2-10 PMI/Q22-Bus Interface

2.10.5 Jumper Setting

The four factory installed jumpers (Figure 2-7), W1 through W4, establish the configuration of the module. Table 2-21 summarizes the possible MSV11-JD, -JE jumper configurations.

Table 2-21 MSV11-JD, JE Jumper Configurations

Jumper	Description
W1 In	Reserved for Digital use only
W1 Out	256 K dynamic RAMs
W2 In	Half populated module
W2 Out	Fully populated module
W3, W4 mounted left-right (Figure 2-7)	+5 VBB battery-backup system (See Note.)
W3, W4 mounted up-down (Figure 2-6)	+5 V system (Factory configuration)

NOTE
The BA23 enclosure does not support battery backup.

2.10.6 MSV11-JD, -JE Switch Settings

The MSV11-JD, -JE modules contain two switch packs. One is an 8-switch DIP (dual in-line package) and one is a 4-switch DIP. The 8-switch DIP selects the starting memory address on an 8 KW boundary. The 4-switch DIP selects the CSR starting address. One of 16 possible CSR addresses may be selected.

2.10.7 Memory Address Switch Settings

The memory address switch (SP1 in Figure 2-7) is an 8-switch DIP. The switch settings are shown in Table 2-22. The table is divided into three columns as follows:

- The decimal switch setting in 8 K increments
- The octal equivalent
- The actual switch settings shown in binary

The least four significant switch settings (5 through 8) of the memory address switch (SP1) represent 8 K increments as shown in the upper half of Table 2-22. Switch settings 1 through 4 are all 0s in this portion of the table and do not come into play until 128 K is reached.

For example, if these switch settings (5 through 8) are 0s, a memory address of 0 is represented. This assumes that switches 1 through 4 are also 0.

If switch setting 8 is a 1 (all others being 0s), the memory address increments by 8 K.

If switch setting 7 is a 1 (all others being 0s), the memory address increments by another 8 K.

The lower half of the table represents increments of 128 K until 2 M is reached. Switch settings 4 through 8 come into play here. Each increment of these switch settings represents an increase of 128 K.

For example, if switch setting 4 is a 1 and switch settings 3 through 1 are 0s, a starting memory address range of 128 K to 248 K is selected.

The specific memory starting address selected within that range is determined by switch settings 5 through 8 (indicated by Xs in the lower half of Table 2-22).

Table 2-22 MSV11-JD, -JE Starting Memory Address Selection

Decimal (K Word)	Octal	Switch Setting (SP1) 1	2	3	4	5	6	7	8
0	00000000	0	0	0	0	0	0	0	0
8	00040000	0	0	0	0	0	0	0	1
16	00100000	0	0	0	0	0	0	1	0
24	00140000	0	0	0	0	0	0	1	1
32	00200000	0	0	0	0	0	1	0	0
40	00240000	0	0	0	0	0	1	0	1
48	00300000	0	0	0	0	0	1	1	0
56	00340000	0	0	0	0	0	1	1	1
64	00400000	0	0	0	0	1	0	0	0
72	00440000	0	0	0	0	1	0	0	1
80	00500000	0	0	0	0	1	0	1	0
88	00540000	0	0	0	0	1	0	1	1
96	00600000	0	0	0	0	1	1	0	0
104	00640000	0	0	0	0	1	1	0	1
112	00700000	0	0	0	0	1	1	1	0
120	00740000	0	0	0	0	1	1	1	1
000–120	00000000–00740000	0	0	0	0	X	X	X	X
128–248	01000000–01740000	0	0	0	1	X	X	X	X
256–376	02000000–02740000	0	0	1	0	X	X	X	X
384–504	03000000–03740000	0	0	1	1	X	X	X	X
512–632	04000000–04740000	0	1	0	0	X	X	X	X
640–760	05000000–05740000	0	1	0	1	X	X	X	X
768–888	06000000–06740000	0	1	1	0	X	X	X	X
896–1016	07000000–07740000	0	1	1	1	X	X	X	X
1024–1144	10000000–10740000	1	0	0	0	X	X	X	X
1152–1272	11000000–11740000	1	0	0	1	X	X	X	X
1280–1400	12000000–12740000	1	0	1	0	X	X	X	X
1408–1528	13000000–13740000	1	0	1	1	X	X	X	X
1536–1656	14000000–14740000	1	1	0	0	X	X	X	X
1664–1784	15000000–15740000	1	1	0	1	X	X	X	X
1792–1912	16000000–16740000	1	1	1	0	X	X	X	X
1920–2040	17000000–17740000	1	1	1	1	X	X	X	X

1 = Switch on
0 = Switch off
X = Switch can be either on or off

Table 2-23 shows the most common configurations for the MSV11-JD and MSV11-JE memory address switches.

Table 2-23 Common Memory Starting Address

Starting Address	SW2 Switches 1	2	3	4	5	6	7	8
MSV11-JD								
0	0	0	0	0	0	0	0	0
1 Mbyte	0	1	0	0	0	0	0	0
2 Mbytes	1	0	0	0	0	0	0	0
3 Mbytes	1	1	0	0	0	0	0	0
MSV11-JE								
0	0	0	0	0	0	0	0	0
2 Mbytes	1	0	0	0	0	0	0	0

2.10.8 CSR Address Switch Settings

The control and status register of the MSV11-JD, -JE allows program control of certain ECC functions and it contains diagnostic information if an error has occurred. The CSR is a 16-bit register and has an assigned address. The CSR can be accessed through the Q22-Bus or PMI protocol.

ECC is performed only on memory accesses and is not used when accessing the CSR.

There is one CSR per memory module. Each CSR can be assigned to one of 16 predetermined addresses which range from 17772100 to 17772136 for 22-bit systems.

The CSR address switch (Figure 2-7) is a 4-switch DIP which allows selection of one of these 16 CSR addresses. Table 2-24 shows the possible CSR address.

Table 2-24 CSR Address Selection

22-Bit CSR Address	Switch Setting 1	2	3	4
17772100	0	0	0	0
17772102	0	0	0	1
17772104	0	0	1	0
17772106	0	0	1	1
17772110	0	1	0	0
17772112	0	1	0	1
17772114	0	1	1	0
17772116	0	1	1	1
17772120	1	0	0	0
17772122	1	0	0	1
17772124	1	0	1	0
17772126	1	0	1	1
17772130	1	1	0	0
17772132	1	1	0	1
17772134	1	1	1	0
17772136	1	1	1	1

1 = Switch on
0 = Switch off

2.10.9 MSV11-JD, -JE LEDs

Two LEDs on the MSV11-JD, -JE modules indicate power and error conditions (Figure 2-7). The green LED indicates that the module is receiving +5 V or +5 VBB from the power supply or battery backup. The power source must be off before you remove or replace a memory module.

The red LED indicates the detection of an uncorrectable single or double error when the module is in a read/write cycle or in diagnostic mode. Refer to the MSV11-J MOS Memory User's Guide (EK-MSV1J-UG-001) for further details.

2.11 RQDX1, RQDX2, AND RQDX3 DISK CONTROLLERS

The RQDXn modules (M8639, M8639-YB, and M8639-YA) connect to a cabinet kit (CK-RQDX1 or CK-RQDX2) that contains the necessary cables to provide the signals for disk drives installed in the system.

The optional RQDX1-E (M7512) and RQDXE (M7513) extender modules (Section 2.12) and their associated cables provide the RQDX controller signals to any external drive connected to the host.

The RQDXn controllers provide the interface for fixed disk and diskette drives to the Q22-Bus. These intelligent controllers have onboard microprocessors. Data transfers using direct memory access (DMA). Programs in the host system communicate with the controller and drives using the mass storage control protocol (MSCP).

These controllers can control a maximum of four drive units. Each fixed disk drive counts as one disk unit (DU). Each RX50 counts as two disk units.

> **NOTE**
> **A BA23 enclosure used as a host or as an expansion box supports only one internal fixed disk drive.**

- The RQDX1 controls a maximum of two fixed disk drives and an RX50 diskette drive.
- The RQDX2 controls a maximum of four fixed disk drives, or two fixed disk drives and an RX50 diskette drive.

> **NOTE**
> **An RQDX1 controller must be the last module installed in the BA23 backplane.**

Figure 2-11 shows the jumper and LED locations for the RQDX1 and RQDX2 controllers. The starting address of all RQDX modules is fixed at 17772150. The starting address of a second RQDXn module installed in the system is a floating address and must be set (refer to Chapter 4, Configuration). Table 2-25 lists the factory configuration.

Four LEDs on the RQDX modules provide diagnostic information. Refer to the *RQDX1 Controller Module User's Guide* (EK-RQDX1-UG) for information.

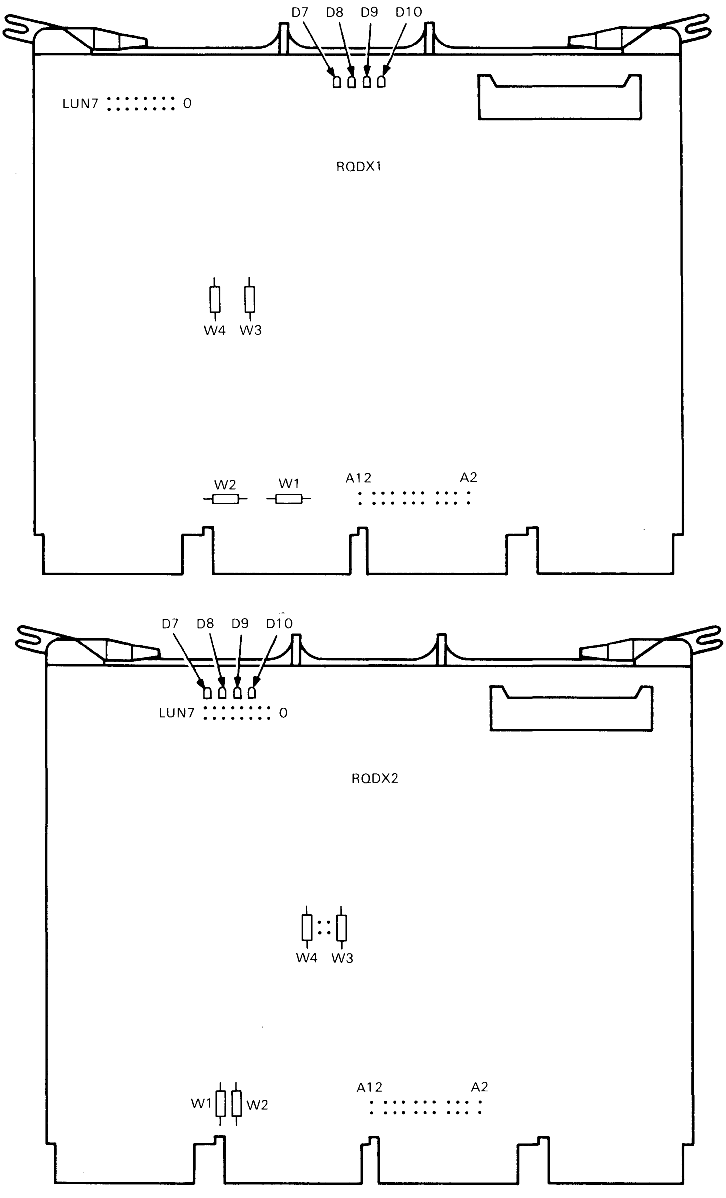


Figure 2-11 RQDX1 and RQDX2 Controller Modules

Table 2-25 RQDXn Factory Jumper Configuration

Module No.	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	← Add. Bits (Jumpers)
1	17772150	I	R	I	R	R	R	I	I	R	I	R	← (Factory)
2	Variable												

I = Installed = 1 R = Removed = 0

Logical unit number (LUN) jumpers 1–8 are removed. See Appendix B for a discussion of LUN designations and the RQDX disk unit numbering scheme.

The interrupt vector for the RQDX modules is set under program control. The first RQDX module is assigned a fixed interrupt vector of 154. If a second RQDX module is installed, its interrupt vector is variable (refer to Chapter 4).

2.12 RQDX1-E (M7512) AND RQDXE (M7513) EXTENDER MODULES

The optional dual-height RQDX1-E and RQDXE extender modules carry the RQDX1, RQDX2, and RQDX3 controller module signals to external MSCP devices. Install the M7512 and M7513 modules in rows A and B of the slot directly below the RQDX1, RQDX2, or RQDX3 controller module. Use the following guidelines when you install an RQDX1-E extender module:

- Install the RQDX1-E (M7512) in the same backplane directly below the RQDX1 controller module.
- Be sure the extender module is the last module installed in the BA23 backplane.

Use the following guidelines when you install an RQDXE extender module:

- Install the RQDXE (M7513) in the same backplane directly below the RQDX2 controller module.
- Neither the RQDX2, RQDX3, nor the RQDXE module needs to be the last module installed in the backplane.

To install RD5n fixed disk drives with the RQDXn and extender modules:

- Always place the first RD5n (RD0) in port 0 of the enclosure containing the RQDXn controller module.
- Set the device select switch to 3 (DU0) on any RDn installed in port 0. (This applies to the host system and to any expansion box or subsystem.)

- Set the device select switch to 4 (DU1) on any RDn installed in port 1. (This applies to the host system and to any expansion box or subsystem.)
- Do not set the device select switch to 1 or 2 on any RDn. These switch settings are reserved for RX50 diskette drives.

Refer to Appendix B, Logical Unit Number Designations, for further information.

2.12.1 RQDX1-E (M7512) Extender Module

Use the RQDX1-E extender module when you have an RQDX1 controller module and you want to add a subsystem or a second fixed disk drive in an expansion box. The RQDX1 controller supports two fixed disk drives and one RX50 diskette drive.

NOTE
A BA23 enclosure used as a host or as an expansion box supports only one fixed disk drive per enclosure.

Figure 2-12 shows the jumper locations on the M7512 module. Table 2-26 provides the RQDX1-E factory configuration of these jumpers. Use this configuration with dual BA23 systems or with a BA23/RD5n subsystem arrangement. The factory configuration is set to connect the expansion unit to connector J3. For further information, refer to the *RQDX1 Controller Module User's Guide* (EK-RQDX1-UG).

Table 2-26 RQDX1-E Factory Configuration*

Jumpers	Function	Factory Configuration
W1–W4	Must be installed. (For manufacturing use only.)	W1–W4
JD1–JD2 JRX1–JDX2	Factory set, do not change.	JD1 to JRX1 JD2 to JRX2
JB1–JB8 JA1–JA8 JC1–JC8		JA1 to JC1 JA2 to JC2 JA3 to JB3 JA4 to JB4 JA5 to JB5 JA6 to JB6 JA7 to JC7 JA8 to JC8

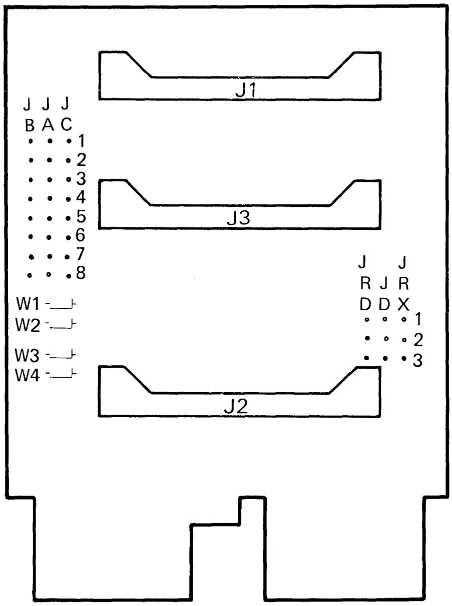


Figure 2-12 RQDX1-E Module

2.12.2 RQDXE (M7513) Extender Module

Use the RQDXE extender module when you have an RQDX2 controller module and you want to add a subsystem or another fixed disk drive in an expansion box. The RQDX2 module supports four fixed disk drives or two fixed disk drives and an RX50 diskette drive.

The M7513 module has three 50-pin connectors that have the following functions:

- J1 connects to the backplane.
- J2 connects directly to the RQDX2 controller module.
- J3 provides the connection to an external distribution panel.

Table 2-27 shows three typical fixed disk and RX50 arrangements using the RQDX2 and the RQDXE extender module. The factory jumper configuration supports all three arrangements shown.

Table 2-28 shows the RQDXE factory configuration. This configuration supports one RX50 and two RD5n disk drives. This configuration can be used with dual BA23 systems or with a BA23/RD5n subsystem.

NOTE
Subsystems, available from Digital, contain a disk or tape drive and their own power supply. They are designed to communicate with the host computer through an extender module installed in the host's backplane.

Refer to Appendix F for additional jumper settings for the RQDXE extender module.

Table 2-27 Three Possible Arrangements Using the RQDXE

Option No.	Arrangement	Port 0	Port 1		Orientation
1	Host box*	RD0	RX50	⇒	Front panel
	Expansion box	RD1	X†	⇒	Front panel
2	Host	RD0	X	⇒	Front panel
	Expansion box	RD1	X	⇒	Front panel
3	Host	RD0	RX50	⇒	Front panel
	Subsystem	RD1		⇒	Front panel

* The term host is used to indicate the enclosure in which the RQDX2 or RQDX3 controller resides.
† X implies that the port is empty or contains a device not supported by the RQDX controller.

Table 2-28 RQDXE Jumper Setting (Factory Configuration)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A3	E1 to E2*	K2 to K4	L1 to L3*	N1 to N2
B1 to B3	F1 to F3		L4 to M2	N4 to P2*
	F2 to F4*			
	H3 to H4*			

* These jumpers are installed to avoid floating inputs on the M7513.

Table 2-29 shows a configuration using the RQDXE (M7513) with three fixed disk drives. Table 2-30 shows the RQDXE jumper setting to support three RD5n disk drives. Use this configuration with a BA23-A enclosure and dual subsystems.

Table 2-29 Four Fixed Disks with an RQDXE

Arrangement	Port 0	Port 1	Orientation
Host	RD0	X	Front panel
Dual subsystem (only)	RD12	RD2	Front panel

Table 2-30 RQDXE Configuration for Three RD5n Disk Drives

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
C1 to C2	E1 to E2*	K1 to K2	L3 to L4	N1 to N2
C3 to C4	E4 to F2	K3 to K4	M1 to M2	P1 to P2
D1 to D2	F3 to H1			
D3 to D4	H3 to H4*			

* These jumpers are installed to avoid floating inputs on the M7513.

2.13 TQK50 (M7546) TAPE CONTROLLER

The TQK50 (M7546) controller comes with a cabinet kit which contains the cable necessary to provide the signals for a TK50 tape drive installed in the system.

The TQK50 controller provides the interface for a TK50 tape drive to the Q22-Bus. This intelligent controller has onboard microprocessors. Data transfers using direct memory access (DMA). Programs in the host system communicate with the controller and tape drive using the mass storage control protocol (MSCP).

A TQK50 can control one TK50 tape drive. Any additional TK50 tape drives installed in the system require additional TQK50 controllers.

Your system's owner's manual contains TK50 operating instructions.

Figure 2-13 shows the jumpers, switches, and LEDs for the TQK50 controller. The CSR (control status register) address for this module is 17774500. The interrupt vector is set to 260 and is under program control. Table 2-31 shows the factory configuration of the jumpers.

Table 2-31 M7546 Fixed CSR Address

Module Number	Factory Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	←Add. Bits (Jumpers*)
1	1774500	I	I	R	R	I	R	I	R	R	R	R	(Factory)

I = Jumper installed
R = Jumper removed

* The jumper nearest the module fingers is A2.

The starting address of any additional TQK50 modules installed in an individual system is a floating address of 17760nnn and is set using the jumpers. The floating address of the M7546 module starts at 17760404 and increments by 4; for example, 17760404, 17760410, 17760414.

REV LEVEL NUMBER	SWITCH BITS 1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0
5	1	0	1	0	0	0	0	0

0 = SWITCH OPEN
1 = SWITCH CLOSED

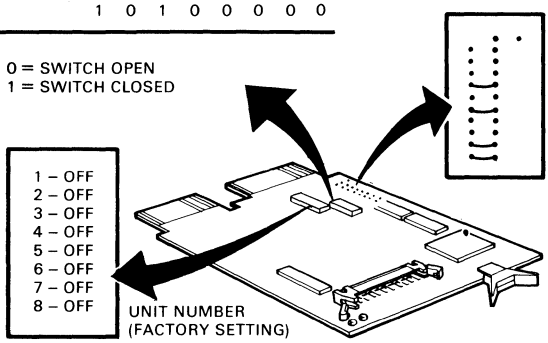


Figure 2-13 TQK50 (M7546) Jumpers and Switches

2.13.1 Unit Number DIP Switch

The unit number DIP switch must be set to correspond to the jumper setting. Table 2-32 shows the unit number switch pack settings and the unit number name.

Table 2-32 Unit Number Switch Pack Settings

Address of Jumper Setting	Unit No. Switch Pack Bits 1	2	3	4	5	6	7	8	Unit Number Name
774500	0	0	0	0	0	0	0	0	MU0 (first TK50)
760nnn	1	0	0	0	0	0	0	0	MU1 (second TK50)
760nnn	0	1	0	0	0	0	0	0	MU2 (third TK50)
760nnn	1	1	0	0	0	0	0	0	MU3 (fourth TK50)

0 = Switch open
1 = Switch closed

2.13.2 Revision Level DIP Switch

Make sure the revision level DIP switch matches the revision level of the module. The revision level is stamped on the back of the module; Table 2-33 shows the switch setting.

Table 2-33 Revision Level Switch Pack

Revision Level No.	Switch Bits 1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0
1 (A)	1	0	0	0	0	0	0	0
2 (B)	0	1	0	0	0	0	0	0
3 (C)	1	1	0	0	0	0	0	0
4 (D)	0	0	1	0	0	0	0	0
5 (E)	1	0	1	0	0	0	0	0

0 = Switch open
1 = Switch closed

2.13.3 TQK50 LEDs

Two LEDs, located on the front of the module, indicate module status. The first (left) LED indicates the status of the module. This LED blinks on (red) and then off when the system is turned on and the module is working properly. The second (right) LED indicates the status of the TK50 tape drive. This LED blinks on (red) and then off when the TK50 tape drive is installed and working properly.

Appendix E, TK50 Extended Diagnostics, provides diagnostic information for field service personnel.

System Options 3

3.1 INTRODUCTION

This chapter describes the options currently supported by the BA23 enclosure. These options, as well as commonly used peripheral devices, are broken down into the following categories:

- Communications
- Mass storage devices
- Backup devices

Each option section includes configuration setups 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.**

3.1.1 Ordering Options

Option order numbers differ depending on whether an option is to be installed at the factory or by the customer as an upgrade after delivery.

A factory-installed system option includes a base module, internal cabling, and I/O filter connectors. For example,

Factory installed: DRV11-BP

To upgrade a system, a base module and the appropriate cabinet kit must be ordered. For example,

Field upgrade:	DRV11-B	Base module
	CK-DRV1B-KB	Cabinet kit

3.1.2 Module Configuration

Each module in a system has a control and status register (CSR) address and an interrupt vector, which must be set when you install the module. The CSR address and the interrupt vector are either fixed or floating (variable).

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 shipped with the correct configuration for use as the first module of that type. If you use two modules of the same type, 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 depends on what other modules are in the system. The ranges are as follows:

- Floating CSR address: (1776)0010–(1776)3776
- Floating interrupt vector: (00000)300–(00000)777

Chapter 4 provides guidelines for determining variable starting 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 starting address of 17761540 is as follows:

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 change bits A12–A2 to set the CSR address within a typical range. A typical switch setting shows 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 is 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

Factory installed:	DEQNA-KP	
Module number:	M7504	
Field upgrade:	DEQNA-M	Base module
	CK-DEQNA-KB	Cabinet kit

The cabinet kit includes a type A filter connector and a cable that connects it to the module.

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 that allows data exchange between computers within a moderate distance (2.8 km or 1.74 mi). The DEQNA can transmit data at a rate of 1.2 Mbytes per second through coaxial cable. It should be the highest priority DMA device on the Q22-Bus, that is, the DMA device nearest to the CPU. For high Ethernet traffic, an additional DEQNA may be installed.

Configure the module by using the three jumpers, W1 through W3 (Figure 3-1).

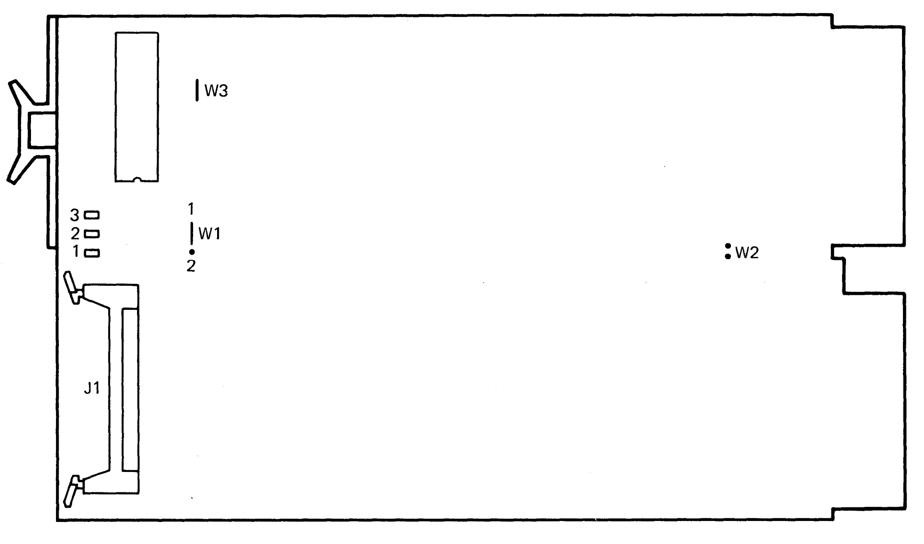


Figure 3-1 DEQNA Module Layout

Jumper 1 (W1) determines the CSR address assignment. If you install two DEQNAs, move jumper W1 of the second DEQNA onto the second DEQNA position. These addresses are fixed.

The interrupt vector is written into a read/write register by software. No hardware configuration is required. Jumpers 2 and 3 are set at the factory and do not need to be changed.

The DEQNA CSR addresses and interrupt vectors are as shown in Table 3-1.

Table 3-1 CSR Addresses and Interrupt Vectors

Module No.	CSR Address	Interrupt Vector
1	17774440	120
2	17774460	Floating

Figure 3-2 shows the internal cabling for the DEQNA module.

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

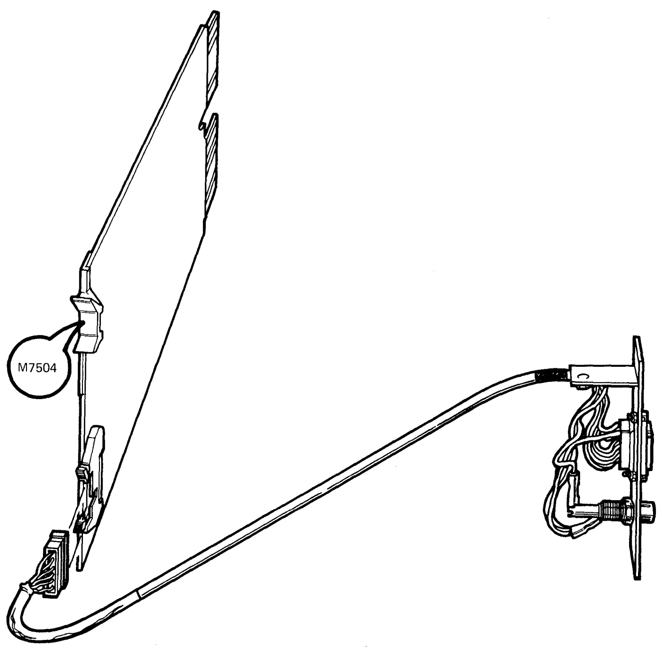


Figure 3-2 DEQNA Internal Cabling

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

3.2.2 DHV11 Asynchronous Multiplexer

Factory installed:	DHV11-AP	
Module number:	M3104	
Field upgrade:	DHV11-M	Base module
	CK-DHV11-AB	Cabinet kit

The cabinet kit includes two type B filter connectors and two cables that connect them to the module.

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, and DF03
- Bell modems: 103, 113, 203C, 202D, and 212

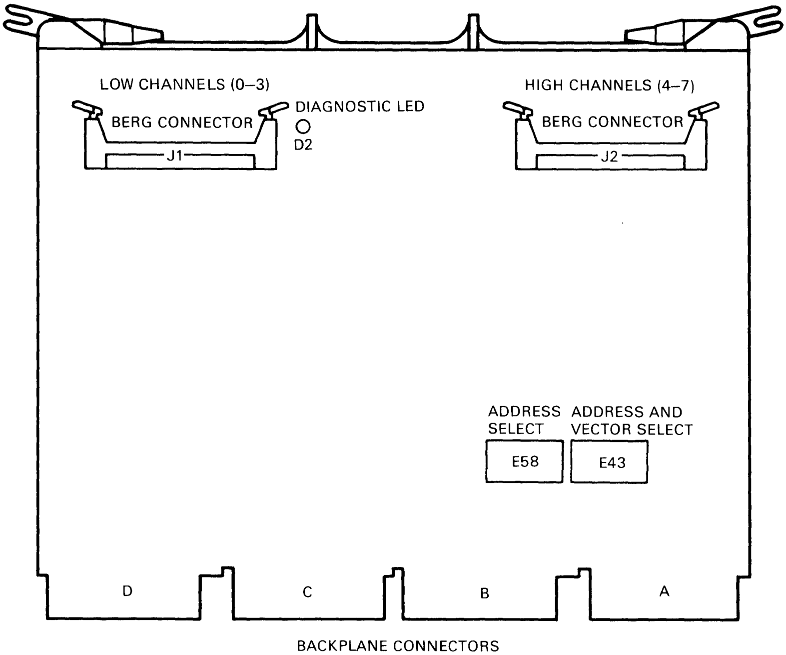


Figure 3-3 DHV11 Module Layout

Set the CSR address and interrupt vector by using the two DIP switches, E58 and E43 (Figure 3-3). The CSR address and interrupt vector are floating. Tables 3-2 and 3-3 show the two settings.

Table 3-2 DHV11 CSR Address

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

1 = Switch on
0 = Switch off

Table 3-3 DHV11 Interrupt Vector

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

1 = Switch closed
0 = Switch open

The actual address and vector of the DHV11 depend on what other modules you install in the system. Chapter 4 provides guidelines for setting the address and vector.

Figure 3-4 shows the cabling setup.

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

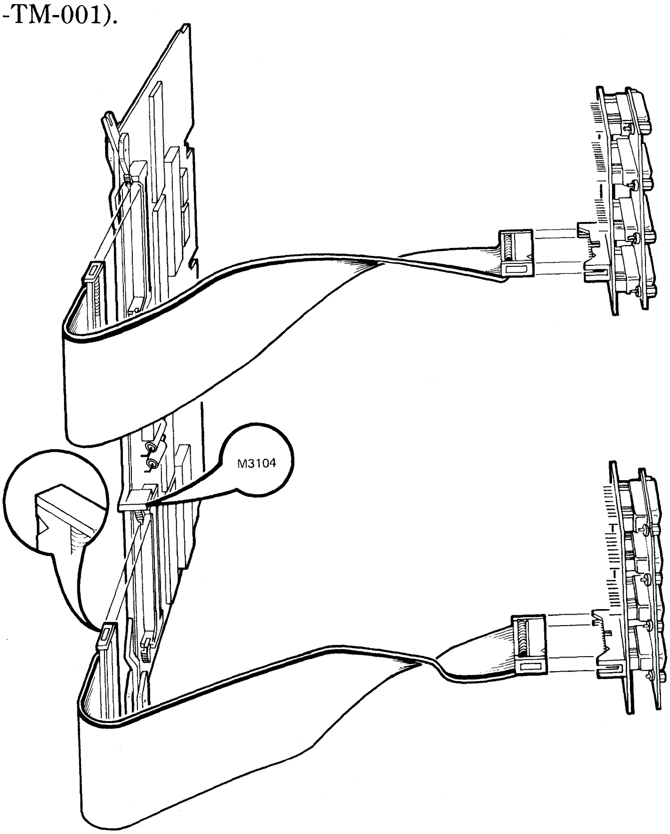


Figure 3-4 DHV11 Internal Cabling

3.2.3 DLVE1 Asynchronous Line Interface

Factory installed:	DLVE1-DP	
Module number:	M8017	
Field upgrade:	DLVE1-M	Base module
	CK-DLVE1-DB	Cabinet kit

The cabinet kit includes a type A filter connector and a cable that connects the module to the connector. The external BC05C-X (X = length in feet) modem cable must be ordered separately.

The DLVE1 (formerly DLV11-E) is a dual-height module that connects a Q-Bus to a serial communications line. The DLVE1 (Figure 3-5) offers the following features:

- Full modem control – Bell 103, 113, 202C, 202D, and 212 modem compatible
- Jumper or program-selectable baud rates
- Split transmit and receive baud rates
- Provisions for user-supplied external clock inputs for baud rate control

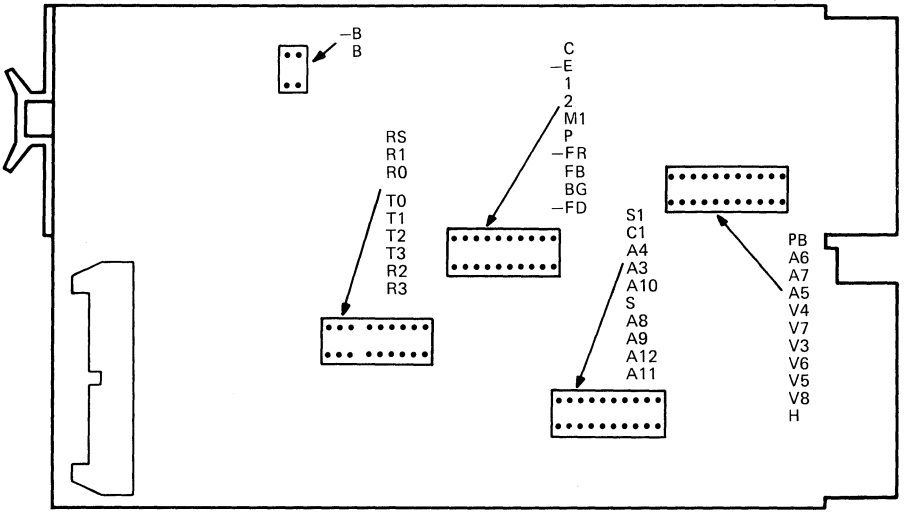


Figure 3-5 DLVE1 Module Layout

Configure the module using the jumpers shown in Figure 3-5. The CSR addresses for two DLVE1 modules are fixed. Table 3-4 lists the settings. The interrupt vector is floating. Table 3-5 shows the factory setting of the interrupt vector.

Table 3-4 DLVE1 Fixed CSR Addresses

Module Number	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits (Jumpers)
1	17775610	I	I	R	I	I	I	R	R	R	I	(Factory*)
1	17776500	I	I	I	R	I	R	I	R	R	R	(1st option)
2	17776510	I	I	I	R	I	R	I	R	R	I	(2nd option)

I = Inserted = 1
R = Removed = 0

* The factory setting is for use with a modem.

Table 3-5 DLVE1 Interrupt Vector

Factory Setting	V8	V7	V6	V5	V4	V3	← Vector Bits (Jumpers)
300	R	I	I	R	R	R	

I = Inserted = 1
R = Removed = 0

NOTE
The actual setting of the interrupt vector of the DLVE1 depends on the other modules in the system. Chapter 4 provides guidelines for determining the interrupt vector.

Table 3-6 lists the factory setting of the other jumpers on the module.

Table 3-6 DLVE1 Jumper Factory Setting

Jumper Settings

R0	I	(Note 1)	BG	I		H	R
R1	R	(Note 1)	P	R		B	R
R2	I	(Note 1)	E	R		-B	R
R3	I	(Note 1)	1	R		FD	R
			2	R		RS	I
T0	I	(Note 3)	PB	R	(Note 2)	FB	R
T1	R	(Note 3)	C		(Note 4)	EF	R
T2	R	(Note 3)	C1	I	(Note 4)	MT	R
T3	R	(Note 3)	S	R	(Note 5)	M	R
S1	R	(Note 3)	S1	R	(Note 5)	M1	R

I = Inserted
R = Removed

Notes
1. Sets the receiver and transmitter baud rates to 110 baud (common speed). See Table 3-7 for other settings.
2. Programmable baud rate is disabled.
3. Sets transmitter baud rate to 9600 if split speed is used.
4. Common speed is enabled.
5. Split speed is disabled.

Table 3-7 lists the jumper settings required for other baud rates. Set transmit and receive jumpers separately when split speed is enabled.

Table 3-7 DLVE1 Baud Rate Selection

Receive Jumpers → / Transmit Jumpers →	R3 / T3	R2 / T2	R1 / T1	R0 / T0	Baud Rate
	I	I	I	I	50
	I	I	I	R	75
	I	I	R	I	110
	I	I	R	R	134.5
	I	R	I	I	150
	I	R	I	R	300
	I	R	R	I	600
	I	R	R	R	1200
	R	I	I	I	1800
	R	I	I	R	2000
	R	I	R	I	2400
	R	I	R	R	3600
	R	R	I	I	4800
	R	R	I	R	7200
	R	R	R	I	9600

Figure 3-6 shows the internal cabling.

For further information, refer to the *DLV11-E and DLV11-F Asynchronous Line Interface User's Manual* (EK-DLV11-OP). This describes the same module, but uses the old name.

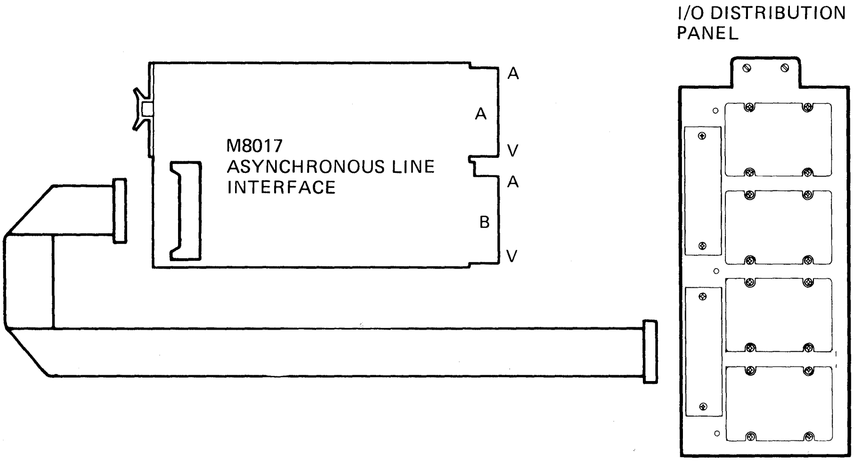


Figure 3-6 DLVE1 Internal Cabling

3.2.4 DLVJ1 Asynchronous Interface

Factory installed:	DLVJ1-LP	
Module number:	M8043	
Field upgrade:	DLVJ1-M	Base module
	CK-DLV11-LB	Cabinet kit

The cabinet kit contains a type B filter connector and a cable that connects it to the module.

The DLVJ1 (formerly DLV11-J) is a dual-height module that connects a Q-Bus to up to four Asynchronous serial lines, for data communications. The serial lines must conform to EIA and CCITT standards. The DLVJ1 transmits and receives data from a peripheral device over EIA "data leads only" lines that do not use control lines. Data is moved under program control along the four independent serial lines.

Configure the DLVJ1 module by using the jumpers shown in Figure 3-7. The CSR address for two DLVJ1 modules are fixed. Table 3-8 lists the factory setting for the CSR addresses.

Table 3-8 DLVJ1 CSR Address

Module Number	Starting 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 = Jumper removed = 0
x-h = Jumper inserted between pins x and h
0-x = 0
1-x = 1

The interrupt vector is floating. The factory configuration is shown in Table 3-9.

Table 3-9 DLVJ1 Interrupt Vector

Factory Setting	V8	V7	V6	V5	V4	V3	←	Vector Bits
300	–	x-h	x-h	0-x	–	–		

x-h = Jumper inserted between pins x and h = 1
0-x = Jumper inserted between 0 and h = 0

> **NOTE**
> **The actual interrupt vector depends on the other modules in the system. Chapter 4 provides guidelines for determining the interrupt vector.**

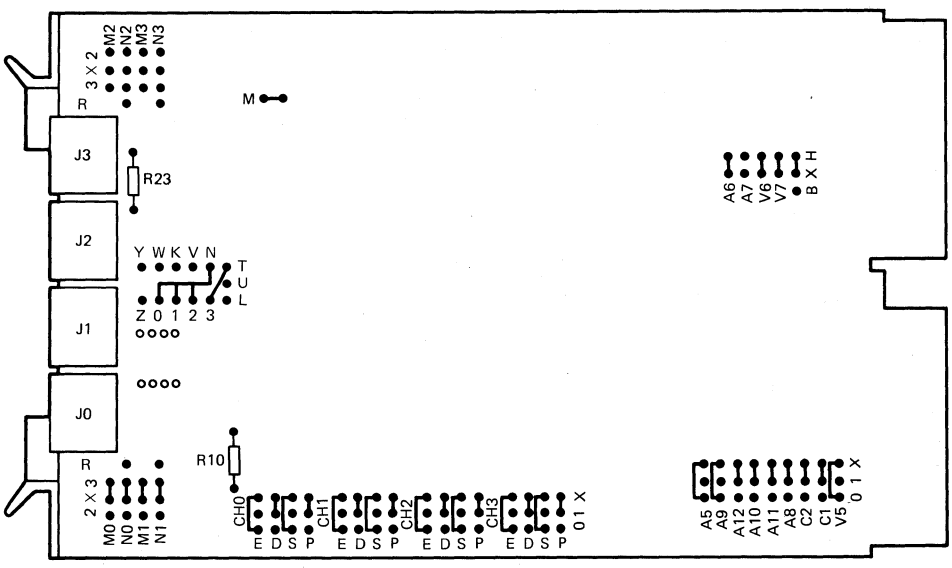


Figure 3-7 DLVJ1 Module Layout

Figure 3-8 shows the internal cabling.

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

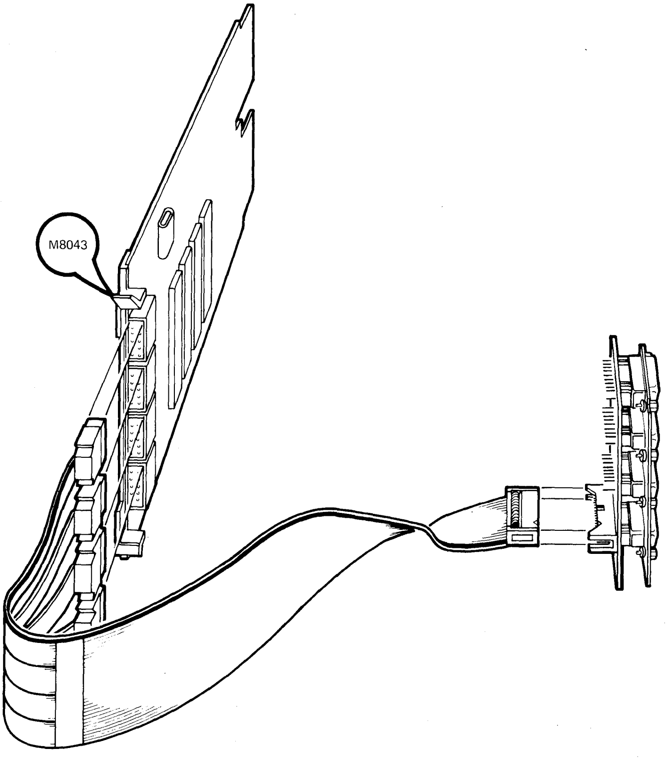


Figure 3-8 DLVJ1 Internal Cabling

3.2.5 DMV11 Synchronous Controller

The DMV11 is a quad-height module that supports:

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

It is available in four system options, each of which has a different interface capability. The option you choose depends on the interface requirements of your system. Table 3-10 lists the four system options and their corresponding upgrade components. Table 3-11 lists the interface for each system option, and the appropriate external cable.

Table 3-10 DMV11 Versions

System Option	Upgrade (Base Module + Cabinet Kit)	Model Number	Module Connector	I/O Insert Type
DMV11-AP	DMV11-M + CK-DMV11-AB	M8053	J2 (of 2)	1 × B (2 × 3)
DMV11-BP	DMV11-M + CK-DMV11-BB	M8053	J1 (of 2)	1 × A (1 × 4)
DMV11-CP	DMV11-M + CK-DMV11-CB	M8064	J1 (of 1)	1 × B (2 × 3)
DMV11-FP	DMV11-M + CK-DMV11-FB	M8053	J2 (of 2)	1 × B (2 × 3)

Table 3-11 DMV11 Interfaces

System Option	Interface	External Cable
DMV11-AP	RS-232-C/CCITT V.28	BC22E or BC22F
DMV11-BP	CCITT V.35/DDS	BC17E*
DMV11-CP	Integral modem	BC55S or BC55T
DMV11-FP	RS-423-A/CCITT V.24	BC55D

* Cable included in the -BA cabinet kit

The -BP and -CP cabinet kits contain type A filter connectors and a cable that connects them to the module.

The DMV11-CP, the version with the integral modem, is an M8064 module. All other versions are M8053 modules.

Configure the CSR address and interrupt vector of the DMV11 by using the switches shown in Figure 3-9. The CSR address and interrupt vector are both floating. Tables 3-12 and 3-13 show the factory setting.

Table 3-12 DMV11 CSR Address

	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	←Add. Bits
	E53 (M8053)								E54 (M8053)		
	E58 (M8064)								E59 (M8064)		
Factory Setting	8	7	6	5	4	3	2	1	2	1	← Switches
177760340	0	0	0	0	0	1	1	1	0	0	

1 = On = Closed
0 = Off = Open

Table 3-13 DMV11 Interrupt Vector

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

1 = On = Closed
0 = Off = Open

NOTE
The actual setting depends on the other modules in the system. Chapter 4 provides guidelines for setting the CSR address and interrupt vector.

Figure 3-10 shows the internal cabling setup for the M8064 and M8053 modules.

For jumper settings of various modems and additional information, refer to the *DMV11 Synchronous Controller Technical Manual* (EK-DMV11-TM-001).

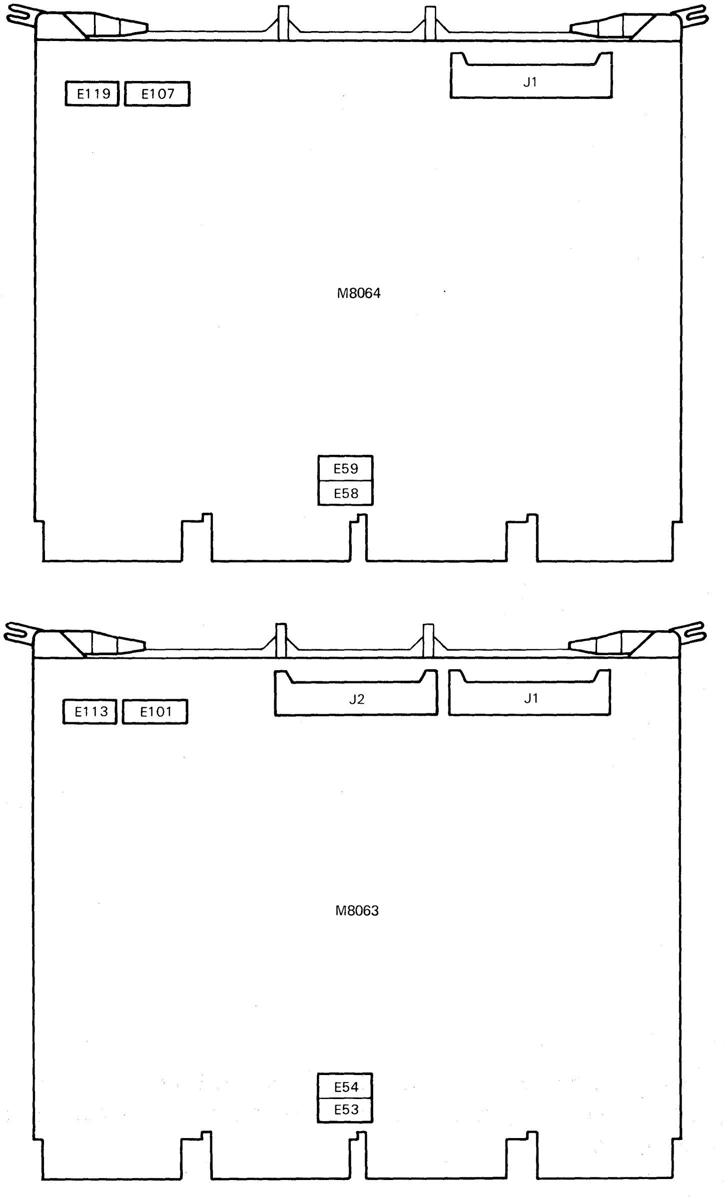


Figure 3-9 DMV11 Module Layout

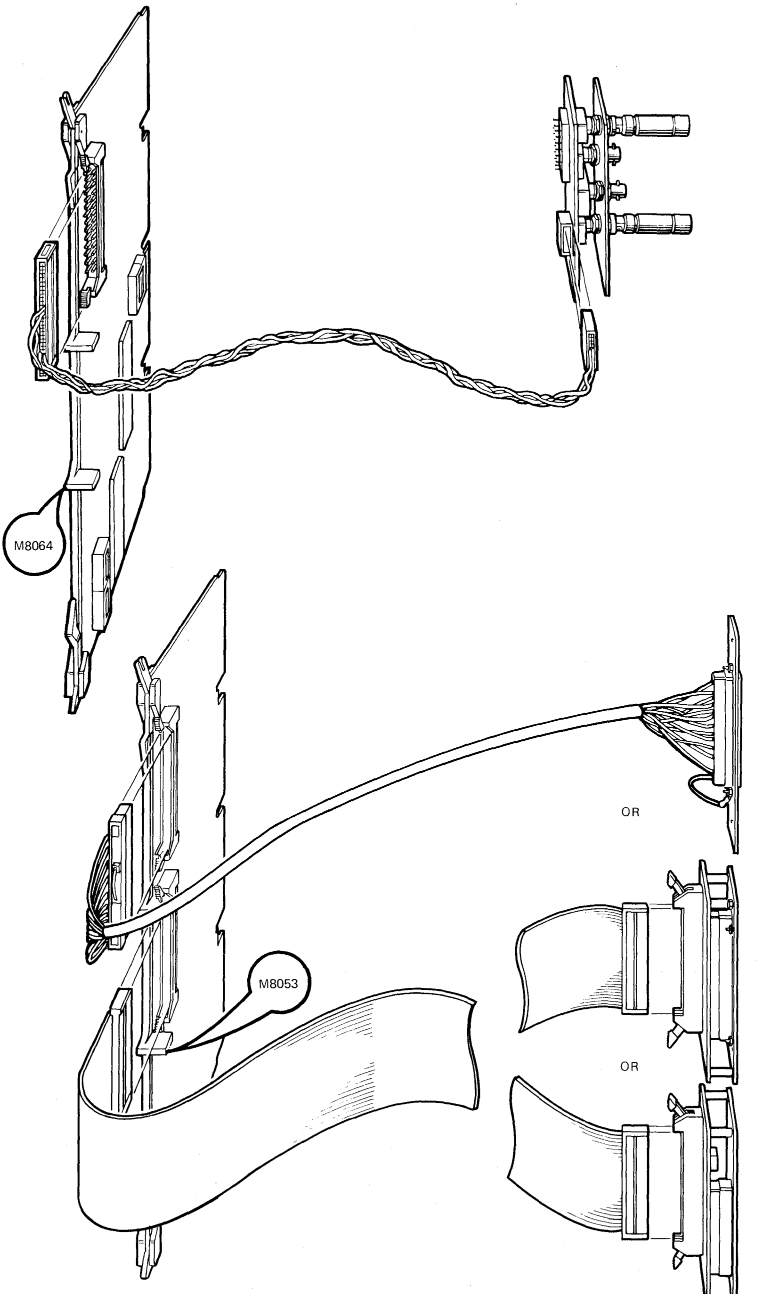


Figure 3-10 DMV11 Internal Cabling

3.2.6 DPV11 Synchronous Interface

Factory installed:	DPV11-AP	
Module number:	M8020	
Field upgrade:	DPV11-M	Base module
	CK-DPV11-AB	Cabinet kit

The cabinet kit includes a type A filter connector and a cable that connects it to the the module.

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 for communication protocols that are bit-oriented, such as Synchronous Data Link Control (SDLC).

Configure the CSR address and interrupt vector of the DPV11 using the jumpers shown in Figure 3-11.

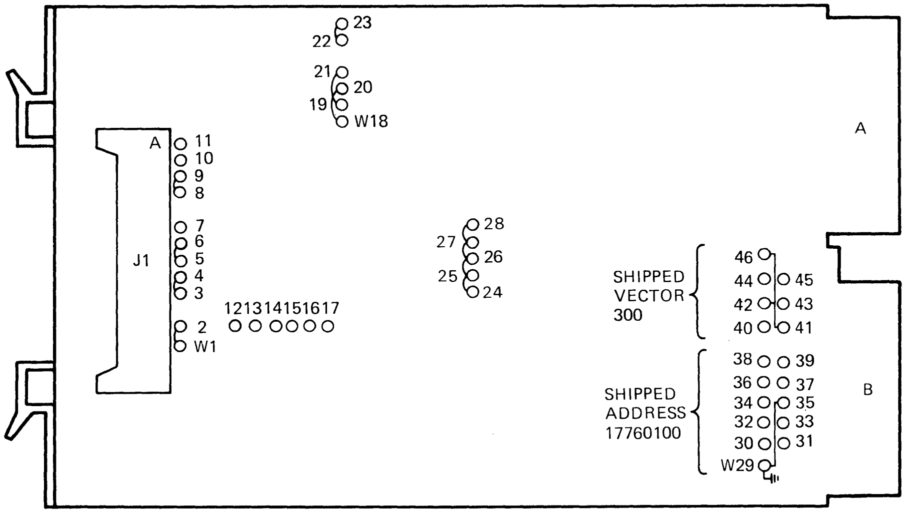


Figure 3-11 DPV11 Module Layout

The CSR address and interrupt vector are both floating. Tables 3-14 and 3-15 show the factory setting.

Table 3-14 DPV11 CSR Address

Factory 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	R	R	R	R	R	R	R	R	R	I	

I = Jumper inserted between pin Wxx and pin 29 (ground)
R = Jumper removed

Table 3-15 DPV11 Interrupt Vector

Factory Setting	V8 W34	V7 W42	V6 W41	V5 W40	V4 W44	V3 W45	← Vector Bits ← Pin
300	R	I	I	R	R	R	

I = Jumper inserted between pin Wxx and pin 46 (ground)
I = 1
R = Jumper removed = 0

NOTE
The actual settings depends on the other modules in the system. Chapter 4 provides guidelines for setting the CSR address and interrupt vector.

Figure 3-12 shows the internal cabling.

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

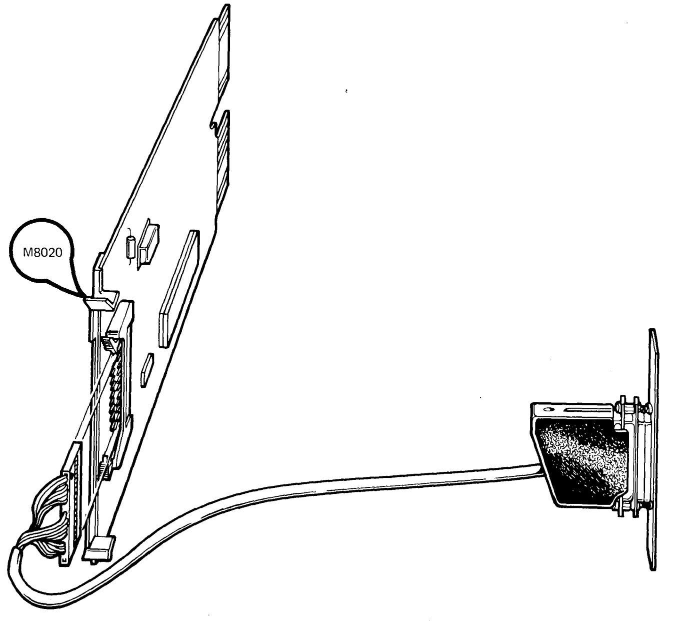


Figure 3-12 DPV11 Internal Cabling

3.2.7 DRV11 Parallel-Line Interface

Factory installed:	DRV11-LP	
Module number:	M7941	
Field upgrade:	DRV11	Base module
	CK-DRV1B-KB	Cabinet kit

The cabinet kit includes two type A filter connectors and two cables that attach them to the module.

The DRV11 (Figure 3-13) is a dual-height module that provides 16 I/O lines, corresponding to the 16 data lines of the Q22-Bus.

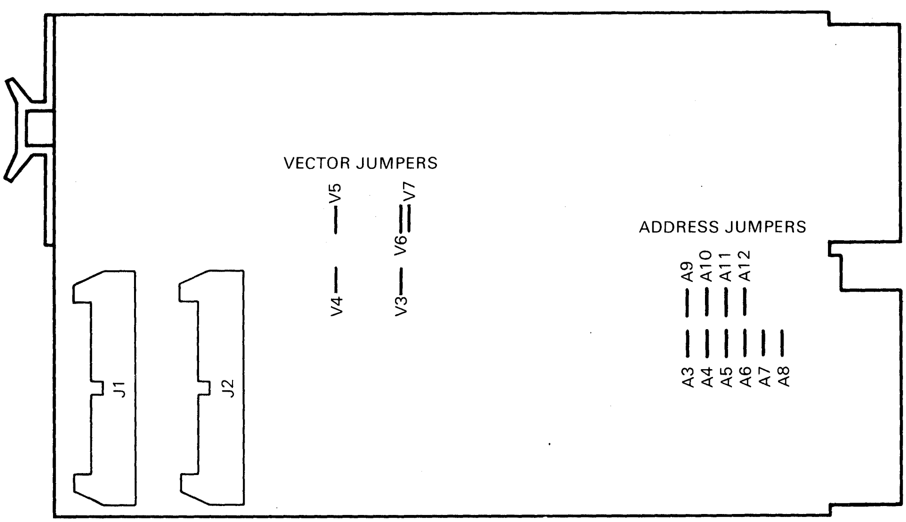


Figure 3-13 DRV11 Module Layout

The CSR address of two DRV11 modules are fixed and are set using jumpers A12 to A3 (Figure 3-13). Table 3-16 lists the factory jumper configuration.

Table 3-16 DRV11 CSR Address

Module Number	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits (Jumpers)
1	17767770	I	R	R	R	R	R	R	R	R	R	← factory
2	17767760	I	R	R	R	R	R	R	R	R	I	

I = Inserted = 0
R = Removed = 1

The interrupt vector is floating. Table 3-17 shows the factory configuration.

Table 3-17 DRV11 Interrupt Vector

Factory Setting	V8	V7	V6	V5	V4	V3	← Vector Bits (Jumpers)
300	I	R	R	I	I	I	

I = Inserted = 0
R = Removed = 1

NOTE
The actual setting depends on the other modules in the system. Chapter 4 provides guidelines for setting the interrupt vector.

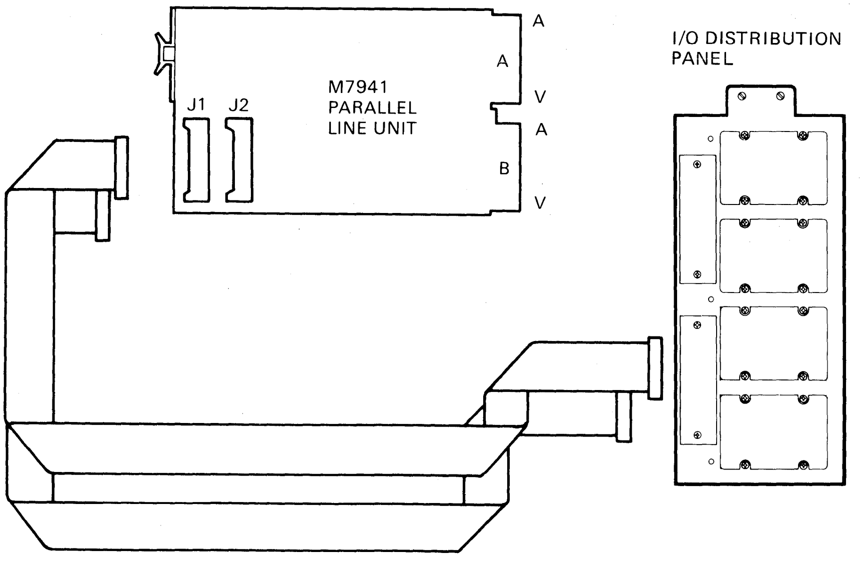


Figure 3-14 DRV11 Internal Cabling

Figure 3-14 shows the internal cabling layout.

For further information, refer to the *DRV11 User's Manual* (EK-ADV11-OP).

3.2.8 DRV11-B DMA Interface

Factory installed:	DRV11-BP	
Module number:	M7950	
Field upgrade:	DRV11-B	Base module
	CK-DRV1B-KB	Cabinet kit

The cabinet kit includes two type A filter connectors and two cables that connect them to the module.

The DRV11-B is a quad-height module that supports DMA. This module makes it possible to transfer data directly between system memory and an external I/O device. The module is programmed by the CPU to move variable length blocks of 8- or 16-bit data words to or from specified locations in the system memory.

NOTE
The DRV11-B is an 18-bit device. It can only provide DMA to the first 256 Kbytes of memory in a system.

Configure the DRV11-B CRS address and interrupt vector using the DIP switches S2 and S1, respectively (Figure 3-15).

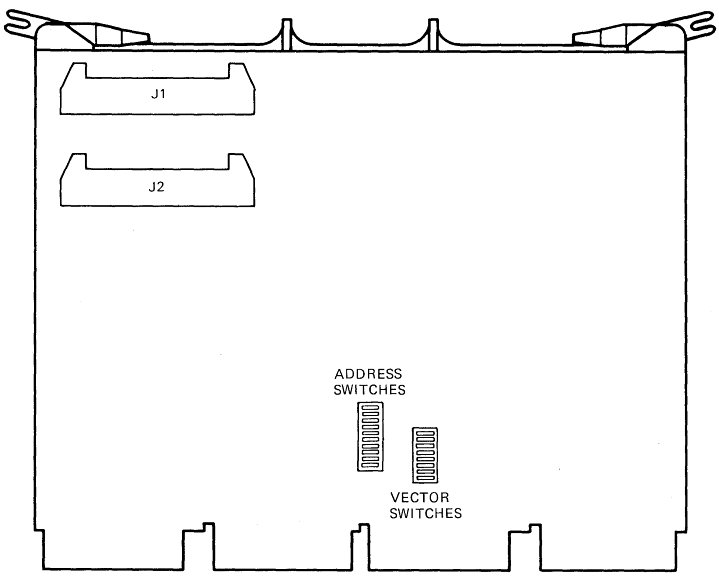


Figure 3-15 DRV11-B Module Layout

The CSR address of two DRV11-B modules are fixed. Table 3-18 lists the settings.

Table 3-18 DRV11-B CSR Address

		A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits
Module Number	**Starting Address**	**S2 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**← Switches**
1	772410	1	0	1	0	1	0	0	0	0	1	(factory)
2	772420	1	0	1	0	1	0	0	0	1	0	

1 = On = Closed
0 = Off = Open

The interrupt vector for the first DRV11-B is fixed. If you install a second DRV11-B, it has a floating vector. Chapter 4 provides guidelines for setting the floating vector. Table 3-19 lists the interrupt vector settings.

Table 3-19 DRV11-B Interrupt Vector

		V8	V7	V6	V5	V4	V3	V2	← Vector Bits
Module Number	**Interrupt Vector**	**S1 2**	**3**	**4**	**5**	**6**	**7**	**8**	**← Switches***
1	124	0	0	1	0	1	0	1	(Factory)
2	floating								

0 = Open = Off
1 = Closed = On

* Switch 1 must be open.

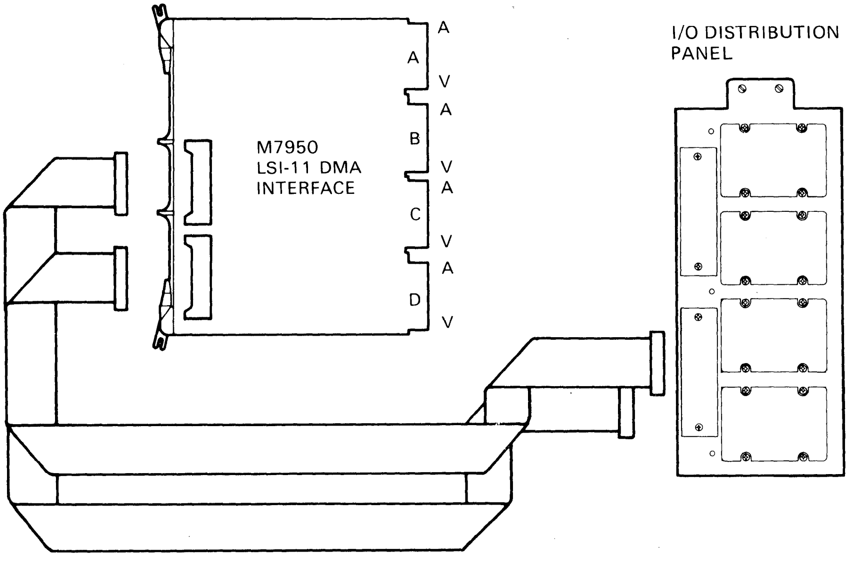


Figure 3-16 DRV11-B Internal Cabling

Figure 3-16 shows the internal cabling.

For further information, refer to the *DRV11-B Interface User's Manual* (EK-DRV1B-OP-001).

3.2.9 DRV11-J High-Density Parallel Interface

Factory installed:	DRV11-JP	
Module number:	M8049	
Field upgrade:	DRV11-J	Base module
	CK-DRV1J-KB	Cabinet kit

The cabinet kit contains 2 type A 50-pin connectors and two cables that connect them to the module.

The DRV11-J (Figure 3-17) 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.

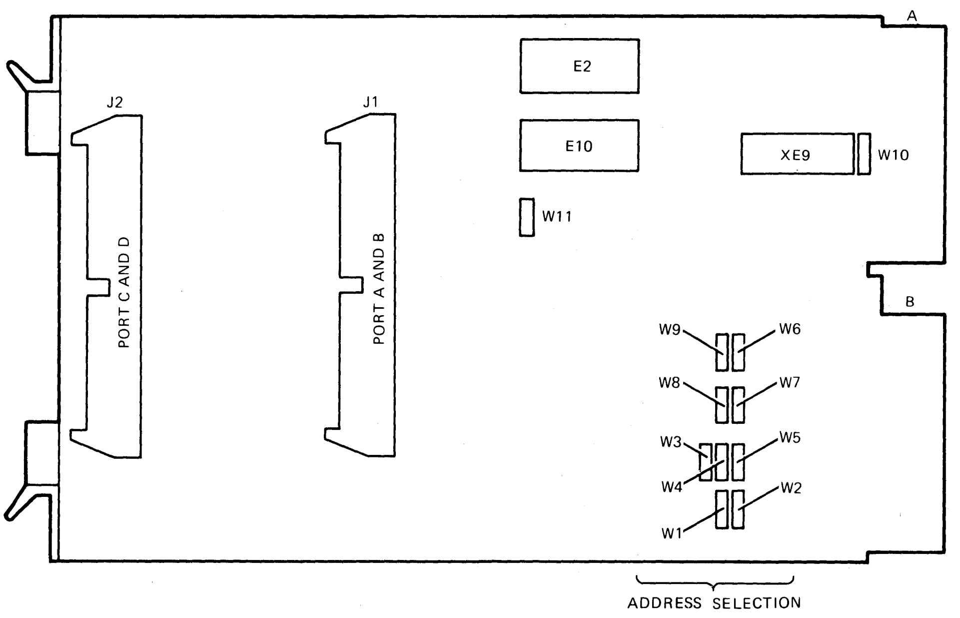


Figure 3-17 DRV11-J Module Layout

The interrupt vector is set under program control, eliminating the need for jumper-defined vectors. The CSR address of the module is fixed and is set with jumpers W1 through W9. Table 3-20 lists the factory configuration for the CSR address.

Table 3-20 DRV11-J CSR Address

		A12	A11	A10	A9	A8	A7	A6	A5	A4	← Bus Lines
Module Number	**Starting Address**	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**	**W7**	**W8**	**W9**	**← Jumper**
1	17764160	R	I	R	R	R	R	I	I	I	x
2	17764140	R	I	R	R	R	R	I	I	R	x

I = Installed = 1
R = Removed = 0

Figure 3-18 shows the internal cabling layout for this module.

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

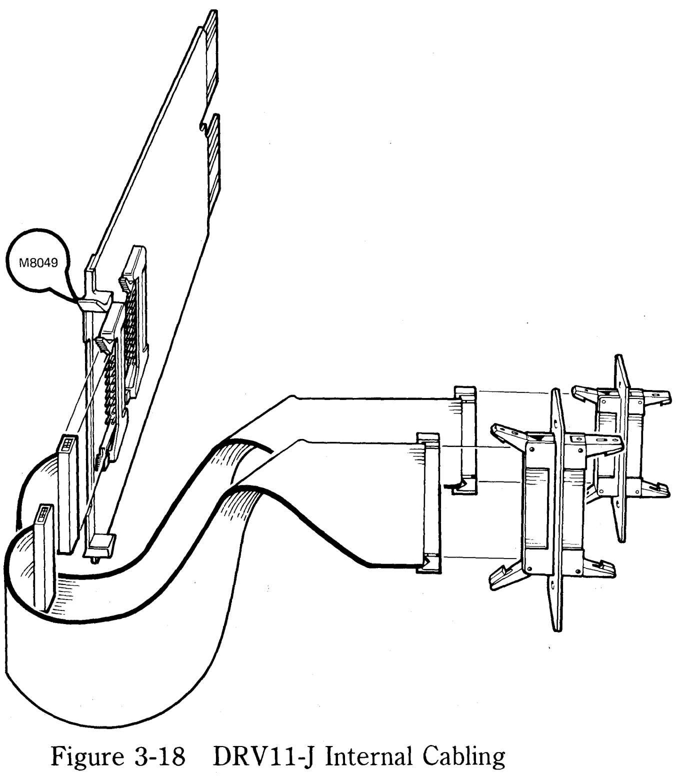


Figure 3-18 DRV11-J Internal Cabling

3.2.10 DUV11 Synchronous Serial-Line Interface

Factory installed:	DUV11-AP	
Module number:	M7951	
Field upgrade:	DUV11-M	Base module
	CK-DUV11-AB	Cabinet kit

The cabinet kit includes a type A filter connector and a cable that connects it to the module.

The DUV11 (Figure 3-19) is a quad-height module that is used to connect any Q-Bus CPU to a Bell 201 synchronous modem or equivalent. It has the following features:

- Is designed for applications using character-oriented protocols.
- Controls a modem for half- or full-duplex operation.
- Transmits data at rates up to 9600 baud per second.
- Interfaces synchronous and asynchronous communications data.

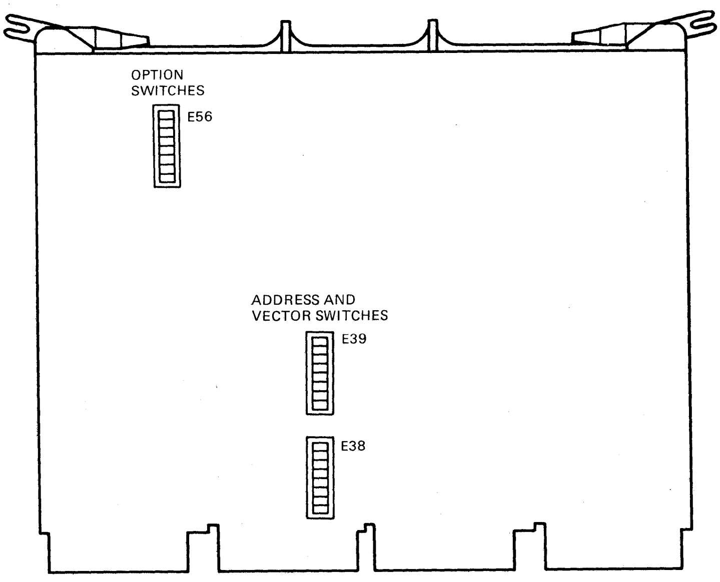


Figure 3-19 DUV11 Module Layout

The CSR address and interrupt vector of the DUV11 are both floating and are configured using DIP switches E38 and E39 (Figure 3-19). Tables 3-21 and 3-22 list the factory settings.

Table 3-21 DUV11 CSR Address

	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits
Factory	E38								E39		
Setting	1	2	3	4	5	6	7	8	1	2	← Switches
17760010	0	0	0	0	0	0	0	0	0	1	

1 = Switch on
0 = Switch off

Table 3-22 DUV11 Interrupt Vector

	V8	V7	V6	V5	V4	V3	← Vector Bits
Factory	E39						← Switches
Setting	3	4	5	6	7	8	
440	1	0	0	1	0	0	

1 = Switch on
0 = Switch off

> **NOTE**
> **The actual setting depends on the other modules in the system. Chapter 4 provides guidelines for setting the CSR address and interrupt vector.**

Figure 3-20 shows the internal cabling layout for the module.

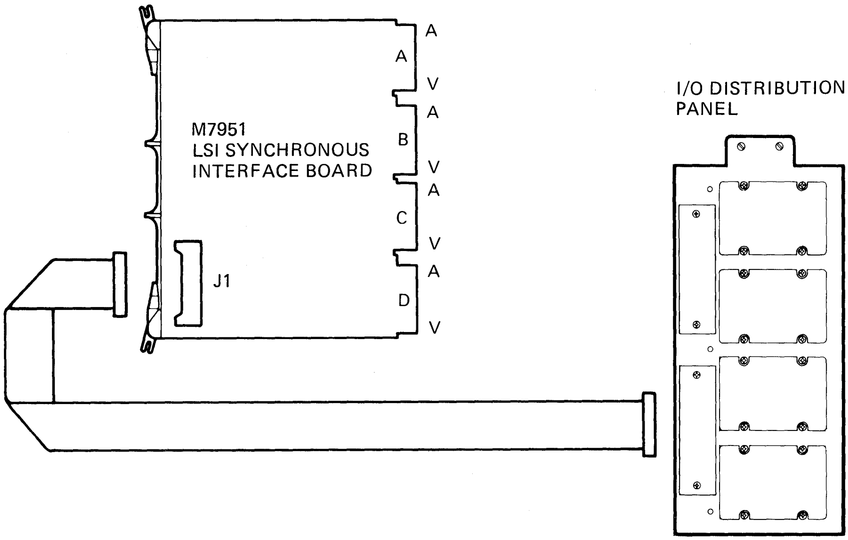


Figure 3-20 DUV11 Internal Cabling

For further information, refer to the *DUV11 Synchronous Serial Line Interface Technical Manual* (EK-DUV11-TM-001).

3.2.11 DZQ11 Asynchronous Multiplexer - (Four Lines)

Factory installed:	DZQ11-M	
Model number:	M3106	
Upgrade:	DZQ11-M	Base module
	CK-DZQ11-DB	Cabinet kit

The cabinet kit includes one type B filter connector and a cable that connects it to the module.

The DZQ11 (Figure 3-21) is a dual-height module that connects the Q22-Bus to up to four asynchronous serial lines. It includes the following features:

- Conforms to the RS-232-C and RS423-A interface standards.
- Permits dial-up (auto-answer) operation with modems using full-duplex operations such as Bell models 103, 113, 212, or equivalent.

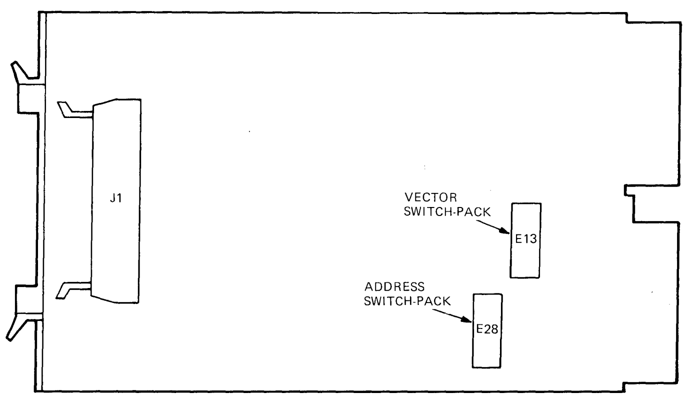


Figure 3-21 DZQ11 (M3106) Module Layout

Configure the DZQ11 using DIP switches E28 and E13. The CSR address and interrupt vector of the DZQ11 are both floating. Tables 3-23 and 3-24 list the factory settings.

Table 3-23 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**	**← Add. Bits ← Switches**
17760010	0	0	0	0	0	0	0	0	0	1	
17760100	0	0	0	0	0	0	1	0	0		

0 = Switch on
1 = Switch off

Table 3-24 DZQ11 Interrupt Vector

Vector Setting	**V8 E13 1**	**V7 2**	**V6 3**	**V5 4**	**V4 5**	**V3 6**	**← Vector Bits ← Switches**
300	0	1	1	0	0	0	
310	0	1	1	0	0	1	

1 = Switch on
0 = Switch off

E13 switch 7 is not used. E13 switch 8 must be on, and E13 switch 9 and 10 must be off for normal operation.

Figure 3-22 shows the internal cabling for the DZQ11.

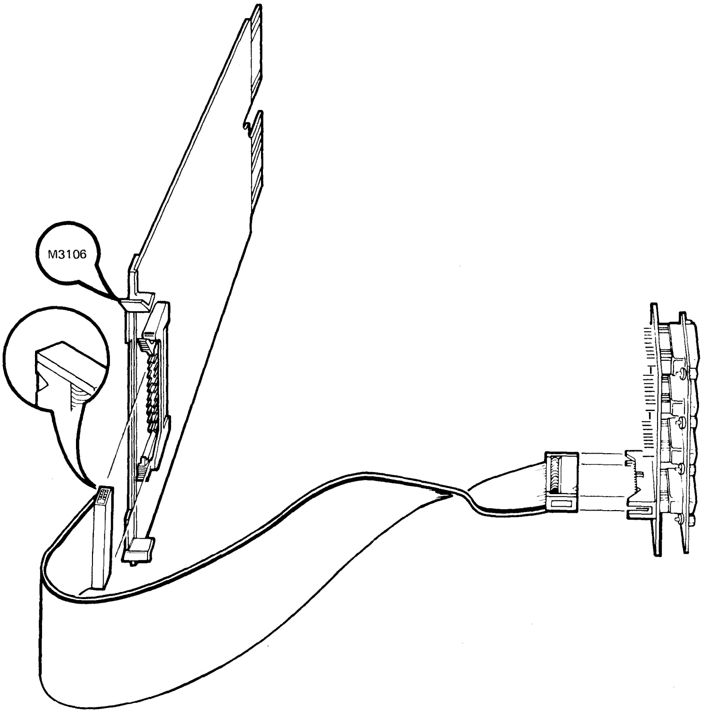


Figure 3-22 DZQ11 (M3106) Internal Cabling

3.2.12 DZV11 Asynchronous Multiplexer

Factory installed:	DZV11-DP	
Model number:	M7957	
Field upgrade:	DZV11-M	Base module
	CK-DZV11-DB	Cabinet kit

The cabinet kit includes one type B filter connector and a cable that connects it to the module.

The DZV11 (Figure 3-23) is a quad-height module that connects a Q22-Bus to up to four asynchronous serial-lines. It includes the following features:

- Conforms to the RS-232 interface standard.
- Permits dial-up (auto-answer) operation with modems using full-duplex operations.

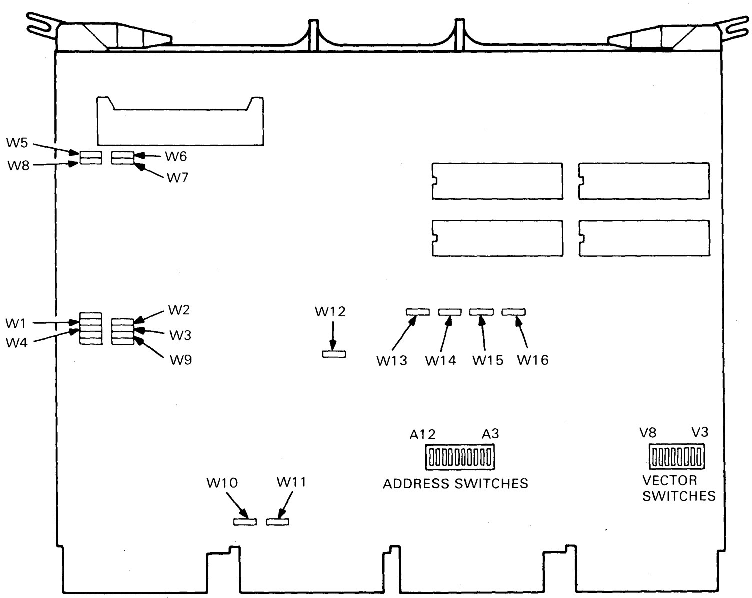


Figure 3-23 DZV11 Module Layout

Configure the DZV11 using 16 jumpers and 2 DIP switches. The CSR address and interrupt vector of the DZV11 are both floating. Tables 3-25 and 3-26 list the factory settings.

Table 3-25 DZV11 CSR Address

CRS Address	A12 E30 1	A11 2	A10 3	A9 4	A8 5	A7 6	A6 7	A5 8	A4 9	A3 10	← Add. Bits ← Switches
17760100	0	0	0	0	0	0	1	0	0	0	
17760110	0	0	0	0	0	0	1	0	0	1	

1 = Switch on
0 = Switch off

Table 3-26 DZV11 Interrupt Vector

Vector Setting	V8 E2 1	V7 2	V6 3	V5 4	V4 5	V3 6	← Vector Bits ← Switches
300	0	1	1	0	0	0	
310	0	1	1	0	0	1	

1 = Switch on
0 = Switch off

> **NOTE**
> **The actual settings depend on the other modules in the system. Chapter 4 provides guidelines for setting floating CSR addresses and interrupt vectors.**

Figure 3-24 shows the internal cabling layout for the module.

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

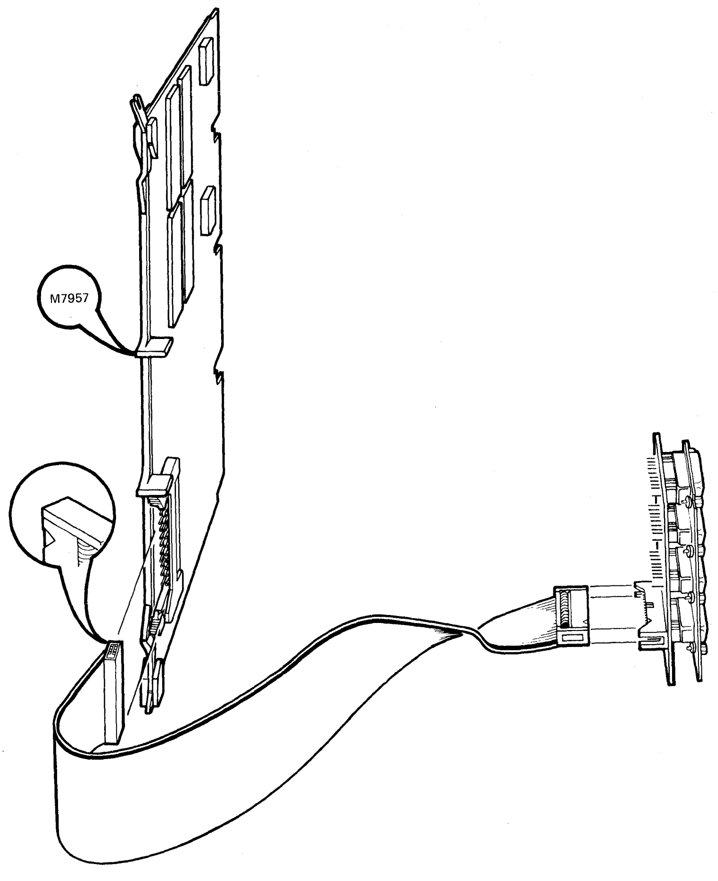


Figure 3-24 DZV11 Internal Cabling

3.2.13 LPV11 Interface Module

Factory installed:	LPV11-AP (includes LP25 lineprinter) LPV11-BP LPV11-EP (includes LP26 lineprinter) LPV11-FP
Module number: (controller)	M8027
Field upgrade:	LPV11-A (base module for LP25) LPV11-B LPV11-E (base module for LP26) LPV11-F
	CK-LPV1A-KA Cabinet kit

The LPV11 is a dual-height module that controls the flow of data between the Q22-Bus and a lineprinter. It is configured using jumpers (Figure 3-25).

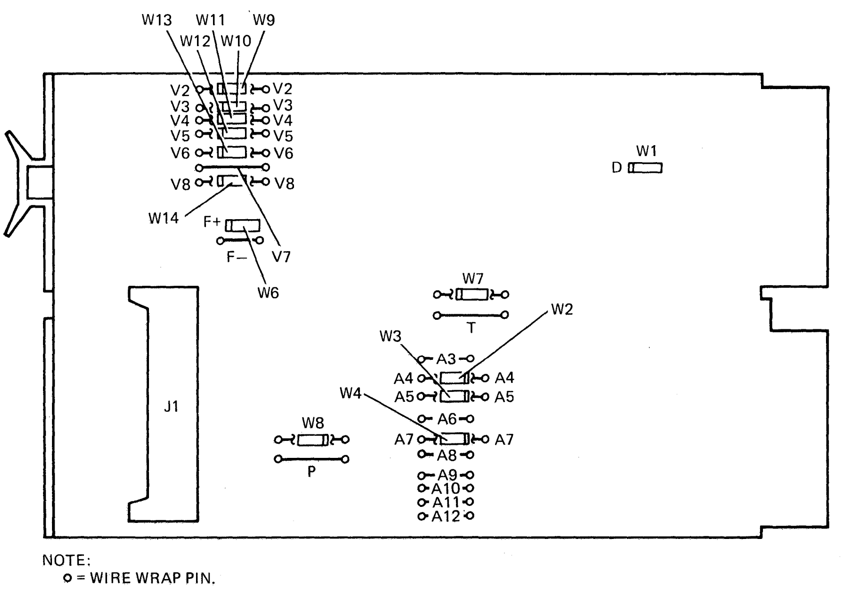


Figure 3-25 LPV11 Module Layout

The CSR address and interrupt are both fixed. Tables 3-27 and 3-28 list the factory configuration. Table 3-29 lists the factory setting of the other jumpers on the module. Figure 3-26 shows the internal cabling setup.

Table 3-27 LPV11 CSR Address

Factory Setting	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits (Jumpers)
17777514	R	R	R	R	R	I	R	I	I	R	

I = Installed = 0
R = Removed = 1

Table 3-28 LPV11 Interrupt Vector

Factory Setting	V8 W14	V7 V7	V6 W13	V5 W12	V3 W10	V2 W9	← Add. Bits Jumper
200	I	R	I	I	I	I	I

I = Installed = 0
R = Removed = 1

Table 3-29 LPV11 Jumper Configuration

Jumper	State
D	I
W7	I
P	R
W8	I
F-	R
T	R

R = Removed
I = Installed

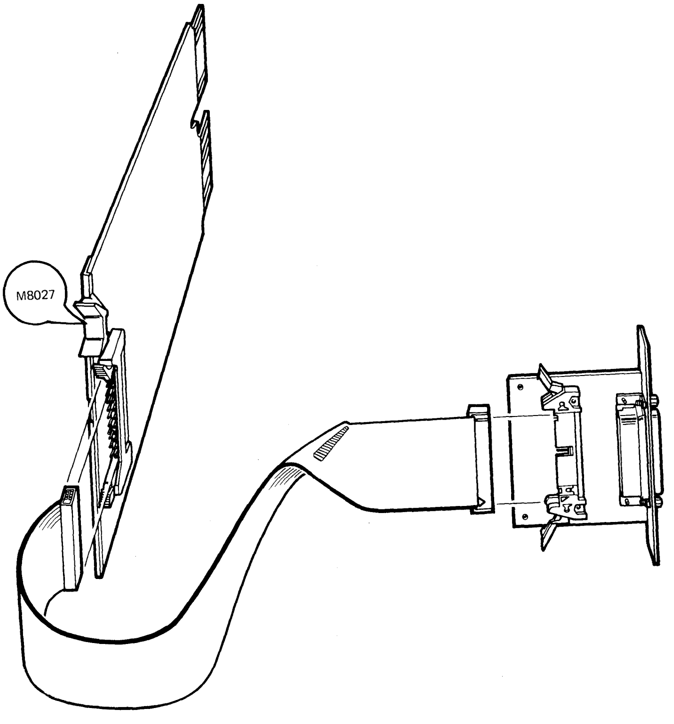


Figure 3-26 LPV11 Internal Cabling

3.3 MASS STORAGE

3.3.1 RC25 Disk Subsystem

The RC25, a standalone mass storage device, has a capacity of 52 Mbytes. It contains two 8-inch, double-sided disks. One disk is fixed and one is removable. Each disk has a capacity of 26 Mbytes. The same spindle drives both disks.

Factory installed:	RQC25-AA	
Field upgrade:	RC25-DA KLESI-QA	(Tabletop drive with cartridge and cabling kit)

The KLESI-QA cabling kit provides the connection between the disk drive and the enclosure. It contains one type A filter connector, a cable that connects it to the controller module (M7740), and a round cable that connects the RC25 to the I/O distribution panel.

Figure 3-27 shows the cabling for the RC25 disk subsystem.

The CSR address of the M7740 adapter module is fixed and is configured using a DIP switch, E58 (Figure 3-28). Table 3-32 lists the factory setting. The interrupt vector is set under program control.

Table 3-30 M7740 CSR Address

	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits
Factory	E44										
Setting	1	2	3	4	5	6	7	8	9	10	← Switches
17772150	1	0	1	0	0	0	1	1	0	1	

1 = Switch on
0 = Switch off

NOTE
The M7740 and M8639 (RQDX controller) are both MSCP devices. All MSCP devices have a CSR address of 17772150. If you install more than one MSCP device in a system, you must change the CSR address of one of them. Set the CSR address of the second device within the floating range. The new address of the second device must be entered into the KDJ11-BC translation table (see Section 2.5.3).

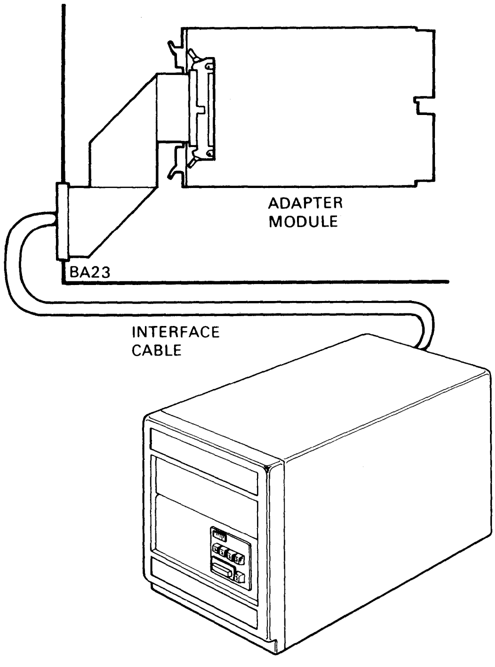


Figure 3-27 RC25 Disk Subsystem

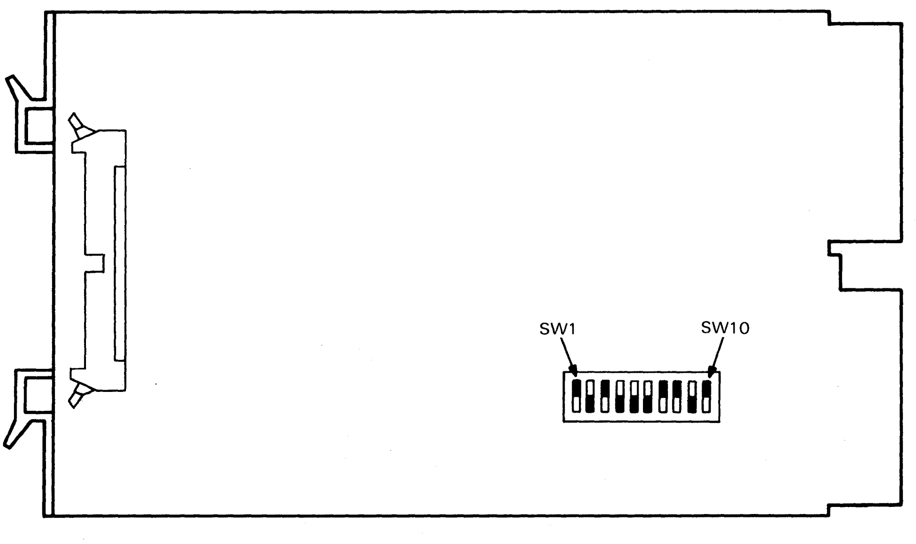


Figure 3-28 M7740 Module Layout

3.3.2 RD51, RD52, and RD53 Disk Drives

Factory installed: RD5nQ-AA (disk kit) n = 1 or 2

Field upgrade: Same as factory installed option.

An RD5nQ-AA kit includes the following:

- RD5n-A: Disk drive
- 17-00282-00: 20-pin cable to signal distribution panel
- 17-00282-00: 34-pin cable to signal distribution panel

The RD51, RD52, and RD53 are fixed disk drives with formatted capacities of 11 Mbytes, 31 Mbytes, and 71 Mbytes, respectively.

When you install these drives in port 0 (left mass storage slot), the two disk drive signal cables connect to J2 and J7 on the signal distribution panel. When you install these drives in port 1 (right mass storage slot), the two disk drive signal cables connect to J1 and J5 on the signal distribution panel. The disk drive power cable connects to J8 on the power supply and to the disk drive (see Sections 1.5.1 and 1.6).

CAUTION
Only one fixed disk drive can be installed in a BA23-A enclosure.

3.3.2.1 Factory Configuration – The read/write printed circuit board on the RD51 has a DIP shunt jumper consisting of seven breakable metal strips (Figure 3-29). Table 3-31 lists the setting for the jumpers.

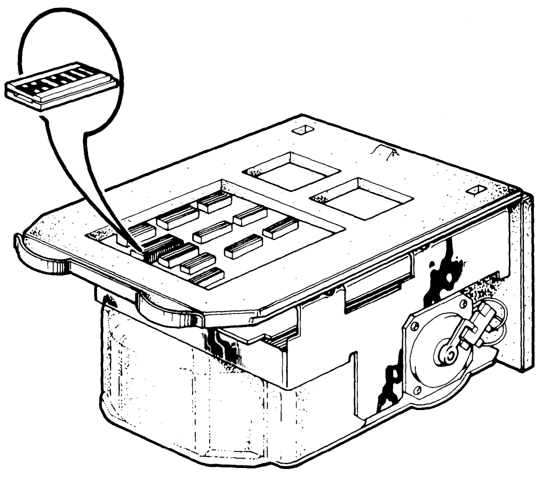


Figure 3-29 RD51 Disk Drive and Shunt Jumper

Table 3-31 RD51 DIP Shunt Pack Factory Setting

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

The RD52 read/write printed circuit board has five pairs of pins (Figure 3-30). To configure an RD52 drive as DU0 (port 0), place the jumper clip on DS3. To configure an RD52 drive as DU1 (port 1), place the jumper clip on DS4.

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

REAR OF DRIVE
4 3 2 1

To configure an RD53 as drive DU0 (installed in port 0), depress switch 3. To configure the RD53 as DU1 (installed in port 1), depress switch 4.

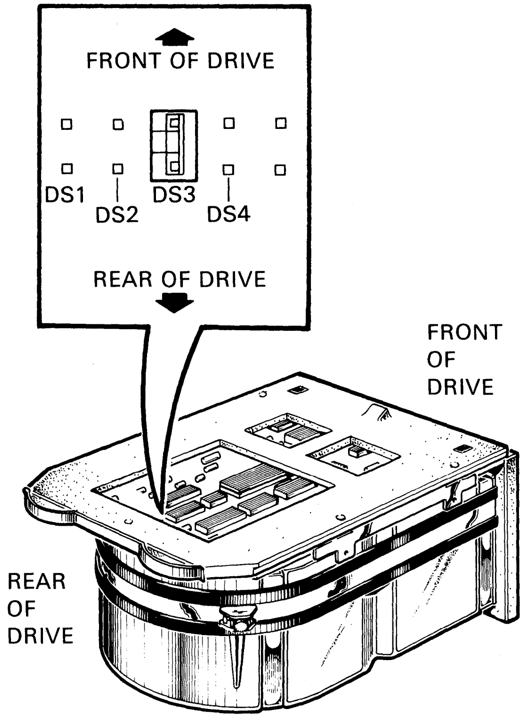


Figure 3-30 RD52 Disk Drive and Jumpers

3.3.2.2 Disk Formatting – Replacement disk drives must be formatted with the ZRQB??. binary program to be compatible with the RQDXn controller module. This program is provided by the XXDP+ diagnostic software system, which is on the field service test diskettes. Use version 5 or later to format an RD52 disk drive.

The disk formatting procedure is as follows:

> **NOTE**
> **Write down the serial number of the fixed disk drive before installing it. You will need it during the formatting procedure.**

Symbols:		
	<CR>	= carriage return
	< >	= example of a correct answer
	(L)	= answer with a letter (Y or N)
	(D)	= answer with a one-digit number
	(A)	= answer with an alphanumeric
	(def)	= default – <CR> enters the listed response

XXDP+ PROMPT	YOUR RESPONSE **<CR>** after each response
.	**R ZRQB??**
DRSD0 ZRQB-C-0 RD51/52 DISK FORMATTER UNIT IS RQDX1/2 DISK DRIVE SUBSYSTEM RSTRT ADR AAAAAA DR>	**STA**
CHANGE HW (L)?	**N**
CHANGE SW (L)?	**N**
ENTER DATE <MM-DD-YYYY> (A)?	(Use the format shown.)
Enter unit to format <0>: (D)?	(Enter the unit number assigned to the drive to be formatted.)
Use existing bad block information <N>: (L) (N)?	**Y**
Use down line-load (L) N?	**N** (def)
Continue if bad block information is inaccessible (L) N?	**N** (def)
Enter 8 character serial number (A)?	(Enter the serial number of the RD51/52.)
Enter date in MM-DD-YY format (A)?	(Use the format shown.)
Format begun Format completed, X revectored LBNs RDRX EOP 1 0 total errs	(This will take about 30 minutes.)

For further information refer to the *RD52-D, -R Fixed Disk Drive Subsystem Owner's Manual* and the *11C23-UE/11C23-UC RD52 Upgrade Installation Guide.*

3.3.3 RQDX1, RQDX2, and RQDX3 Disk Controllers

Factory installed:	CK-RQDX1-KA CK-RQDX2-KA CK-RQDX3-KA
Field upgrade:	Same as factory installed option.
Module number:	M8639 (RQDX1) M8639-YB (RQDX2) M8639-YA (RQDX1)

An RQDXn controller kit includes the following:

- RQDXn controller module
- BC02D-ID 50-pin cable, RQDX to signal distribution panel

Optional RQDX1-E (M7512) and RQDXE (M7513) extender modules and their associated cables (Sections 3.3.3.1 and 3.3.3.2) provide the RQDXn controller signals to external drives connected to the host.

The RQDXn controllers provide the interface for fixed disk and diskette drives to the Q22-Bus. These intelligent controllers have onboard microprocessors. Data transfers using DMA. Programs in the host system communicate with the controller and drives using MSCP.

An RQDXn can control a maximum of four drives. Each fixed disk counts as one drive. Each RX50 counts as two drives. You can have only two RQDX controllers in a system.

NOTES
The RQDX1 controls a maximum of two fixed disk drives and an RX50. The RQDX2 controls a maximum of four fixed disk drives, or two fixed disk drives and an RX50.

If an RQDX1 controller is used, it must be the last module in the backplane.

CAUTION
Only one fixed disk drive can be installed in a BA23-A enclosure.

Figure 3-31 shows the jumper and LED locations for the RQDX controllers.

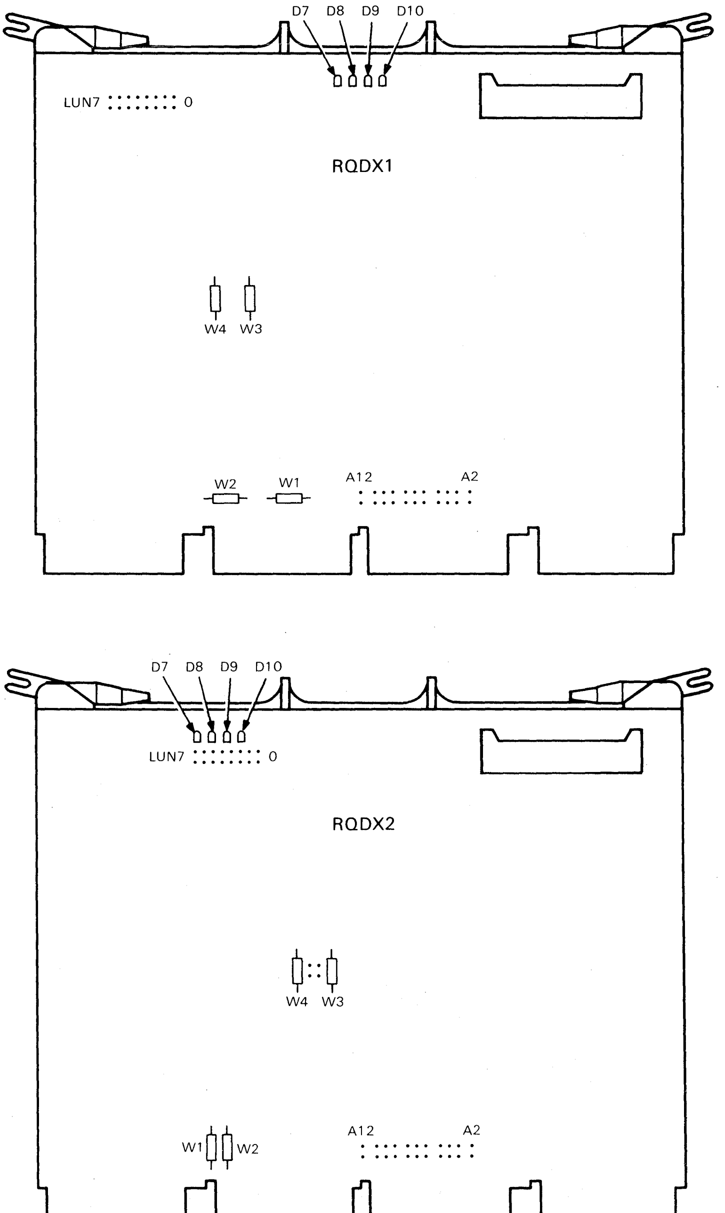


Figure 3-31 RQDX1 and RQDX2 Module Layouts

The CSR address of the RQDXn modules is fixed. Table 3-32 lists the factory setting.

Table 3-32 RQDX CSR Address

Module Number	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2 ←	Add. Bits (Jumpers)
1	17772150	I	R	I	R	R	R	I	I	R	I	R ←	Factory
2	Floating												

I = Installed = 1
R = Removed = 0

Logical unit number (LUN) jumpers 1 - 8 are removed.

The interrupt vector for the RQDXn modules is set under program control. The first RQDXn module is assigned a fixed interrupt vector of 154. If a second RQDXn module is installed, its interrupt vector is floating.

NOTE
All MSCP devices have a CSR address of 17772150. If you install more than one MSCP device in a system, you must change the CSR address of one of them. Set the CSR address of the second device within the floating range. If the devices is to be booted, the new address of the second device must be entered into the KDJ11-B translation table (see Section 2.5.3).

For further information, refer to the *RQDX1 Controller Module User's Guide* (EK-RQDX1-UG).

3.3.3.1 RQDX1-E (M7512) Extender Module – Use the RQDX1-E extender module when you have an RQDX1 controller and want to add a subsystem or additional MSCP devices in a BA23 expansion box.

Figure 3-32 shows the jumper locations on the RQDX1-E module. Table 3-33 provides the factory configuration of these jumpers. Use this configuration with dual BA23 systems or with a BA23-A subsystem arrangement. The factory configuration is set to connect the expansion unit of the subsystem to connector J3.

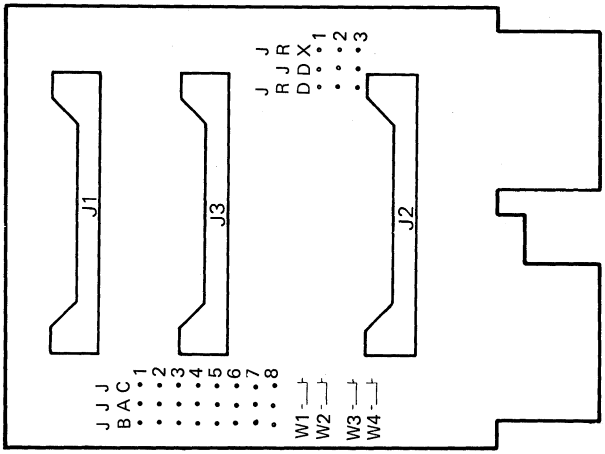


Figure 3-32 RQDX1-E Jumper Locations

Table 3-33 RQDX1-E Factory Configuration

Jumpers	Function	Factory Configuration
W1–W4	Must be installed. (For manufacturing use only.)	W1–W4
JD1–JD2 JRX1–JDX2	Factory set; do not change.	JD1 to JRX1 JD2 to JRX2
JB1–JB8 JA1–JA8 JC1–JC8		JA1 to JC1 JA2 to JC2 JA3 to JB3 JA4 to JB4 JA5 to JB5 JA6 to JB6 JA7 to JC7 JA8 to JC8

For further information, refer to the *RQDX1 Controller Module User's Guide* (EK-RQDX1-UG).

3.3.3.2 RQDXE (M7513) Extender Module – Use the RQDXE extender module when you have an RQDX2 or RQDX3 controller module and want to add a subsystem or additional MSCP devices in a BA23-C expansion box.

NOTE
A BA23-C enclosure, used as the host or as an expansion box, supports only one fixed disk drive per enclosure.

Three fixed disk drives are permissible when the RQDX2 or RQDX3 controller and RQDXE extender modules are used with a BA23-A enclosure and two subsystems.

Table 3-34 shows the factory configuration of the RQDXE extender module. The configuration supports two fixed disk drives. Table 3-35 shows the jumper setting to support three fixed disk drives. Refer to Chapter 2, Section 2.12, for guidelines and Appendix F for additional configurations.

Table 3-34 RQDXE Jumper Setting (Factory Configuration)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A3	*E1 to E2	K2 to K4	*L1 to L3	N1 to N2
B1 to B3	F1 to F3		L4 to M2	*N4 to P2
	*F2 to F4			
	*H3 to H4			

* These jumpers are installed to avoid floating inputs on the M7513.

Table 3-35 RQDXE Configuration for Three Fixed Disk Drives

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A3	*E1 to E2	K1 to K3	L3 to M1	N1 to N2
B1 to B3	F1 to F3	K2 to K4	L4 to M2	*N4 to P2
C2 to C4	H1 to H2			
D2 to D4	*H3 to H4			

* These jumpers are installed to avoid floating inputs on the M7513.

3.3.4 RX50-AA Diskette Drive

The RX50 (Figure 3-33) is a random access, dual-diskette storage device that uses two single-sided 5-1/4-in. RX50K diskettes. It has a total formatted capacity of 818 Kbytes (409 per diskette). The RX50 has two access doors and slots for diskette insertion. A light next to each diskette slot indicates when the system is reading or writing to the diskette in that slot.

A ribbon cable connects the RX50 to the signal distribution panel. Another cable connects the RX50 to the power supply.

NOTE
Only one RX50 drive can be used with one RQDX controller module.

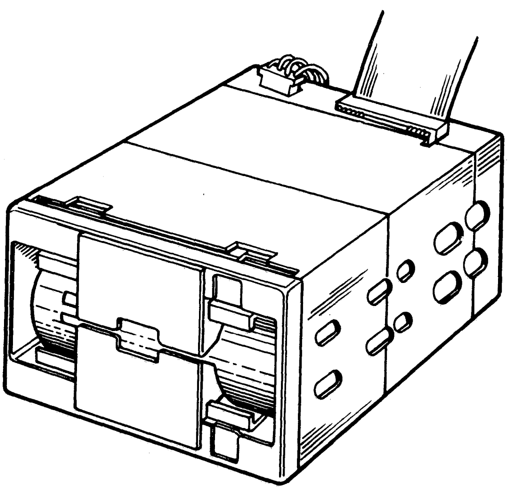


Figure 3-33 RX50 Diskette Drive

3.3.5 RL02 Disk Subsystem

Factory installed:	RLV22-AP	
Module number: (controller)	M8061	
Field upgrade:	RL02-AK	Disk drive
	CK-RLV1A-KA	Cabinet kit

The cabinet kit contains the RLV12 controller module, a type A filter connector and a cable to connect it to the module.

The RL02 disk drive is a rack-mountable, removable-media mass storage device. Removable disks placed into the RL02 disk drive can store 10.4 Mbytes of formatted data each. The RL02 disk drive subsystem (Figure 3-34) consists of the disk drive and a cabinet kit.

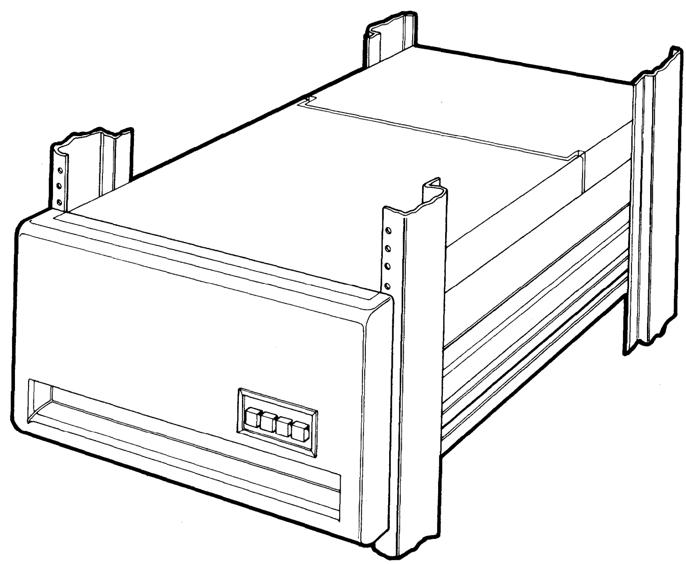


Figure 3-34 RL02 Disk Drive Subsystem

The RLV12 controller (Figure 3-35) is a quad-height module that transfers data between the Q22-Bus and the RL02 using DMA.

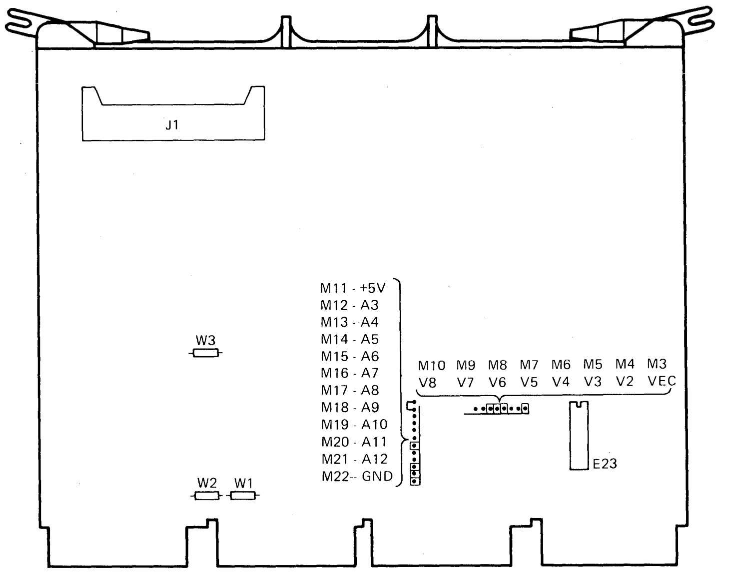


Figure 3-35 RLV12 Module Layout

The CSR address and interrupt vector are fixed. Tables 3-36 and 3-37 list the factory settings.

Table 3-36 RLV12 CSR Address

Factory Setting	A12 M21	A11 M20	A10 M19	A9 M18	A8 M17	A7 M16	A6 M15	A5 M14	A4 M13	A3 M12	← Add. Bits ← Jumpers
17774400	1	1	0	0	1	0	0	0	0	0	

1 = Jumper connected to ground (pin M22) 0 = No connection

Table 3-37 RLV12 Interrupt Vector

Factory Setting	V8 M10	V7 M9	V6 M8	V5 M7	V4 M6	V3 M5	V2 M4	←Vector Bits ←Jumpers
160	0	0	1	1	1	0	0	

1 = Jumper connected to ground (pin M22) 0 = No connection

For further information, refer to the *RL01/RL02 Disk Subsystem User's Guide* (EK-RL012-UG-002).

3.4 BACKUP DEVICES

3.4.1 TQK25-EP Tape Drive Subsystem

The TQK25 is a streaming tape drive that uses magnetic tape cartridges for backup data storage. The TQK25 is a standalone unit that can be placed on top of the system enclosure.

The TQK tape drive subsystem (Figure 3-36) consists of the following two major components:

- TK25 drive
- LSI-11 CPU cabinet kit (TQK25-CP)

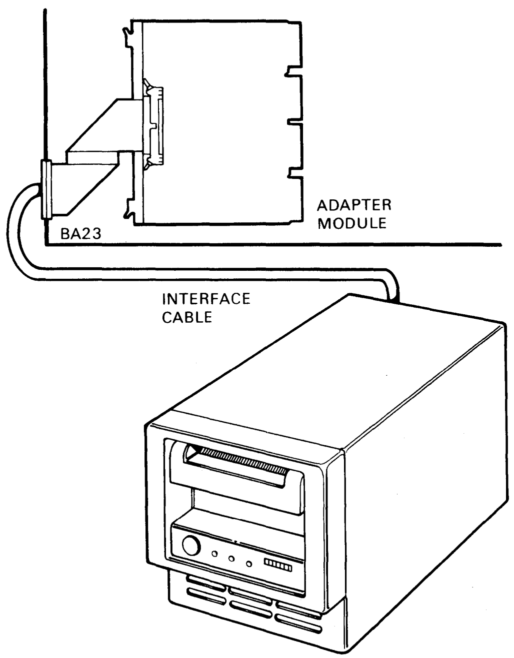


Figure 3-36 TK25 Tape Drive Subsystem

The drive contains the tape mechanism and the supporting electronics.

The LSI-11 CPU cabinet kit contains the following:

- Installation guide
- M7605 adapter module
- Ribbon cable (internal)
- External cable
- Type A filter connector

The M7605 adapter module (Figure 3-37) provides the interface between the tape drive and the Q22-Bus.

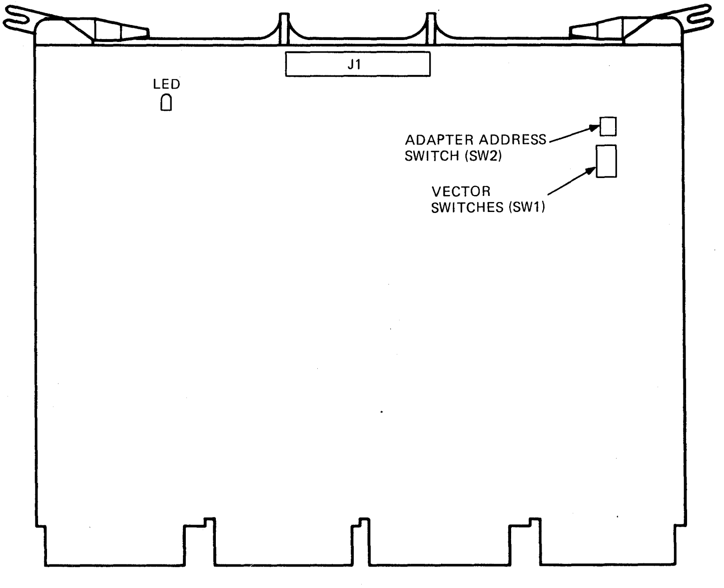


Figure 3-37 M7605 Module Layout

The CSR address and interrupt vector for the M7605 adapter module are both fixed and are set using DIP switches SW1 and SW2 (Figure 3-37). Tables 3-38 and 3-39 list the settings.

Table 3-38 M7605 CSR Address

Factory Setting	SW2 1	2	3	4	← Switches
17772520	on	on	on	on	

Table 3-39 M7605 Interrupt Vector

Factory Setting	V8 SW1 1	V7 2	V6 3	V5 4	V4 5	V3 6	V2 7	← Switches
224	0	1	0	0	1	0	1	

0 = Switch on
1 = Switch off

For further information, refer to the following documents:

TK Tape Drive Subsystem User's Guide (EK-0TK25-UG)
TK25 Tape Drive Customer Installation Guide (EK-T25TD-IN)
TQK25 Q-Bus CPU Kit Installation Guide (EK-T25QA-IN)

3.4.2 TQK50-KA Tape Drive Subsystem

Factory installed:	TK50-AA (tape drive with cartridge) TQK50-AA controller module and signal cable.
Field upgrade:	Same as factory installed option.

NOTE
Both parts must be ordered for a complete subsystem.

The TQK50 (Figure 3-38) is a streaming tape drive subsystem that provides 100 Mbytes of backup data storage. The media is magnetic tape cartridges.

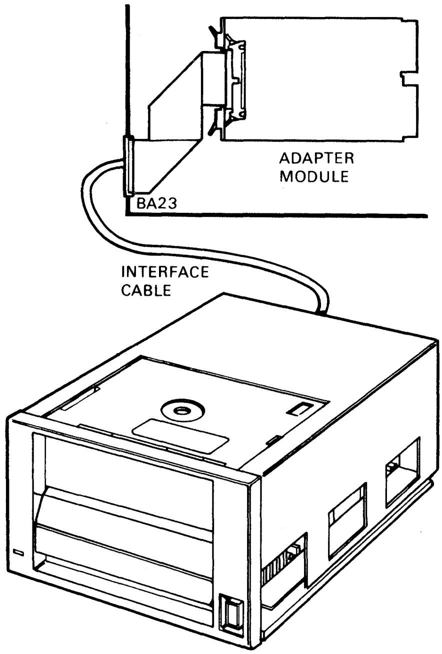


Figure 3-38 TQK50 Tape Drive Subsystem

The TK50 tape drive contains the tape mechanism with supporting electronics.

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

Figure 3-39 shows the location of two DIP switches on the controller module. Use these DIP switches to configure the following:

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

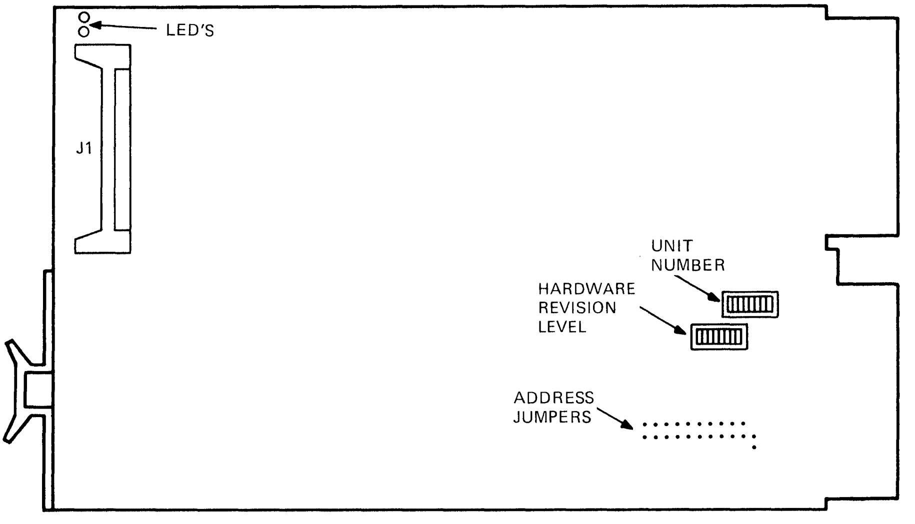


Figure 3-39 M7546 Module Layout

The CSR address is fixed and is set using jumpers (Figure 3-39). Table 3-40 lists the settings.

Table 3-40 M7546 CSR Address

Factory Setting	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	← Add. Bits (Jumpers*)
17774500	I	I	R	R	I	R	I	R	R	R	R	

I = Jumper installed
R = Jumper removed

* The jumper nearest the module fingers is A2.

The interrupt vector is under program control.

The CSR address for a second module installed in the system is a floating address. The first floating address is 17760404.

For further information, refer to the *TQK50 Tape Drive Subsystem Owner's Manual* (EK-0TK50-OM).

4.1 CONFIGURATION RULES

When you configure the BA23 backplane, you must consider the following factors:

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

4.2 MODULE PHYSICAL PRIORITY

The order in which you place modules in the backplane affects system performance. Install modules according to the following rules:

- Install the KDF11-B, KDJ11-BB, and KDJ11-BC CPU in slot 1.
- Install MSV11-P memory module(s) following the KDF11-B, KDJ11-BB, and KDJ11-BC CPU.
- Install the KDJ11-BF CPU in slot 2 or 3.
- Install the MSV11-JD and MSV11-JE memory module(s) immediately preceding the KDJ11-BF CPU.
- Install dual-height modules in the A/B rows of slots 1 through 3. No grant continuity card is necessary.
- Install dual-height modules in either the A/B or C/D rows of slots 4 through 8. The opposite row must contain either another dual-height module or a grant continuity card (M9047 or G7272) in rows A or C.
- Install modules following the CPU and memory using the sequence shown in Table 4-1.

Table 4-1 Order of Modules in the BA23 Backplane

Order	Type of Device	Option	Module	Comments
1	Communications	DEQNA	M7504	Ethernet
		DPV11	M8020	Synchronous
		DRV11-J	M8049	General purpose – no silos
		DRV11-B	M7950	
2	Lineprinter	LPV11	M8027	
3	Communications	DLVE1	M8017	Asynchronous – no silos
		DLVJ1	M8043	Asynchronous – no silos
		DZV11	M7957	Asynchronous – with silos
		DHV11	M3104	Asynchronous – with silos
		DMV11-M	M8053	Synchronous – DMA
		DMV11-N	M8064	Synchronous – DMA
		DUV11	M7951	Bisynchronous
4	Tape controller	TQK25	M7605	
		TQK50	M7951	
5	Disk controller	KLESI	M7740	
		RLV12	M8061	
6	MSCP controller	RQDX1	M8639	Last occupied slot
		RQDX2	M8639-YB	

4.3 EXPANSION SPACE

When you configure your system, you must consider both the amount of space available in the backplane and the rear I/O distribution panel.

4.3.1 Backplane

The BA23 backplane has eight slots available for you to install Q22-Bus compatible modules. The configuration examples in this chapter show the slots occupied by modules and the number of open slots remaining.

4.3.2 Rear I/O Distribution Panel

The rear I/O distribution panel contains two type A (1 × 4) and four type B (2 × 3) cutouts for mounting I/O panel inserts. You can convert the bottom two type B cutouts to provide for three additional type A cutouts. Figure 4-1 provides a configuration worksheet to keep track of the number of available inserts.

4.4 POWER REQUIREMENTS

Use the configuration worksheet (Figure 4-1) to keep track of the total current and power used to be sure you do not overload the system. The current is measured at +5 and +12 Vdc. The current and power requirements of each module must not exceed the limits shown in Table 4-2. Table 4-3 lists the current drawn by the Q22-Bus and the type of insert used for each module.

Table 4-2 Current and Power Limits

Systems Containing H7864-A Power Supply	System Containing H7864 Power Supply
Current: at + 5 Vdc = 36 amps +12 Vdc = 7 amps	Current: at + 5 Vdc = 36 amps +12 Vdc = 6 amps
Power: 230 watts	Power: 230 watts

4.5 BUS LOAD

Use the configuration worksheet (Figure 4-1) to keep track of the number of ac loads for each Q22-Bus module. Subtract the bus loads of each module from a total of 30 ac loads.

4.6 MODULE CSR ADDRESSES AND INTERRUPT VECTORS

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

- Check off all the options to be installed in the system.
- If there is a V in the vector column, the device has a floating vector. Assign a vector to each option to be installed, starting at 300 and continuing in the following sequence:

  300, 310, 320, 330, 340, 350, 360, 370,
- If your system has a KDF11 module, the floating vectors begin at 310.
- If there is an F in the address column, the device has a floating CSR address. Use Table 4-5 to determine the correct addresses for these devices.

NOTE
If a module has a floating vector and CSR address, additional modules of the same type also have a floating vector and CSR address.

Table 4-3 Power Requirements, Bus Loads, I/O Panel

Option	Module	Current +5 V	Current +12 V	Bus Loads ac	Bus Loads dc	I/O Inserts A = 1 × 4 B = 2 × 3
KDJ11-BC	M8190	5.5	0.1	2.3	1.1	1 × B
KDF11-BE	M8189	5.5	0.1	2.3	1.1	1 × B
MSV11-PK	M8067-K	3.45	–	2.0	1.0	–
MSV11-PL	M8067-L	3.6	–	2.0	1.0	–
DEQNA-KP	M7504	3.5	0.5	2.2	0.5	1 × A
DPV11-DP	M8020	1.2	0.3	1.0	1.0	1 × A
DRV11-JP	M8049	1.8	–	2.0	1.0	2 × A
DRV11-BP	M7950	1.9	–	3.3	1.0	2 × A
DRV11-LP	M7941	0.9	–	2.8	1.0	2 × A
LPV11-XP	M8027	0.8	–	1.4	1.0	1 × A
DLVE1-DP	M8017	1.0	1.5	1.6	1.0	1 × A
DLVJ1-LP	M8043	1.0	0.25	1.0	1.0	1 × B
DZV11-DP	M7957	1.2	0.39	3.9	1.0	1 × B
DHV11-AP	M3104	4.3	0.48	2.9	0.5	2 × B
DMV11-AP	M8053-MA	3.4	0.38	2.0	1.0	1 × B
DMV11-BP	M8053-MA	3.4	0.38	2.0	1.0	1 × B
DMV11-CP	M8064-MA	3.35	0.26	2.0	1.0	1 × A
DMV11-FP	M8053-MA	3.4	0.38	2.0	1.0	1 × B
DUV11-DP	M7951	1.2	0.39	3.0	1.0	1 × A
TQK25-KA	M7605	4.0	–	2.0	1.0	1 × A
TQK50	M7546	2.2	–	2.0	1.0	1 × A
KLESI-QA	M7740	3.0	–	2.3	1.0	1 × A
RLV12-AP	M8061	5.0	0.10	2.7	1.0	1 × A
RQDX1	M8639-YA	6.4	0.25	2.0	1.0	–
RQDX2	M8639-YB	6.4	0.25	2.0	1.0	–
RX50-AA	–	0.8	1.8	–	–	–
RD51-A	–	1.0	1.8	–	–	–
RD52-A	–	1.0	1.8	–	–	–
TK50-AA	–	1.5	2.5	–	–	–

SLOT NUMBERS		OPTION	CURRENT (AMPS)				AC BUS LOADS		PANEL INSERTS			
			+5		+12				2 x 3		1 x 4	
			USED	AVAILABLE	USED	AVAILABLE	USED	AVAILABLE	USED	AVAILABLE	USED	AVAILABLE
		MAXIMUM	—	36.0	—	7.0	—	29.0	—	4	—	2
1	CPU											
2	1 DOUBLE											
3	1 DOUBLE											
4	1 QUAD OR 2 DOUBLES											
5	1 QUAD OR 2 DOUBLES											
6	1 QUAD OR 2 DOUBLES											
7	1 QUAD OR 2 DOUBLES											
8	1 QUAD OR 2 DOUBLES											
DISK UNIT NO. 1												
DISK UNIT NO. 2												

TOTAL OF THIS COLUMN x 12 = ☐ WATTS AT 12 V

TOTAL OF THIS COLUMN x 5 = ☐ WATTS AT 5 V

☐ TOTAL WATTS (MUST BE 230 OR LESS)

Figure 4-1 Configuration Worksheet

Table 4-4 Address/Vector Worksheet

Option	Module	Unit No.	Check if in System	Octal Size in Bytes	Vector	CSR Address (N=177)
KDJ11-BC	M8190	1	X		–	–
MSV11-PL	M8067	1	X		–	N72100 start add.=0
MSV11-PL	M8067	2			–	N72102 start add.=512
MSV11-PL	M8067	3			–	N72104 start add.=1024
MSV11-PL	M8067	4			–	N72106 start add.=1536
DEQNA	M7504	1			120	N74440
DEQNA	M7504	2			120	N74460
DPV11	M8020	1		10	V	F
DRV11-JP	M8049	1		10	V	N64120
DRV11-JP	M8049	2		10	V	N64140
DRV11-B	M7950	1		10	124	N72410
DRV11-B	M7950	2		10	V	N72420
LPV11	M8027	1			200	N77514
DLVE1	M8017	1			V	N75610
DLVJ1	M8043	1			V	N76500
DLVJ1	M8043	2			V	N76510
DZV11	M7957	1		10	V	F
DHV11	M3104	1		20	V	F
DMV11-CP	M8064	1		20	V	F
DUV11	M7951	1		10	V	N60440
TQK25	M7605	1			224	N72520
TQK50	M7546	1			260	N74500
TQK50	M7546	2		4	260	N60404
KLESI-QA	M7740	1		10	154	N72150
RLV12	M8061	1		10	160	N74400
RQDX1,2	M8639	1		4	154	N72150

4.6.1 Floating CSR Addresses

Table 4-5 shows the floating CSR address for some common combinations of devices that require reconfiguration.

Check off all the devices in the system you want to reconfigure and find the column in Table 4-5 that makes the best match. In most cases, if you do not install a device listed in the middle of the column, the address of the device that follows changes.

Observe the following rules:

- Check the box for each module installed in the system.
- Find the column that corresponds to all the installed modules, where:

  number = installed
  * number = may be installed or not

  NOTE
  When an address is preceded by an *, the address of the following device(s) does not change.

- Assign the floating CSR address according to the numbers shown in Table 4-5. The address is 17760nnn. The numbers in the figure are the last three digits of the address for the module.

Substitute numbers given in Table 4-5 for the nnn in address 17760nnn to find the floating CSR address.

Table 4-5 Floating CSR Address Chart

Option	Common Configurations							
DZQ/V 1				100	100	100	100	100
DZQ/V 2				*110	*110	110	*110	110
DZQ/V 3				*120		120		120
DPV11	*270	*270	*270		*310	*330	*310	*330
DMV11			320				340	360
2nd MSCP		334	*354		354	374	374	414
2nd TK50	*404	*444	*444	*444		*504	*504	504
DHV11 1	440	500	500	500	500	540	540	
DHV11 2	460	520	520	520	520			

4.6.2 Floating Address Guidelines

If the system you wish to configure does not resemble any of the common configurations shown in Table 4-5, refer to the following list and Appendix D, Configuration Worksheet, for directions or contact your field service representative for help.

- The first DUV11 CSR address is 17760040.
- The first DZV11 CSR address is 17760100 if no DUV11s are present.
- The first DPV11 CSR address is 17760270 if no DUV11s or DZV11s are present.
- The first DMV11 CSR address is 17760320 if no DUV11s, DZV11s, or DPV11s, are present.
- The first disk MSCP CSR address is always 17772150.
- The second disk MSCP CSR address is 17760334 if no DUV11s, DZV11s, DPV11s, or DMV11s are present.
- The first tape MSCP CSR address is always 17774500.
- The second tape MSCP CSR address is 17760404 if no DUV11s, DZV11s, DPV11s, or DMV11s are present and no more than one disk MSCP is present.
- The first DHV11 CSR address is 17760440 if no DUV11s, DZV11s, DPV11s, or DMV11s are present and no more than one disk MSCP is present and no more than one tape MSCP is present.

4.7 CONFIGURATION EXAMPLES

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

4.7.1 Base System Configuration

Figure 4-2 shows the cabling layout of a base system in the following sequence:

Backplane → Cabinet kit → I/O distribution panel

Figure 4-3 shows the backplane setup for a base system, which can be expanded at a later time.

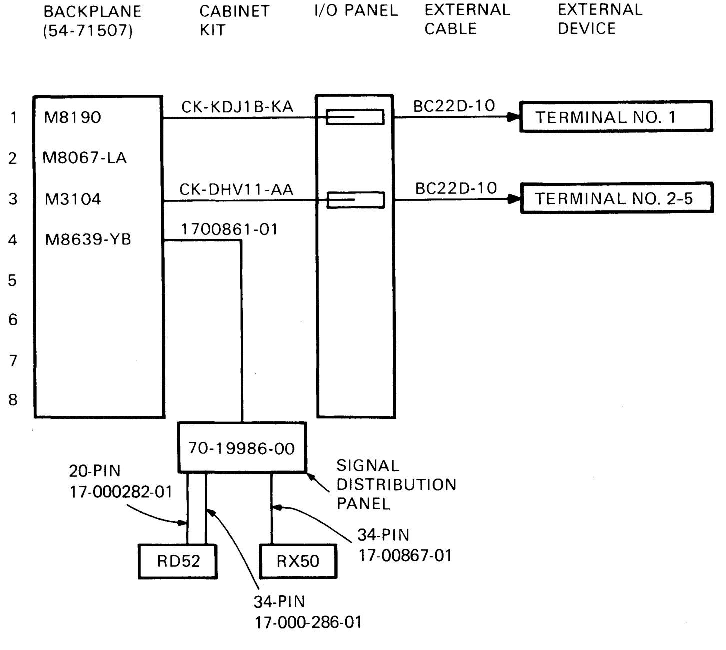


Figure 4-2 Cable Connections for the Base System

MASS STORAGE DEVICE: RX50
RD52

BACKPLANE SLOT NO.	ROW A B C D	I/O CUTOUTS (STANDARD I/O) (1 x4) 2	(2 x 3) 4
1	KDJ11-BC (QUAD) CPU		1
2	MSV11-PL (QUAD) 512 KB MEMORY		
3	DHV11 (QUAD) 8 - LINE MULTIPLEXER		2
4	RQDX1 (QUAD) RD/RX CONTROLLER		
5			
6			
7			
8			
	TOTAL USED:	0	3
	AVAILABLE :	2	1

Figure 4-3 Base System

4.7.2 Advanced System Configuration

Figure 4-4 shows the cabling layout for an advanced system configuration in the following sequence:

Backplane → Cabinet kit → I/O distribution panel → External cable → External device

Figure 4-5 shows the expandability of the BA23 enclosure. It includes the following features:

- 1 Mbyte of main memory
- An RD52 fixed-disk drive
- An eight-line asynchronous multiplexer
- A DEQNA module to connect to Ethernet
- An LPV11 module for the LP25 printer
- A TQK50 tape controller for backup and restore

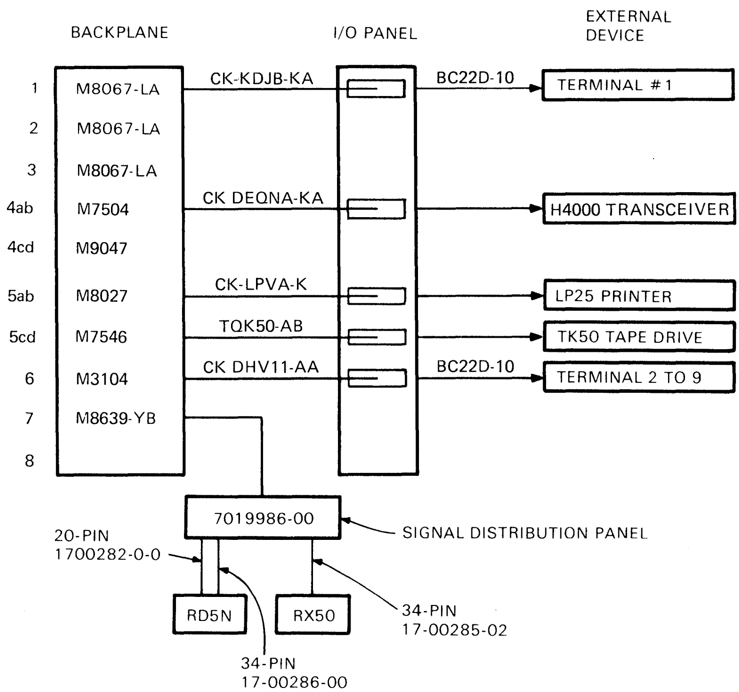


Figure 4-4 Cable Connections for an Advanced Configuration

MASS STORAGE DEVICE: RX50
RD52
BACKUP DEVICE: TQK50–AA

BACKPLANE SLOT NO.	ROW A	ROW B	ROW C	ROW D	I/O CUTOUTS (STANDARD I/O) (1 x4) 2	I/O CUTOUTS (STANDARD I/O) (2 x 3) 4
1	KDJ11-BC (QUAD) CPU					1
2	MSV11-PL (QUAD) 512 KB MEMORY					
3	MSV11-PL (QUAD) 512 KB MEMORY					
4	DEQNA NET (DUAL)		M9047 GRANT CARD		1	
5	LPV11 PRT (DUAL)		TQK50 CONT (DUAL)		1	
6	DHV11 (QUAD) 8 - LINE MULTIPLEXER					2
7	RQDX1 (QUAD) RD/RX CONTROLLER					
8						
				TOTAL USED:	0	3
				AVAILABLE :	2	1

Figure 4-5 Advanced System

4.8 PREPARE THE SETUP TABLE AND THE OPERATING SYSTEM

When your system is fully configured:

- Enter any devices you want to boot in the translation table (see Chapter 2, MicroPDP-11 Base Systems, Section 2.5.3).
- Prepare your operating system.

To prepare your operating system to recognize the devices installed in the system, perform a one-time SYSGEN (system generation) or CONFIG (configure) operation. Refer to the operating system software documentation for instructions.

Diagnostics 5

5.1 INTRODUCTION

This chapter describes the following topics:

- Startup self-test (Section 5.2)
- KDJ11-B (M8190) testing procedures and messages (Section 5.3)
- KDF11-B (M8189) testing procedures and messages (Section 5.4)
- Console emulator mode (Section 5.5)
- ODT (Octal Debugging Technique) commands (Section 5.6)
- Tests that can be loaded from user diskettes (Section 5.7)
- Troubleshooting procedures with DEC/X11 Run Time Exerciser (Section 5.9)
- Troubleshooting procedures with XXDP+ Diagnostic Programs (Section 5.10)
- Troubleshooting procedures for the BA23 enclosure (Section 5.11)

5.2 STARTUP SELF-TEST

The factory configuration of the KDJ11-B and KDF11-B modules is set for automatic self-test and boot mode. This test runs each time the system is turned on or restarted, and tests the:

- CPU
- Memory
- Connections between both CPU and memory modules and the Q22-Bus.

It begins by testing a small portion of the CPU module and then by progressively testing more and more of the base system. The system enters automatic boot mode on successful completion of the start-up test (see Chapter 2). When the self-test discovers an error or failure, the system displays a message. Refer to Section

5.3.1 for an explanation of the KDJ11-B messages. Refer to Section 5.4.1 for an explanation of the KDF11-B messages. Section 5.11 provides a flowchart to help you isolate a failing FRU (field replaceable unit).

5.3 KDJ11-B TESTING PROCEDURE

The self-test program contains 40 separate parts beginning with test 77 and counting down to 30 octal. The SLU display panel displays the number of the current self-test. The SLU panel also displays boot messages (27 to 00 octal). Table 5-1 provides a summary of these tests and messages.

Table 5-1 KDJ11-B Self-Test and Boot Diagnostic ROM Messages

Number	Description
77	CPU hung or Halt switch on at power-on or restart
76	First CPU pretests, memory management unit (MMU) register tests
75	Turn MMU on and run MMU tests and CPU tests
74	*
73	Power-up to on-line debugging technique (ODT)
72	Power-up to 24/26
71	EEPROM checksum test
70	CPU ROM and page addressing test
67	Miscellaneous CPU and extended instruction set (EIS) tests
66	SLU 1 – check all four registers
65	SLU 2 – check receivers and transmitters maintenance mode
64	SLU 3 – check interrupts and errors in maintenance mode
63	Test MMU abort logic
62	Standalone CPU cache mode tests (memory off)
61	Line clock test
60	Floating-point processor (FPP)
57	CPU commercial instruction set (CIS) test
56	Standalone mode exit – check address 1776000 for guaranteed timeout
55	*
54	Memory sizing test
53	Check for memory at address 0
52	Test memory from 0 to 4 Kbytes
51	Cache test using memory
50	Memory data byte tests for all memory
47	Parity and error correcting code (ECC) for all memory
46	Memory address line shorts for all memory
45 to 31	*
30	Test exit – test completed successfully

Table 5-1 KDJ11-B Self-Test and Boot Diagnostic ROM Messages (Cont.)

Number	Description
27	Spare – not used
26	Spare – not used
25	Reserved – Not used by ROM code. This code is driven by the MDM module on UNIBUS systems. Do not use it, even if system is Q-Bus
24	DECNET boot (DLV11-E/F of DUV11) waiting for a reply from host
23	XON not received after XOFF – To correct type CTRL Q
22	Xmit ready bit never sets in DLART transmit CSR
21	Drive error
20	Controller error
17	Boot device selection was invalid (i.e., AA)
16	Invalid unit number selected
15	Nonexistent drive
14	Nonexistent controller
13	No tape
12	No disk
11	Invalid boot block
10	Drive not ready
07	For Q-Bus only. No bootable device found in automatic boot mode
06	Console disable by switch 1 = On and no force dialog. For V6.0 only, APT break received and ROM code has entered ODT
05	Spare
04	Dialog mode
03	Off board ROM boot in progress
02	EEPROM boot in progress
01	CPU ROM boot in progress
00	Control transferred from ROM code to booted device. The display blanks when it receives a code of 00

* These are UNIBUS tests, not run on Q22-Bus systems.

5.3.1 KDJ11-B Messages

Normally the system displays a message in three locations:

- The console terminal – displays a number and brief message. An example of a message is shown in Section 5.3.2. Table 5-2 shows the boot/diagnostic messages.
- The SLU display panel – displays a two-digit octal code.
- The M8190 module – displays a message on the red diagnostic LEDs on the rear edge of the module. The top three LEDs (looking into the card-cage) represent the octal MSB and the lower three LEDs represent the octal LSB.

When all three display locations are working, the system displays the same information in all locations. If the console terminal is not working, refer to the SLU display panel for information. If the SLU is not working, refer to the module itself.

Sometimes, the console terminal displays a message in the format:

000100
@

The number (000100, in this example) is the octal address of the next instruction to be executed. The @ sign indicates that the system has halted and passed control to the console emulator mode. Make sure that the Halt button is not in, and then restart the system using the restart button. If the system halts again, the CPU is faulty and should be replaced.

Table 5-2 KDJ11-B Self-Test and Boot/Diagnostic ROM Messages

Error Number	Probable FRU Failure
177 to 100	(Subtract 100, and refer to the codes below.)
77	Halt switch, M8190, power supply.
73	Not a failure; selected mode is ODT.
61	Clock from power supply.
54	Memory module.
53	
52	
50	
47	
46	
23	Console terminal not ready due to XOFF received from terminal while attempting to print a message.
Any other number	M8190

Before removing and replacing the recommended FRU, boot from the diagnostic software and verify the fault using the diagnostic software.

To boot from a diagnostic diskette, you must restart the built-in diagnostics after the test that found the error. To do this:

- Remove all removable media containing user data.
- Write-portect all other on-line data storage devices (devices containing fixed media).

    NOTE
    Restarting testing after the test that found the fault is only suggested when attempting to boot write-protected media containing software diagnostics. In this case, all other on-line data storage devices must be write-protected to prevent possible data loss.

- Install the bootable diagnostic.
- Type **<CTRL> 0** followed by a **4** and **<Return>** to restart the testing. This restarts the built-in diagnostics.

If this restart procedure fails, the diagnostic diskettes cannot be loaded to verify the error and the failing FRU. In this situation, replace the FRU recommended by the Table 5-2 listing.

5.3.2 KDJ11-B Console Terminal Messages

When an error occurs during the self-test, the system displays a message on the console terminal. Figure 5-1 shows an example of such a message.

These messages contain the following information:

1. An error number – this is the number of the self-test that failed and is typically an octal number from 30 to 77. Sometimes the system displays an octal number from 130 to 177. The system displays this exception when an "unexpected trap to location XXX" error occurs. In this case, the failing self-test is the number minus 100.
2. An error description – this is a one-line description of the error.
3. The "see troubleshooting documentation" message.
4. The address of the error – this address information locates the error to the ROM address itself and the address in the program listing.
5. The contents of R0 to R6 of register set 0 and the contents of kernel PAR 3.
6. For some memory tests, the system displays the expected data, found data (wrong data), and faulty memory address.
7. A command line with up to four user-selectable options showing how to continue the system testing. These options include:
   - Rerun the test once and, if it passes, continue with all remaining tests.
   - Loop on failing test continuously. To stop this loop, type **<CTRL> C**. When stopped, the system then displays the total number of successful passes and total number of error passes.
   - Map memory and I/O page – available for tests 56 to 30. Helps locate a misconfigured or failing memory module in the system.
   - Advance to next test – allows the user to restart the system testing after the failing test.

NOTE
Use the "Advance to next test" command only when attempting to boot write-protected media containing software diagnostics. Write-protect all other on-line data storage to prevent its possible loss.

Even if the system does not display the "Advance to next test" command, you can call it by typing **<CTRL> O** followed by **4** and the **Return** key.

```
TESTING IN PROGRESS - PLEASE WAIT
MEMORY SIZE IS 256 K BYTES
9 STEP MEMORY TEST
STEP 1  2  3  4  5  6  7  8

ERROR 46
MEMORY CSR ERROR

SEE TROUBLESHOOTING DOCUMENTATION
```

```
ERROR PC = 173436   PAGE = 15   PROGRAM LISTING ADDRESS = 015436

R0 = 060000      R1 = 052525      R2 = 172100      R3 = 172344
R4 = 100000      R5 = 040000      R6 = 172300      PAR3 = 010000

COMMAND     DESCRIPTION

1           RERUN TEST
2           LOOP ON TEST
3           MAP MEMORY AND I/O PAGE
4           ADVANCE TO THE NEXT TEST

TYPE A COMMAND THEN PRESS THE RETURN KEY:
```

Figure 5-1 Error Message Screen

5.4 KDF11-B TESTING PROCEDURES

Normally the system displays a message in two locations:

- On the console terminal
- On the KDF11-B module LEDs

The console terminal display has the following format:

nn <a message>
(where nn is a number from 00 to 23)

Some errors cause the system to halt any type of program. In this case, control passes to the console emulator mode. This mode allows you to simulate error conditions using ODT commands (Section 5.6).

5.4.1 KDF11-B Messages

If any part of the self-test or boot diagnostics fails, the console terminal displays a message consisting of a number and a brief message. Table 5-3 describes the possible failure and a recommended action.

For example, if the system fails to boot, the console terminal displays a message similar to the following:

```
ERROR UNIT DU0
ERR 16 NOT BOOTABLE

ERROR UNIT DU2
ERR NOT BOOTABLE

ERROR UNIT DU1
ERR 16 NOT BOOTABLE
WISH TO REBOOT [Y,(N)]?
```

Table 5-3 KDF11-B Self-Test and Boot Diagnostic ROM Messages

Number	Message	Description and Recommended FRU/Action
01	NO MEMORY	
02	FATAL MEMORY FAULT	Errors 01 through 11 indicate a faulty CPU or memory module. First replace CPU module. Retry. If fault remains, replace memory module.
03	MEMORY FAULT	
04	MMU ABORT	
05	TRAP 4	
06	TRAP 10	
07	TRAP 14	
08	TRAP 20	
09	POWER FAIL	
10	TRAP 30	
11	TRAP 34	
12	NONEXISTENT CONTROLLER	Boot device as specified by S1 not found. Check setting of S1. Retry. If error remains, replace controller module.
13	DRIVE NOT READY	Make sure a diskette is in the drive. Make sure the fixed disk is on-line.
14	DRIVE ERROR	Check the diskette and diskette drive.
15	CONTROLLER ERROR	Replace controller module.
16	NOT BOOTABLE	No bootable operating system. Install operating system.
17	NO DISK	Install diskette or disk containing bootable operating system.
18	NO TAPE	System is accessing tape drive with no tape. Mount tape.
19	NONEXISTENT UNIT	Boot device as specified by switch S1 not found. Check setting. Retry. If error remains, replace controller module.
20	ROM E126 BAD	Replace CPU boot ROM E126.
21	ROM E127 BAD	Replace CPU boot ROM E127.
22	NO FORCED PARITY	See description errors 01 through 11 (CPU and memory errors).

5.4.2 KDF11-B Diagnostic LEDs

If a program fails and the console terminal does not display any messages, check the LEDs on the KDF11-B module for the diagnostic code. Table 5-4 identifies the possible errors.

Table 5-4 List of LED Self-Test Display Codes

Display in Octal	Definition
00	Diagnostic/boot ROM not executing. Cleared by ROM code before transferring control to secondary boot.
01	If not halt, then CPU test, else CPU error.
02	If not halt, then MEMORY test, else MEMORY error.
03	Waiting for XON.
04	Waiting for console input.
05	Boot device status error.
06	Invalid boot block.
07	DECnet waiting for response from host.
10	DECnet waiting for message completion.
11	DECnet processing received message.
12	If not halt, then MMU test, else MMU error.
13	Error in first 8KW of memory. Fatal error.
14	Scope loop.
15	Extended MEMORY test in progress.
16	MAP function in progress.
17	System hung, halt switch on, or not power-up mode 2. Set by hardware reset.

5.4.3 KDF11-B System Halt

Sometimes the console terminal displays a message in the format:

000100
@

The number (000100, in this example) is the octal address of the next instruction to be executed. The @ sign indicates that the system has halted and passed control to the console emulator mode. Use the boot ROM listing for the contents of the instruction at which the processing stopped. Check the CPU diagnostic LEDs for additional diagnostic information.

5.5 KDJ11-B AND KDF11-B CONSOLE EMULATOR MODE

The system enters console emulator mode when any of the following occurs:

- The programs execute a halt instruction.
- You press the Halt button on the control panel.

This mode of operation replaces the use of control switches and indicators for communicating directly with the system. When you type commands on the keyboard, the system displays responses on the console terminal instead of lighting indicators on the control panel. When the system halts and enters console emulator mode, it displays the following on the console terminal:

```
nnnnnn
@
```

The number nnnnnn is the octal location of the next instruction to be executed, and the @ is the ODT prompt character. At this point you can examine or modify the contents of the system's registers and memory by entering ODT commands. The use of ODT commands is explained in Table 5-5. Refer to the *Microcomputer and Memories Handbook* (EB-18451-20) for a more detailed description.

A portion of the microcode on the KDJ11-B and KDF11-B modules emulates the capability normally found on a programmer's console. The CPU interprets streams of ASCII characters from the console terminal as console commands. The KDF11-B modules micro ODT accepts 18-bit addresses, allowing it to access 248 Kbytes of memory and the 8-Kbyte I/O page. The KDJ11-B modules micro ODT accepts 22-bit addresses, allowing it to access 4088 Kbytes of memory and the 8-Kbyte I/O page.

5.6 KDJ11-B AND KDF11-B OCTAL DEBUGGING TECHNIQUE (ODT)

ODT (octal debugging technique) functions only when the system is in console emulator mode. ODT consists of a group of commands and routines for finding error conditions and for simple communication with the system. ODT helps you debug object programs interactively. Express all addresses, registers, and memory location contents in octal notation. Letters and symbols make up the ODT command set.

The hardware-implemented ODT command set is a subset of commands in a larger software-implemented ODT program. The hardware program, residing on KDJ11-B and KDF11-B modules, serves primarily to diagnose hardware problems. The system's response to ODT commands helps trace events occurring in the system.

> **NOTE**
> **The hardware ODT commands can modify programs; therefore, remove master diskettes before using ODT.**

Table 5-5 lists the basic ODT commands. Both F11 micro ODT and J11 micro ODT use these commands. F11 micro ODT uses 18-bit addressing only. J11 micro ODT uses 22-bit addressing only.

Table 5-5 Console ODT Commands

Command	Symbol	Function
Slash	/	Prints the contents of a specified location.
Carriage Return	<CR>	Closes an open location.
Line feed	<LF>	Closes an open location and then opens the next contiguous location.
Internal Register Designator	$ or R	Opens a specific CPU register.
Processor Status Word Designator	S	Opens the PS; must follow a **$** or R command.
Go	G	Starts execution of a program.
Proceed	P	Resumes execution of a program.
Binary dump	CTRL/S	(For manufacturing use only.)
(Reserved)	H	Is reserved for use by Digital Equipment Corporation. (Causes the CPU to execute a microcode routine that, in effect, does nothing.)

5.7 USER TEST DISKETTES

The user test diskette set contains the user-friendly diagnostic diskettes and the field service diagnostic diskettes.

5.7.1 User-Friendly Diagnostics

Two user-friendly diagnostic diskettes provide you with an easy way to verify the operation of the entire system. These diskettes have the following labels:

- Micro-11 User Test 1
- Micro-11 User Test 2

The complete kit has the DIGITAL P.N. ZYA03-P3.

Load the first diskette into the first diskette drive, and a blank diskette into the second diskette drive. To run the tests, select **T** from the menu.

If the tests find no errors, the system displays as "test passed" message and testing is complete.

If the tests detect an error, the system automatically prompts you to install the second diskette and to run additional diagnostics. These additional tests locate the FRU that has failed. Refer to your *MicroPDP-11 Systems Owner's Manual,* Chapter 4, Troubleshooting, for additional information.

5.7.2 Field Service Diagnostics

The user test diskettes also contain a field service diagnostic menu. You can access this menu by typing **F** at the main user diagnostic menu. The system test can now be looped for 10 minutes or until you stop it by typing <CTRL> C. When stopped, the console terminal displays status and error information.

This menu also allows you access to the XXPD+ monitor. Once in the monitor, you can type **H** to access an XXDP+ on-line help file.

> **NOTE**
> **Only trained service personnel familiar with XXDP+ software should access the XXDP+ monitor or use the field service diskettes described in Section 5.7.3.**

5.7.3 Field Service Test Diskettes

A set of field service diskettes is provided for use by trained service personnel. These diskettes use the XXDP+ software system to isolate a failing FRU. The complete kit has the DIGITAL P.N. ZYA04-P3.

XXDP+ includes the program modules necessary to build a run-time exerciser for the entire system (including system options). Independent device diagnostics are also included.

An on-line help file is available on all diskettes under the name FILES.TXT. To access this help file, type **H** when in the XXDP+ monitor. All diskettes also contain a directory of all program modules. To access this directory, type **D**.

For more information on the diagnostic system, refer to:

- *DEC/X11 User's Manual* (AC-F053-MC)
- *DEC/X11 Cross Reference Manual* (AC-F055C-MC)
- *XXDP+/SUPR User's Manual* (AC-F348A-MC)
- *XXDP+ DEC/X11 Programming Card* (EK-OXXDP-MC)

NOTE
XXDP+ (also called version 1) is being revised and rewritten. This major revision changes the implementation of many XXDP+ monitor features. The revision of XXDP+ will soon be in the field service diskette set included with the system. Do not attempt to use this new version of XXDP software without first reviewing the changes.

5.8 OTHER DIAGNOSTIC MEDIA

Bootable diagnostics are available for TK25 streaming tape drives. Order Digital P.N. AU-T995A-MC for a TK25-compatible diagnostic cartridge. Bootable diagnostics are also available for RC25 disk drives. Order Digital P.N. BK-T996A-MC for RC25-compatible removable disk media

5.9 TESTING WITH THE DEC/X11 RUN-TIME EXERCISER

The DEC/X11 run-time exerciser consists of a group of program modules. Each module tests a specific component of your MicroPDP-11 system. When the run-time exerciser detects an error, it displays a message describing the circumstances of the error. Determine which system component failed and then:

- Run the appropriate XXDP+ diagnostic program.
- Look up the error call in the listing for the specific program module to determine what operation was in progress when the error occurred.
- Examine the parameter of the failure (processor status word, stack pointer, program counter, etc.).

You can modify program modules to:

- Halt on different errors.
- Provide different status displays.
- Run alone or with selected other programs.

You can use ODT (Section 5-6) to examine system registers and memory locations.

5.9.1 Run-Time Exerciser Messages

The run-time exerciser provides displays of three basic types of messages:

- System errors
- Data errors
- Status errors

5.9.1.1 System Error Messages – The program modules display a system error in the following format: SYS ERR. The DEC/X11 run-time exerciser displays a system error message when it detects one of the following:

- A bus error trap (to location 4)
- A reserved instruction trap (to location 10)
- A queue overflow

If a system error occurs, run the program modules individually. If all modules pass, run them in groups until the failure returns. Refer to Section 5.9.2 for directions.

5.9.1.2 Data Error Messages – The first line of a data error message ends with the words DATA ERROR. The program modules display data errors in the following format:

```
RQAA0 PC XXXXXX APC YYYYYY PASS# NNNNN. ERR# NNNNN. DATA ERROR
CSRA AAAAAA S/B BBBBBB WAS WWWWWW WRADR DDDDDD RDADR EEEEEE
```

where:

- RQAA0 is the name of the failing program test module (listed as XRQAA0.OBJ in the directory).
- PC XXXXXX is the physical address of the program call that causes the message (program counter).
- APC YYYYYY is the assembled program count of the program call.
- PASS# NNNNN. is the pass number (decimal) during which the error occurred.
- ERR# NNNNN. is the error count (decimal) for the current run.
- CSRA AAAAAA is the address of the control and status register of the failing device.
- S/B BBBBBB is the expected data (S/B, or "should be," data).
- WAS WWWWWW is the bad data.
- WRADR DDDDDD is the address of the expected data (S/B, or "should be," data).
- RDADR EEEEEE is the address of the bad data.

You can rerun the DEC/X11 modules individually or run the appropriate XXDP+ program. If you want to examine the message further, find the APC (assembled program count) value in the program listing. The APC location display contains the program call that caused the error message.

5.9.1.3 Status Error Message – This message is in the same general format as the data error message. You can recognize a status error message by the absence of SYS ERR or DATA ERROR in the first line.

This message includes a STATC value where the value is the contents of the status register of the failing device. Like a data error, a status error can be traced to a listing by looking up the location given for the APC.

The status error message does not include:

- The S/B ("should be") message
- The WAS (bad data) message

5.9.2 Selecting and Deselecting Program Modules

You can run programs individually or in groups by using the Select and Deselect commands. These commands allow you to:

- Deselect program modules one at a time.
- Deselect all modules and then select only the desired modules.

These commands operate only within the system exerciser program. They cannot be executed without first starting the exerciser. Table 5-6 shows the commands and their function.

Table 5-6 Select/Deselect Commands

Command	Function
.SEL<CR>	Selects all modules for execution.
.SEL RQAA0<CR>	Selects only the RQAA0 program module. The program name must be typed as it appears in the listing.
.DES<CR>	Deselects all modules.
.DES RQAA0<CR>	Deselects only the RQAA0 module.

You can obtain the status of a module (selected or deselected) by using the MAP command. This command instructs the monitor program to display a list of resident modules with their starting addresses and status. For example:

```
 MAP<CR>
CPAFO AT 017752 STAT 040020
CPBGO AT 021502 STAT 040020
RQAA0 AT 023242 STAT 150000
```

The second most significant octal digit of the STAT (status) message indicates whether or not a module is selected.

- When the number is 0, 1, 2, or 3, the module is deselected.
- When the number is 4, 5, 6, or 7, the module is selected.

Refer to the *DEC/X11 User's Manual* (AC-F053-MC) for further information.

5.9.3 Expanding the Run-Time Exerciser

Each system has a run-time exerciser designed for that system's configuration. If you expand your system, you must rebuild the exerciser in order to test the added components.

You must rebuild the exerciser, rather than just add to it, because it is an interactive system of programs. Rebuilding involves selecting the program modules appropriate to the new hardware and including them with the existing program modules in a new exerciser. Refer to the *DEC/X11 User's Manual* (AC-F053-MC) for further information.

5.10 TESTING WITH THE XXDP+ PROGRAMS

The set of field service diskettes provided with your MicroPDP-11 system include the XXDP+ diagnostic programs. Refer to Table 5-7 for a partial list of these programs. These diskettes also contain other XXDP+ programs for testing additional options.

Table 5-7 XXDP+ Diagnostic Programs

XXDP+ Program Name	Title
JKDB??	KDF11 basic instruction test
JKDA??	KDF11 MMU test
JKL5??	KDF11B CPU cluster test
VMA8??*	KDF11 BOOT/ROM test
VMSA??	Q-Bus 22-bit address memory test
VDZA??	DZV11 test: part one
VDZB??	DZV11 test: part two
ZRQA??	RD/RX performance exerciser
ZRQB??†	RD51 formatter program
OKDA??	KDJ11 CPU and cache test

* Revision of VM8A?? must be version F0 or later.

† This program also contains the RD52/RD53 formatter program on version 5 or later of the field service diskettes.

The XXDP+ diagnostic software helps to isolate failures by testing the function of the selected FRU. The system reports the results of a test on a pass/fail basis.

You can modify the XXDP+ programs to perform specific functions. Modification of these programs requires careful study of the program listings and the *XXDP+/SUPR User's Manual* (AC-F348A-MC). This manual describes the commands available under the various XXDP+ utility programs and lists specific program modifications and procedures.

The following paragraphs describe some of the more common operations.

5.10.1 XXDP+ Messages

The XXDP+ diagnostic programs do not use a universal format for messages. The large number of parameters tested makes a variety of formats necessary. Most formats display:

- Several octal words, which provide the parameters at the time of the error
- A mnemonic indicating what occurred

The tables or error directories of the individual program listings reference these program-specific mnemonics.

5.10.2 Starting a Program

To start a program, type **R** and the first four letters of the name followed by **??**. Press the **Return** key. The program prompts you for responses. The question marks allow any revision of the program to run.

5.10.3 Restarting Programs

You can configure the XXDP+ diagnostic programs to:

- Run continuously,
- Halt at the end of a pass, and/or
- Halt (or loop) on selected errors.

You can halt a program by pressing the Halt button. You can then enter appropriate ODT commands or restart the program by typing the restart address given in the program listing. For example:

@200G

When a diskette boots and you enter the XXDP+ monitor, the system displays the restart address in the monitor heading. If the diagnostic program has not overwritten the memory locations, return to the monitor by typing this restart address.

If the diagnostic program has overwritten the memory locations of the XXDP+ monitor program, reboot the diskette to return to the monitor.

5.10.4 Modifying a Diagnostic Program

You can modify diagnostic programs to perform specialized diagnostic functions. The individual program listings explain what to modify for each purpose. Modifying a program requires the use of ODT commands to change the contents of certain locations.

The following example changes the memory exerciser program to perform a loop-on error. The program listing directs you to change software switch register 176 to 1000.

- Load the program with the L command instead of the R command.

  ```
  .L VMSA??<CR>
  ```

  The system loads the program into memory and displays the . (period) prompt. The program is not executed at this time.

- Press the **Halt** button on the control panel. This places the system in console emulator mode where control passes to the ODT program. The system displays the ODT @ prompt.
- Open location 176 by typing **176** and pressing the **/** (slash) key. The system displays the present contents of that location.

    @176/000000

- Type the number specified by the program listing after the zeros (in this case, 1000).

    @176/000000 1000<CR>
    @

- Type **176/** again to make sure the change has been made. Press the **Return** key.

    @176/0010000<CR>
    @

- Start the program at location 200 with the ODT Go command.

    @200G

    The system displays the program name and executes the program. When testing is complete, the system displays END PASS and starts another pass.

- Press the **Halt** button to terminate the program. This returns control to the ODT program.
- Press the **Halt** button again to exit from console emulator mode. Then press the **Restart** button, which passes control back to the XXDP+ monitor program.

Modifying the program by this method affects only the system's memory; it does not change the program on the diskette. Therefore it is not necessary to restore the contents of the location after the program is completed.

5.11 TROUBLESHOOTING THE BA23 ENCLOSURE

The startup diagnostics automatically run the CPU and memory module self-tests. Table 5-1 and 5-3 lists the number produced by this testing and a probable FRU failure. The user test and field service diskettes provide further testing of the system. To isolate the problem to a failing FRU, follow the flowchart shown in Figure 5-2. Refer to Chapter 6, FRU Removal and Replacement Procedures, for the appropriate removal and replacement procedures.

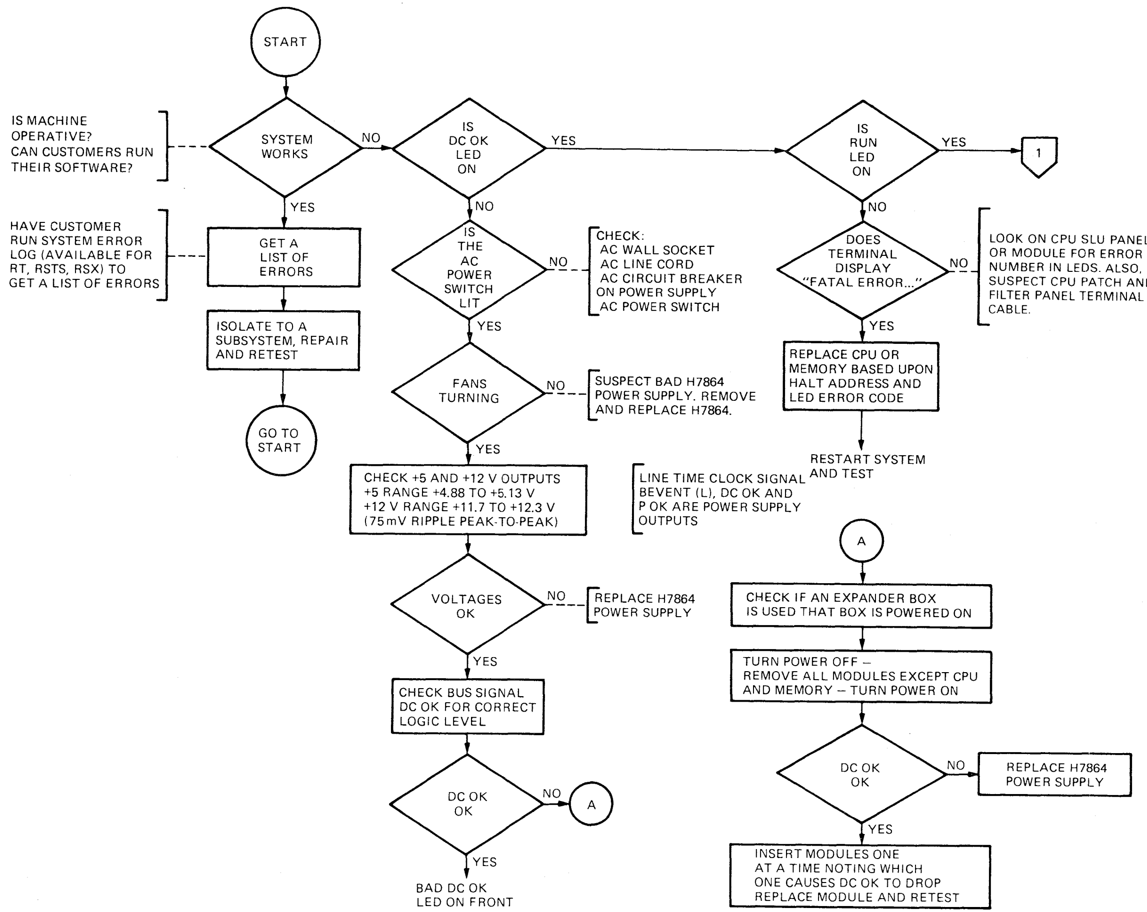


Figure 5-2 Troubleshooting Flowchart (Sheet 1 of 2)

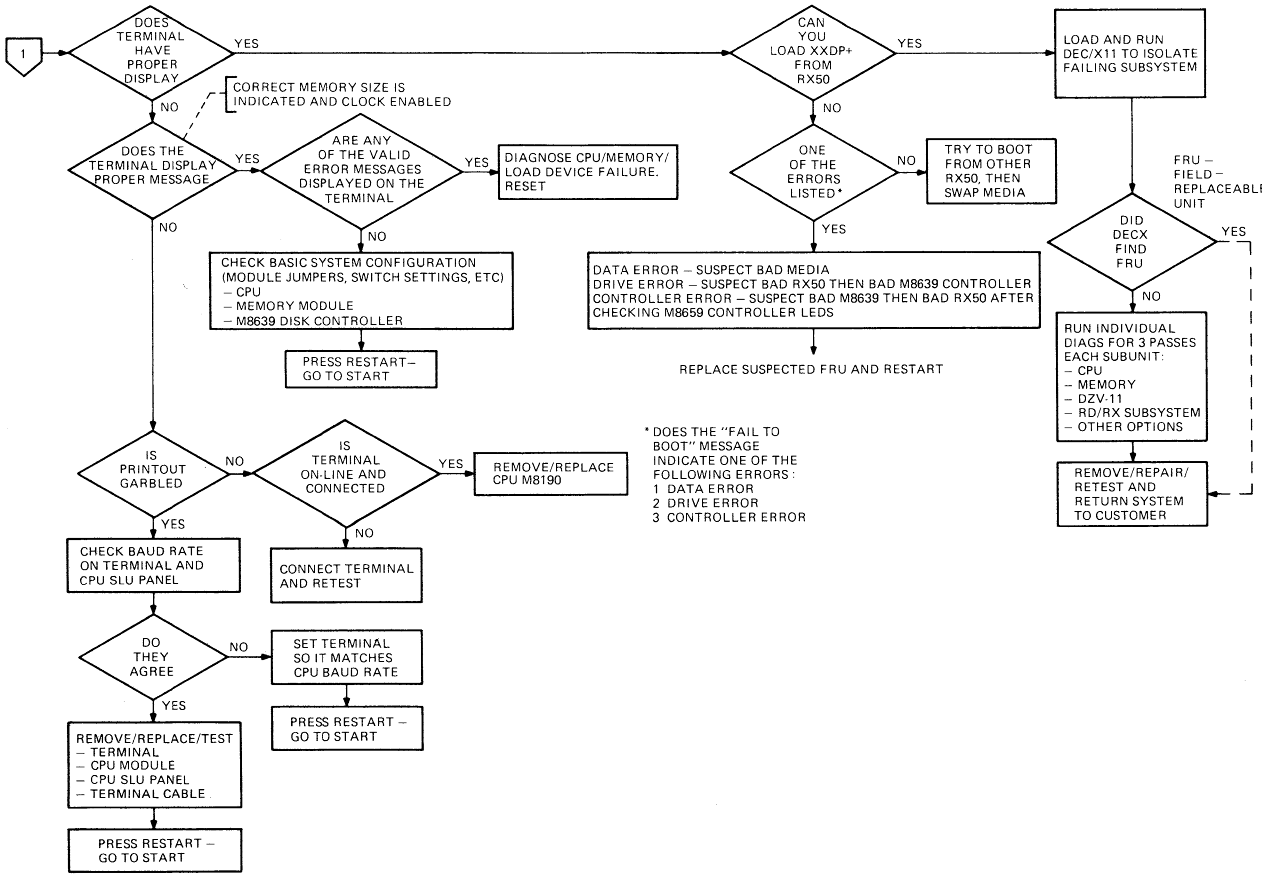


Figure 5-2 Troubleshooting Flowchart (Sheet 2 of 2)

FRU Removal and Replacement Procedures 6

6.1 INTRODUCTION

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

CAUTION
Static electricity can damage modules installed in the BA23 enclosure and in mass storage devices. Always use a grounded wrist strap (DIGITAL P.N. 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.

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.

Table 6-1 Field Replaceable Units

Component	Order DIGITAL P.N.
H7864 power supply	30-20444-00*
H7864-A power supply	30-21749-01*
Power supply ac power cable with ac switch	70-20434-01
Dc fan	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†
RD51 read/write module	29-24665-00
RD52 read/write module	29-24992-00
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
630QA patch panel	54-17644-01
SLU cable 10 pin	17-00624-01
LED cable 20 pin	17-00712-02

Table 6-1 Field Replaceable Units (Cont.)

Component	Order DIGITAL P.N.
Adapter plate	74-28684-01
I/O distribution panel	70-19979-00
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
KDF11-BE	M8189
KDF11-BP	M8189
KDJ11-BC	M8190
MSV11-PK	M8067
DZV11	M7957
DZV11 cabinet kit	CK-DZV11-DB
DLVJ1	M8043
DLVJ1 cabinet kit	CK-DLVJ1-LB
DEQNA	M7504
DEQNA cabinet kit	CK-DEQNA-KB
RQDX1	M8639
RQDX2	M8639-YA
Grant card	M9047
or	G7272

* 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, and RD52Q-AA options. These options contain the drive and the signal cables.

NOTES

1. **Connectors J1 and J2 are located on the backplane (H9278-A) assembly.**
2. **If the disk drive is not present, the power cable connector should be plugged into J3 on the distribution panel.**
3. **If the disk drive is not present, the power cable connector should be plugged into J4 on the distribution panel.**
4. **The rear fan cable is an integral part of the H7864 power supply.**
5. **The cable is an intergral part of the 7020695-01 assembly.**
6. **For four-slot MicroPDP-11/SV systems, the backplane part number is H9278-B.**

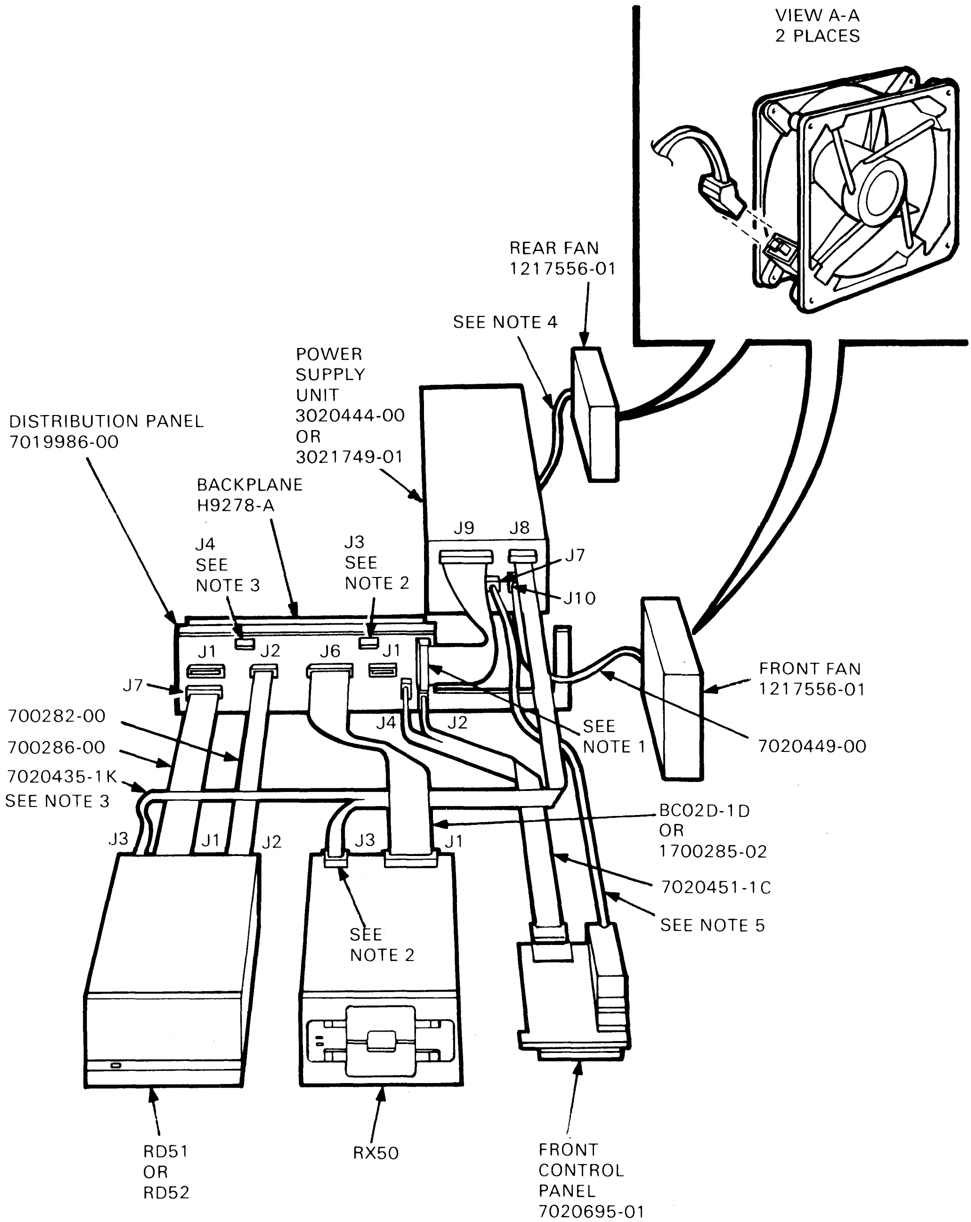


Figure 6-1 BA23 Enclosure FRUs

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 assembly.
7. Disconnect the 20-pin connector from the control panel.
8. Remove the power supply connector from J7 on the power supply.

To install a replacement control panel, use the following procedure:

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 set properly (see Chapter 1, BA23 Enclosure, Section 1.3.2).

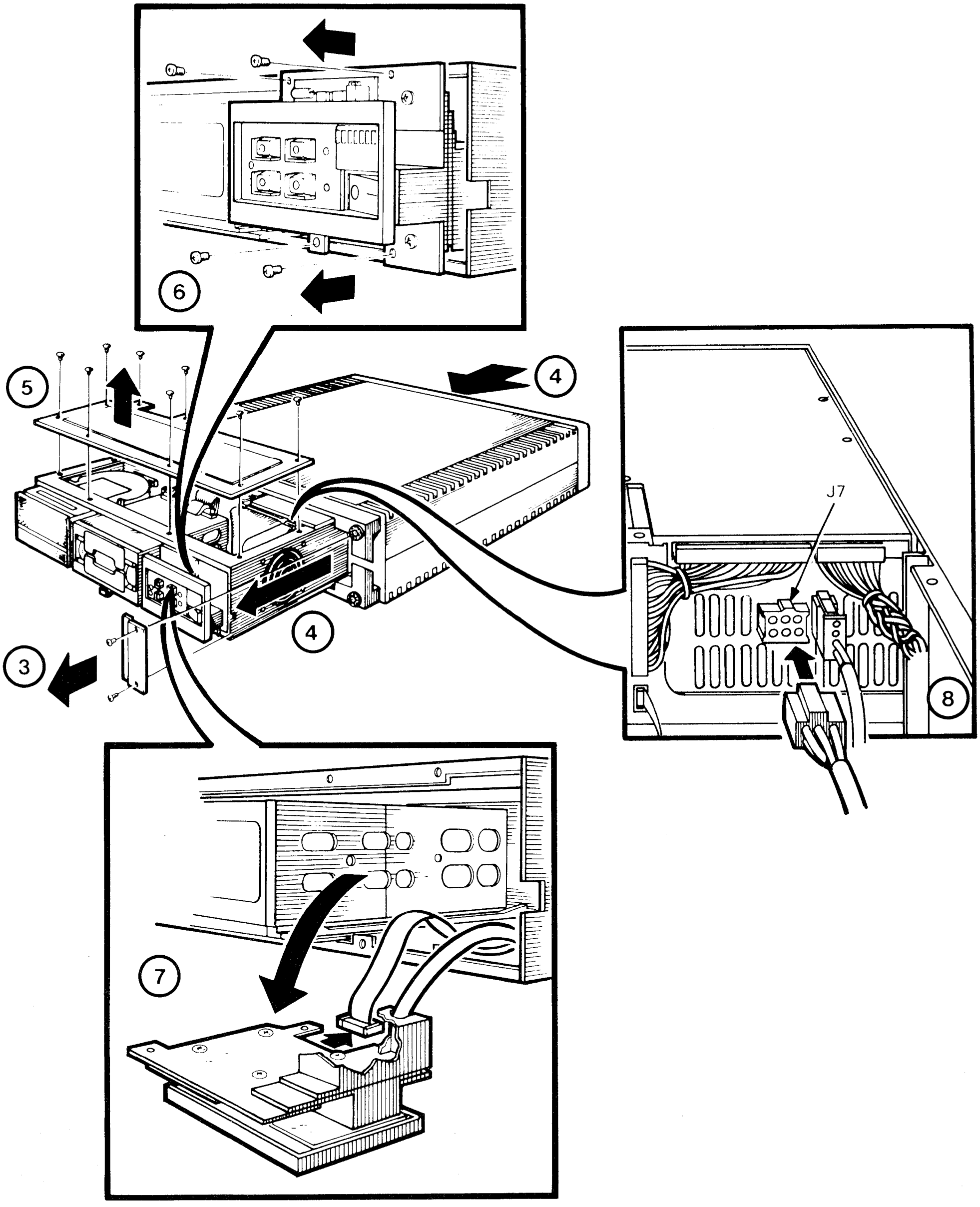


Figure 6-2 Remove the Control Panel

6.3 RX50 DISKETTE DRIVE REMOVAL

Use the following procedure to remove the RX50 diskette drive (Figure 6-3).

NOTES
The diskette drive is a single field replaceable unit (FRU). Do not disassemble the diskette drive or remove any of the printed circuit boards. All adjustments must be made in a special test configuration.

Only use formatted RX50K diskette available from Digital Equipment Corporation and its licensed 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 RX50 diskette drive forward, and remove the drive.

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

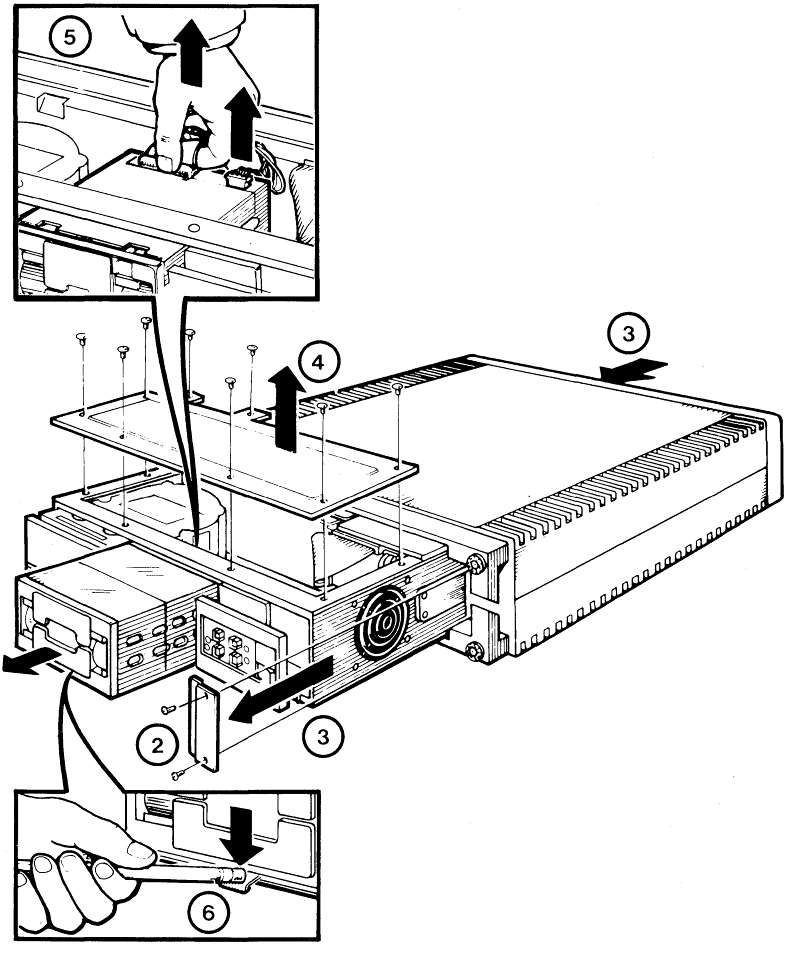


Figure 6-3 RX50 Diskette Drive Removal

6.4 RD5n FIXED DISK DRIVE REMOVAL

Use the following procedure to remove an RD5n fixed disk drive (Figure 6-4).

CAUTION
Handle any fixed disk drive with care. Dropping or bumping the drive can damage the disk surface.

NOTES
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 P.N. 99-90045-01).

You must format a newly installed RD5n disk drive before testing the system and using the drive. Refer to Appendix C for formatting instructions for your system.

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.

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 the drive.

7. To configure an RD52 drive as DU0, make sure the jumper clip is set at DS3 (Figure 6-5). To configure an internal RD52 drive as DU1, place the jumper clip on DS4.
8. To configure an RD53 drive as DU0, depress switch 3. To configure an RD53 drive as DU1, depress switch 4. The switch pack is located on the rear edge of the RD53 read/write board.

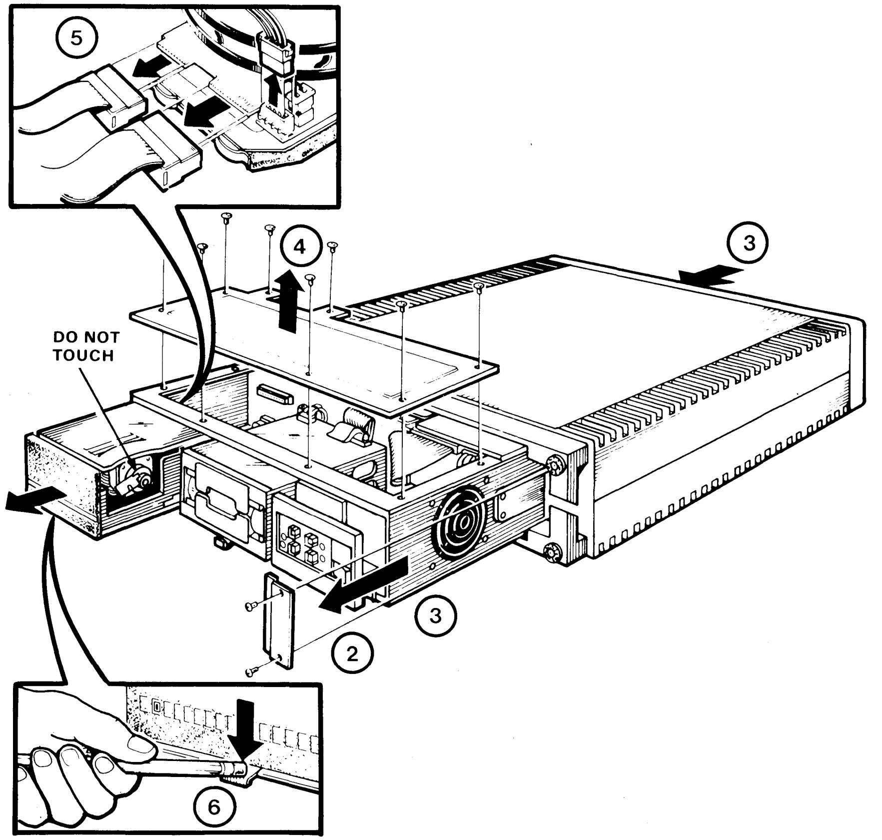


Figure 6-4 RD5n Removal (RD51 Disk Drive Shown)

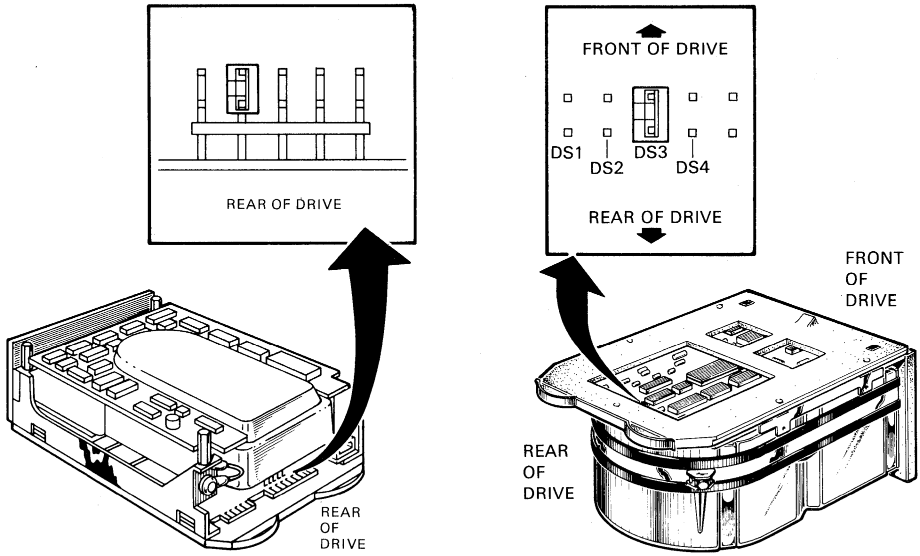


Figure 6-5 Set the RD52 Jumper Clip

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 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 replaceable. 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 6-6)
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 6-7).
3. Disconnect connector P5 from the side of the board.

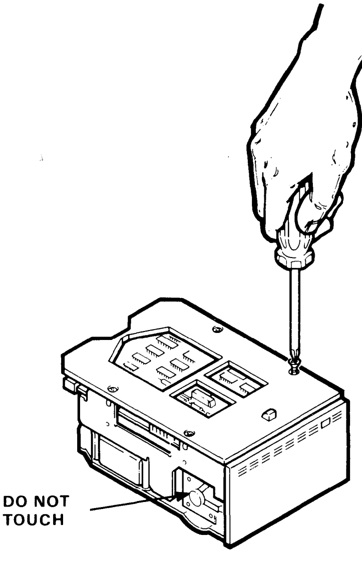


Figure 6-6 RD51 Disk Drive Skid Plate Removal

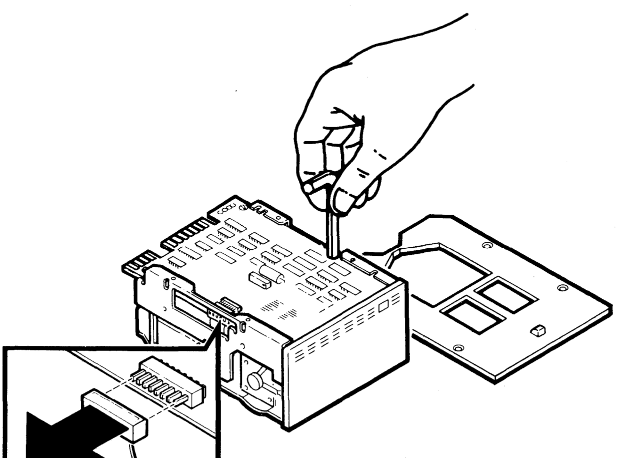


Figure 6-7 RD51 Disk Drive Allen Screws and Connector P5 Removal

4. Disconnect connectors P6, P7, and P8 from the front of the read/write printed circuit board (Figure 6-8).
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.
7. Make sure the jumper configuration of the 14-pin DIP shunt pack matches the listing in Table 6-2.

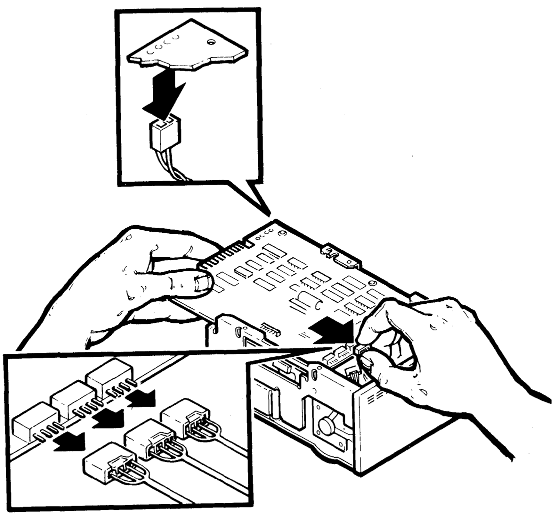


Figure 6-8 RD51 Disk Drive Connectors P6, P7, P8, and P4

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 6-9).

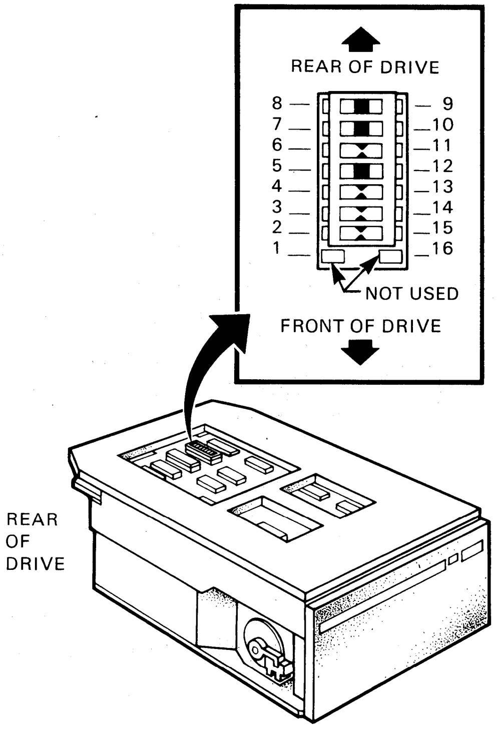


Figure 6-9 DIP Shunt Pack Setting

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

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

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

1. Remove the four Phillips screws retaining the slide plate and ground clip. Set the slide plate aside (Figure 6-10).

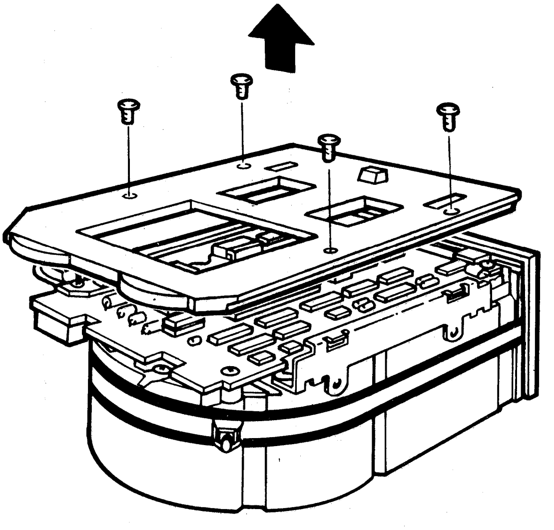


Figure 6-10 Remove the Slide Plate

2. Unplug the 2-pin connector (Figure 6-11).
3. Remove the two Phillips screws that attach the front bezel to the drive.

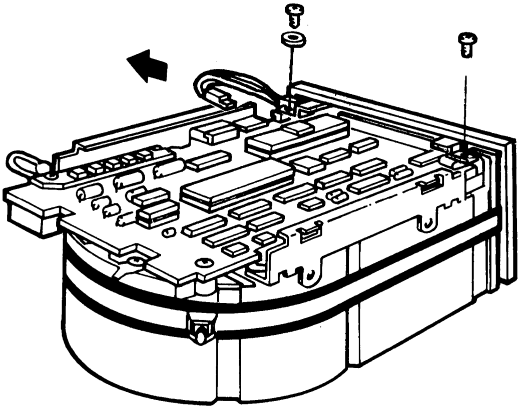


Figure 6-11 Remove the 2-Pin Connector and Screws

4. Remove the front bezel by pulling it away from the drive. The bezel is held in place with pop fasteners (Figure 6-12).

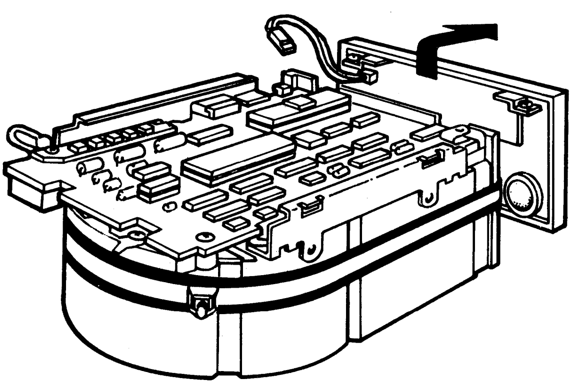


Figure 6-12 Remove the Front Bezel

5. Remove the three Phillips screws from the heatsink, grounding strip, and the corner opposite the heatsink (Figure 6-13).

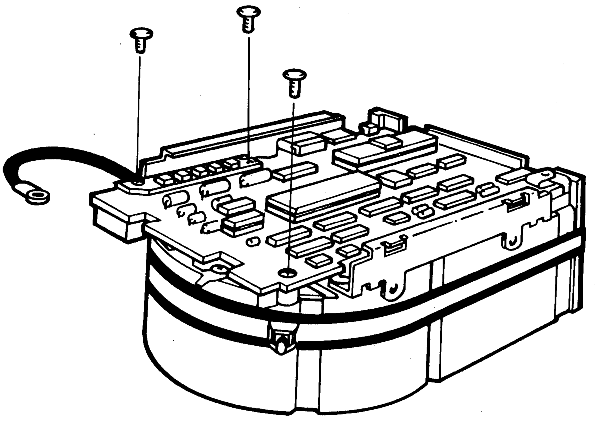


Figure 6-13 Remove Phillips Screws from Heatsink

6. Lift the MPCB straight up until it clears the chassis. This disconnects P4, a 12-pin fixed plug (Figure 6-14).
7. Disconnect P5, a 10-pin connector.

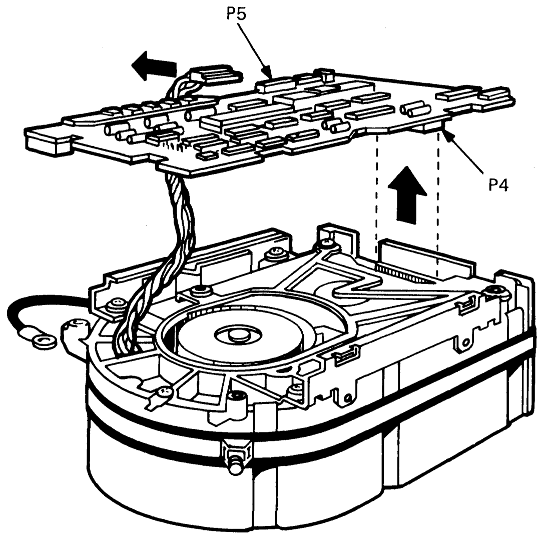


Figure 6-14 Remove the MPCB

6.4.3 RD53 Disk Drive Read/Write Board Removal

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

1. Remove the four Phillips screws retaining the slide plate and ground clip. Set the slide plate aside (Figure 6-15).
2. Loosen the two captive screws holding the board in place.
3. Rotate the board upward (the board pivots in hinge slots at the front of the drive). Tilt the board until it comes to rest against the outer frame. Be careful not to strain any connectors or cables.
4. Disconnect the motor control board connector J8 and the preamplifier board connector J9 from the read/write board. Handle with care.
5. Lift the read/write board out of the hinge slots.

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

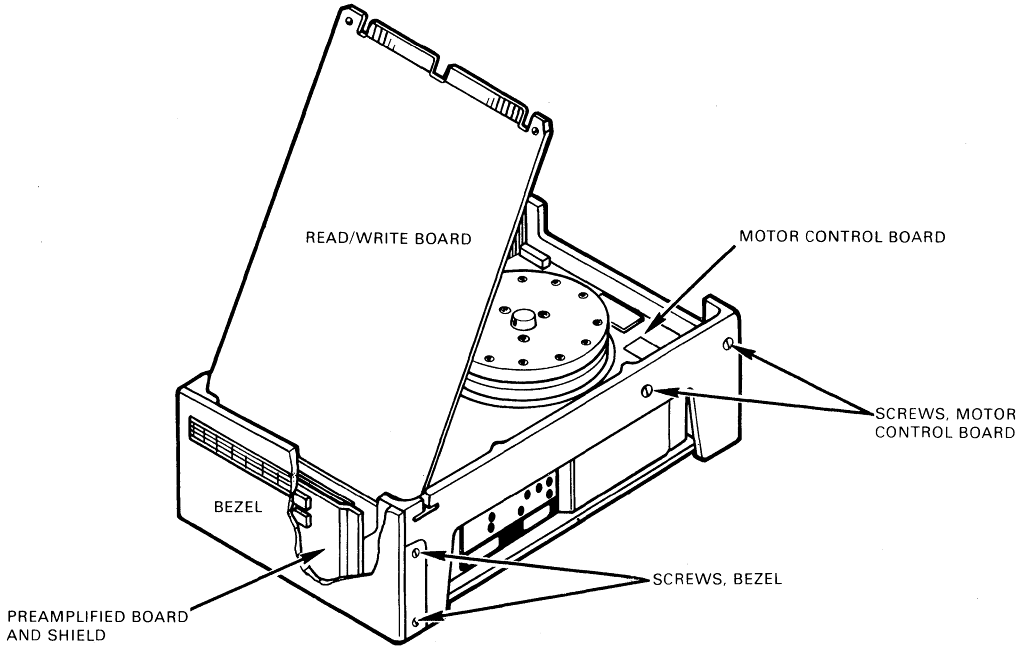


Figure 6-15 RD53 Read/Write Board Removal

6.5 BACKPLANE ASSEMBLY REMOVAL

To remove the backplane assembly, use the following procedure:

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 6-16).

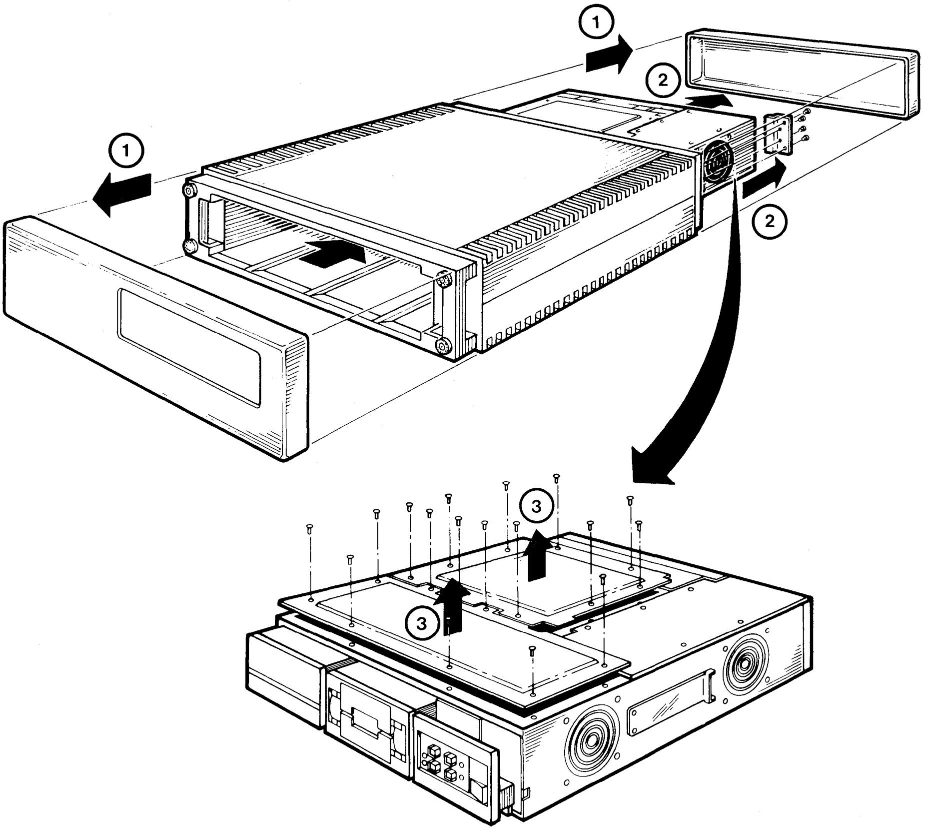


Figure 6-16 Accessing the Backplane

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 6-17). Refer to Section 6.9 for instructions.
6. Remove the cowling (if present) from the front fan.
7. Remove any RX50 and RD5n disk drives that may be present (see Sections 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.

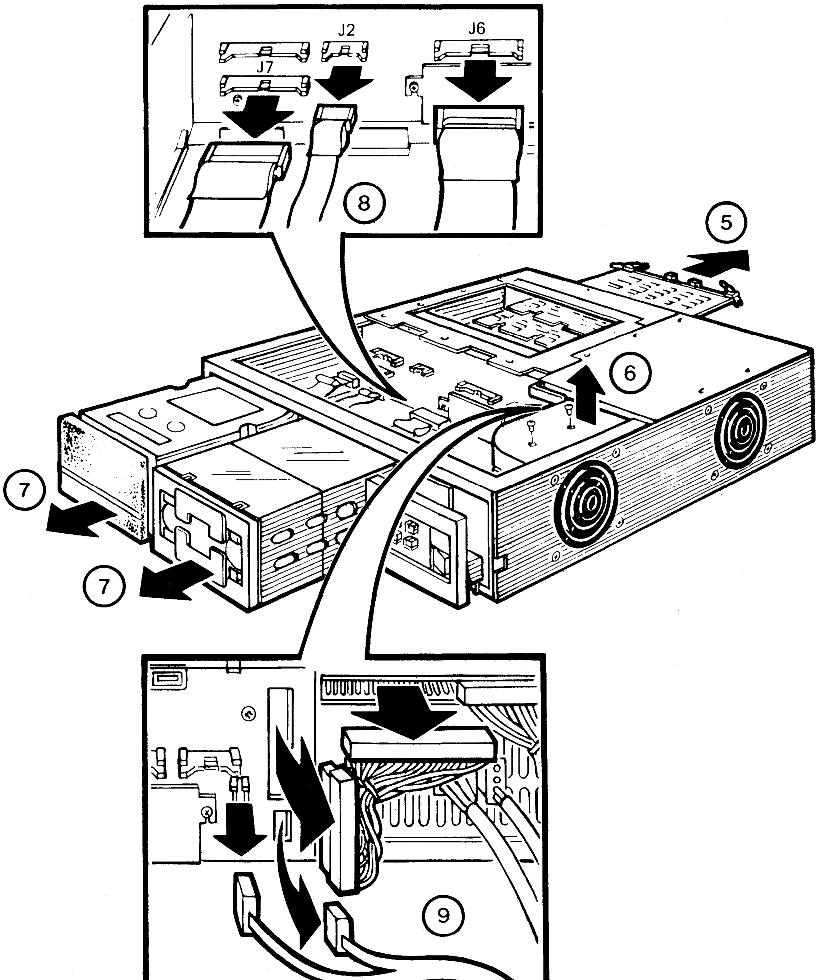


Figure 6-17 Removing Cables and Modules

10. Loosen the two screws retaining the small access cover. Remove the cover and disconnect the cable from side two of the backplane (Figure 6-18).
11. Remove the four screws holding the backplane assembly to the chassis.

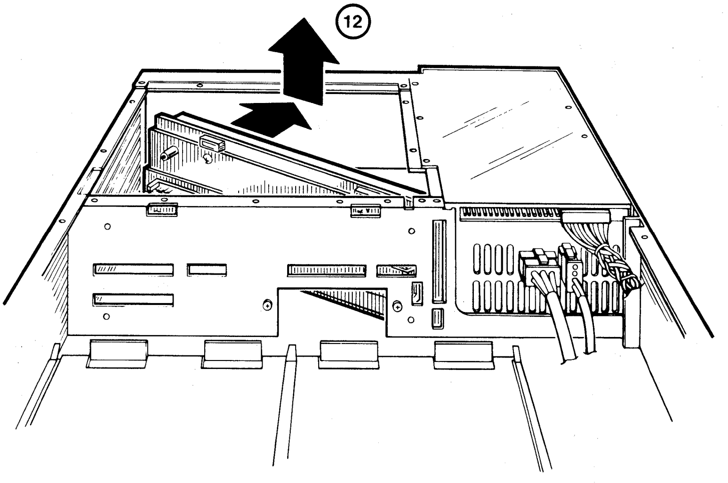


Figure 6-18 Removing Access Cover and Screws

12. Pivot the CD side of the backplane assembly 45 degrees toward the rear and lift it straight up (Figure 6-19).

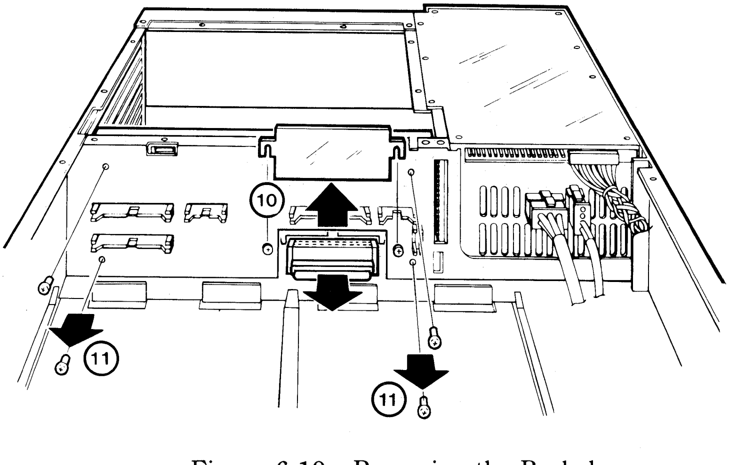


Figure 6-19 Removing the Backplane

6.6 POWER SUPPLY (H7864-A/H7864) REMOVAL

To remove the power supply (Figure 6-20), use the following procedure:

NOTE
The H7864-A and H7864 power supplies are not adjustable, nor do they 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).
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 6-21).
10. Disconnect the power connector from the rear cooling fan.

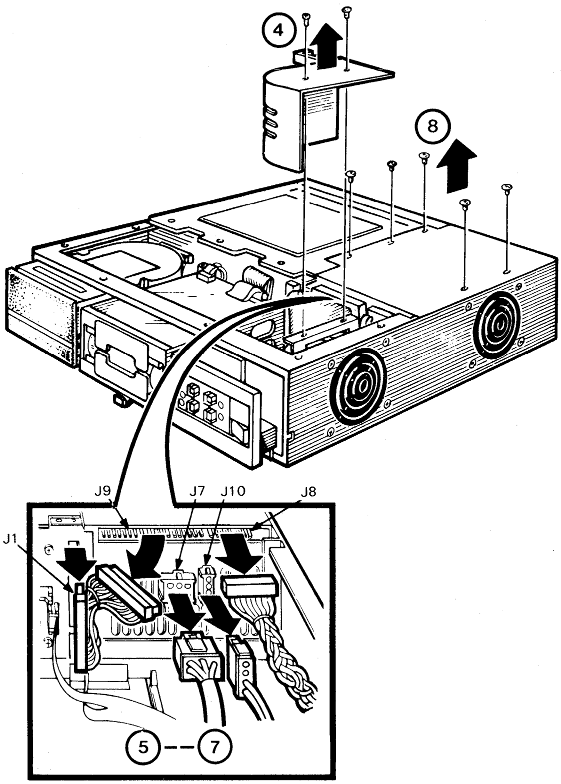


Figure 6-20 Power Supply Removal

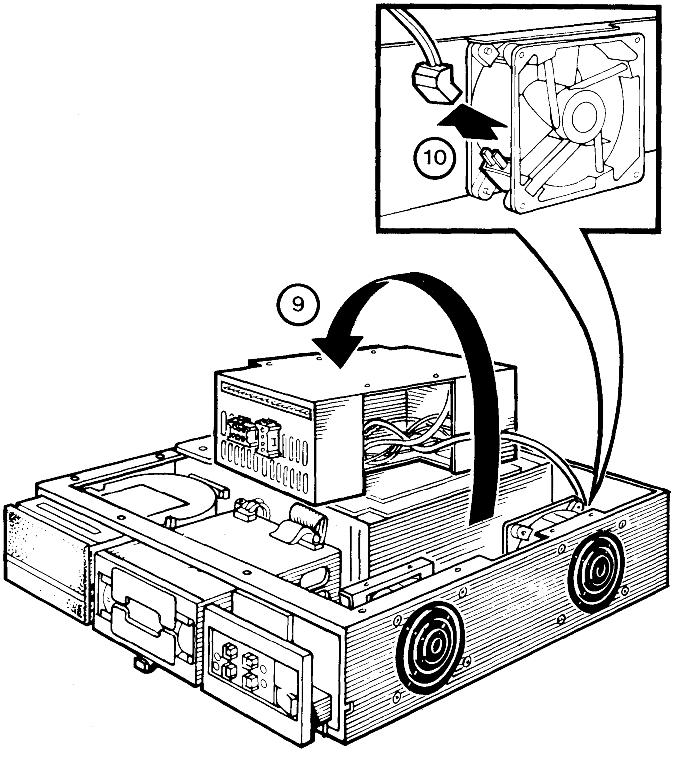


Figure 6-21 Remove Power Supply and Fan Connector

To install a replacement power supply, use the following procedure:

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 6-22).

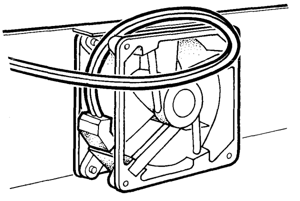


Figure 6-22 Install Rear Fan Power Cable

2. Place the power supply in position. Make sure you route the rear fan cable over the top of the rear fan (Figure 6-23).
3. Reverse steps 1 through 8 of the removal procedure to finish installing the power supply.

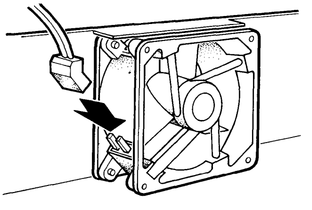


Figure 6-23 Rear Cooling Fan Power Cable Position

6.7 REAR COOLING FAN REMOVAL

To remove the rear cooling fan (Figure 6-24), use the following procedure:

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.

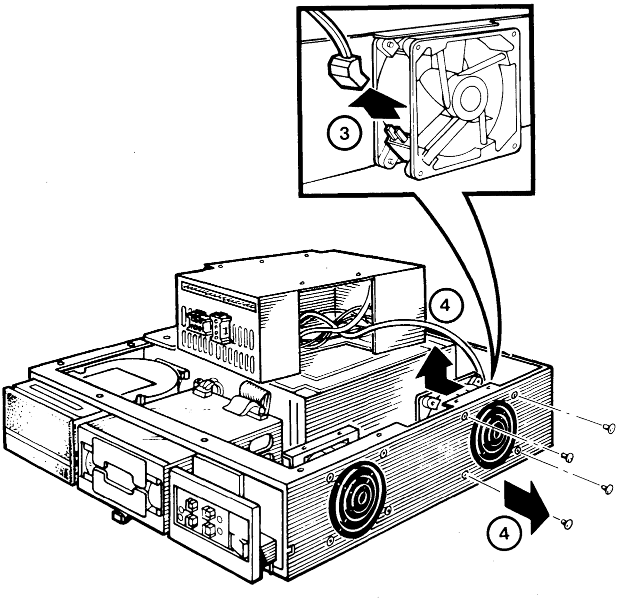


Figure 6-24 Remove the Fan from the Chassis

To install a rear replacement fan, use the following procedure:

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 6-25).
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 6-22.

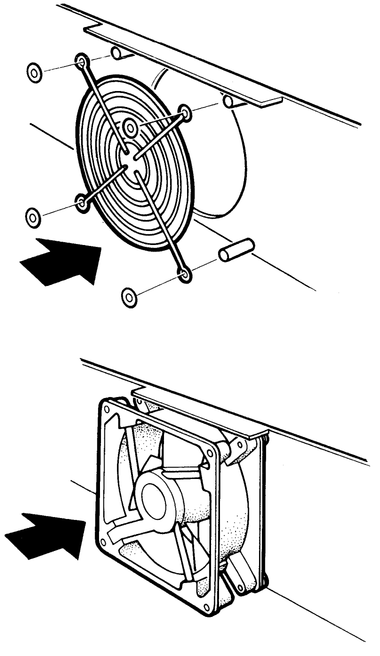


Figure 6-25 Install the Rear Fan

6.8 FRONT FAN REMOVAL

To remove the front fan (Figure 6-26), use the following procedure:

1. Disconnect the ac power cable and remove the front cover.
2. Remove the front retaining bracket 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.

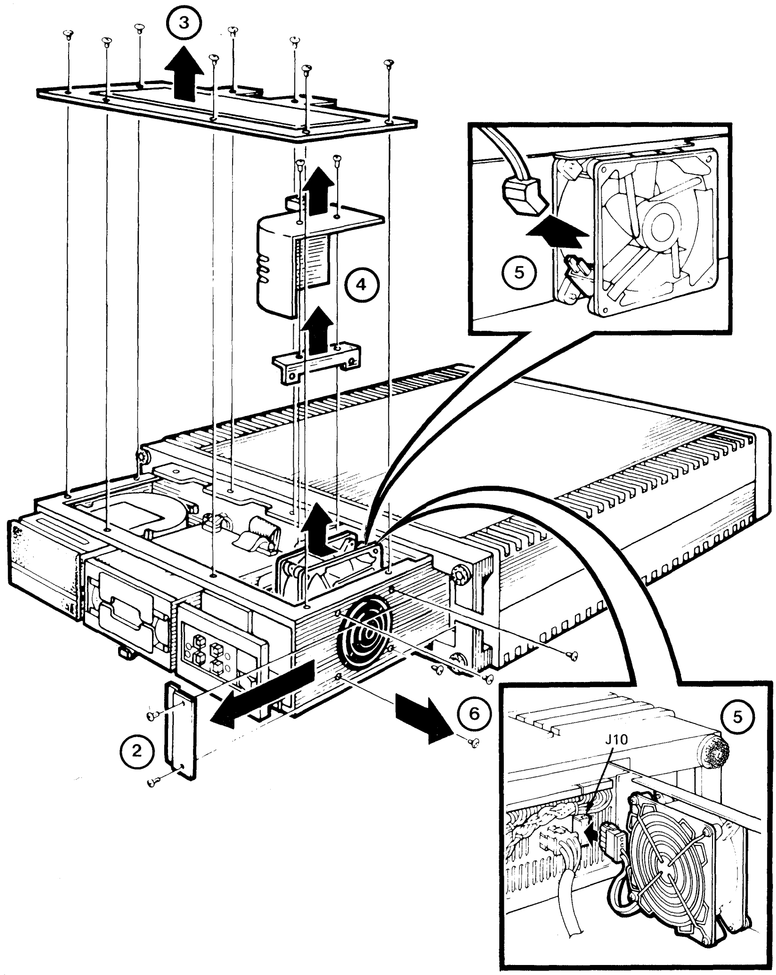


Figure 6-26 Disconnect the Front Cooling Fan

6. Remove the four screws and spacers that hold the fan and fan guard to the chassis and remove the fan (Figure 6-27).

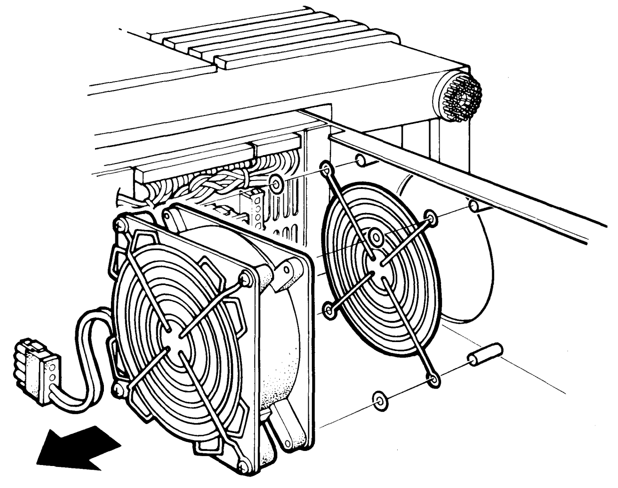


Figure 6-27 Remove the Front Cooling Fan

To install a replacement front fan, use the following procedure:

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 6-28).

   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 6-28.

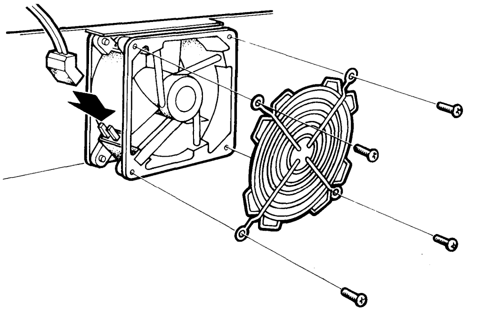


Figure 6-28 Connect the Front Fan Power Cable and Fan Guard

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 6-29).
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.

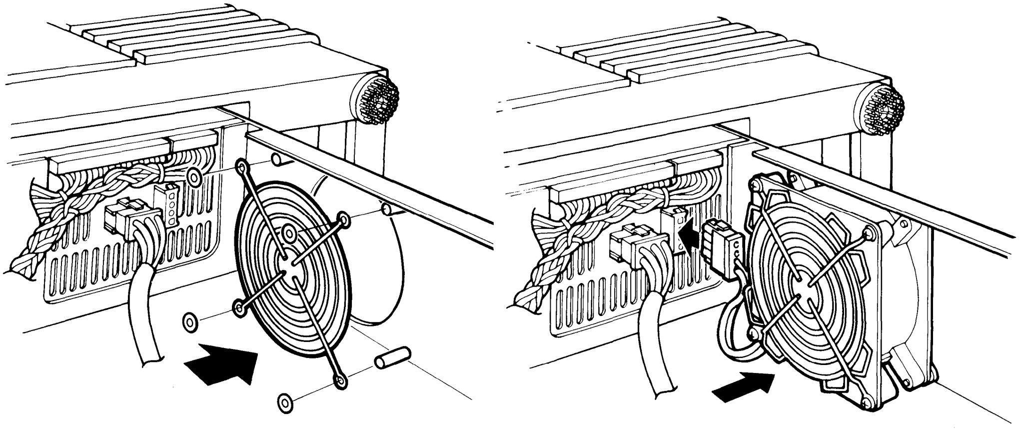


Figure 6-29 Install Replacement Fan

6.9 MODULE REMOVAL

To remove modules from the BA23-A enclosure (Figure 6-30), use the following procedure:

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

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

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

If you install dual-height modules in slots 1, 2, or 3 of the BA23-A backplane, you must install them in rows A and B.

If you install dual-height modules in slots 4 through 8 of the BA23-A 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.

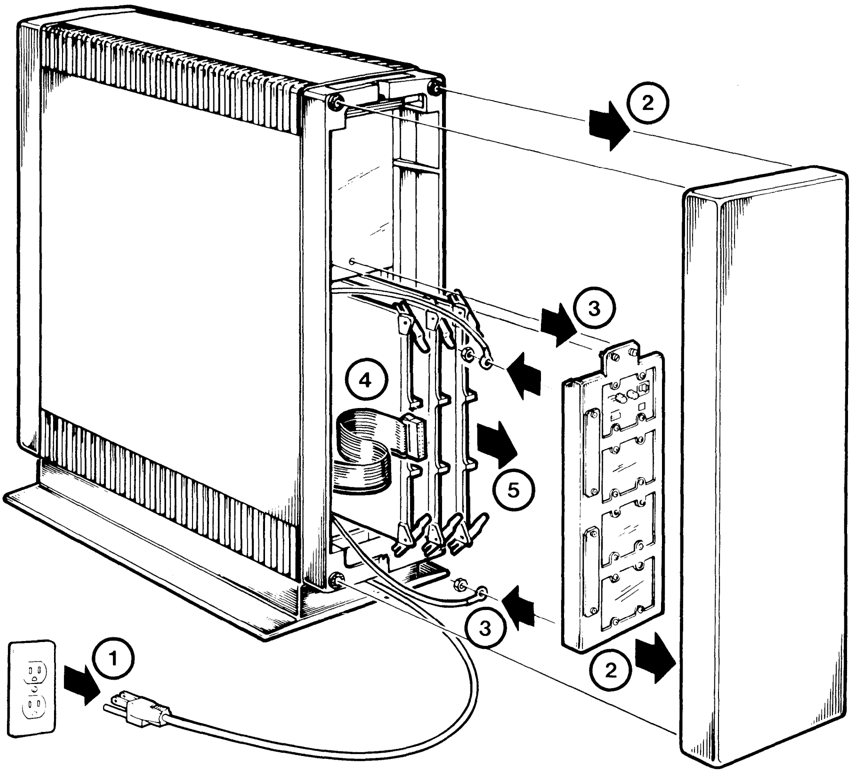


Figure 6-30 Module Removal

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 stripe 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 stripe on each cable.
6. Remove the module from the chassis.

NOTE
Q22-Bus quad-height modules have levers at each end used to lock the module in place and to assist in releasing the module from the backplane. Figure 6-31 shows the operation of these ejector levers.

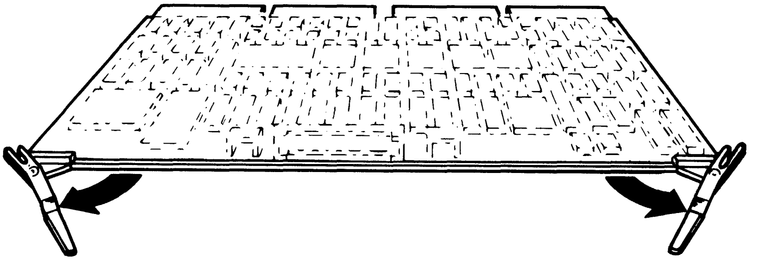


Figure 6-31 Quad-Height Module Ejector Levers

To install modules, use the following procedure:

1. Make sure you set the jumper and switch configuration of the replacement modules correctly. Check the setting against the old module or refer to the user's or installation guide supplied with the new module (also see Chapter 3, System Options).
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, Troubleshooting, of your system owner's manual for instructions.

6.10 REAR I/O INSERT PANEL REMOVAL

To remove a rear I/O insert panel (Figure 6-32), use the following procedure:

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 insert panel. Note the orientation of the red stripe on each cable (not shown).
5. Remove the four screws holding the insert panel to the rear I/O panel assembly and remove the insert.

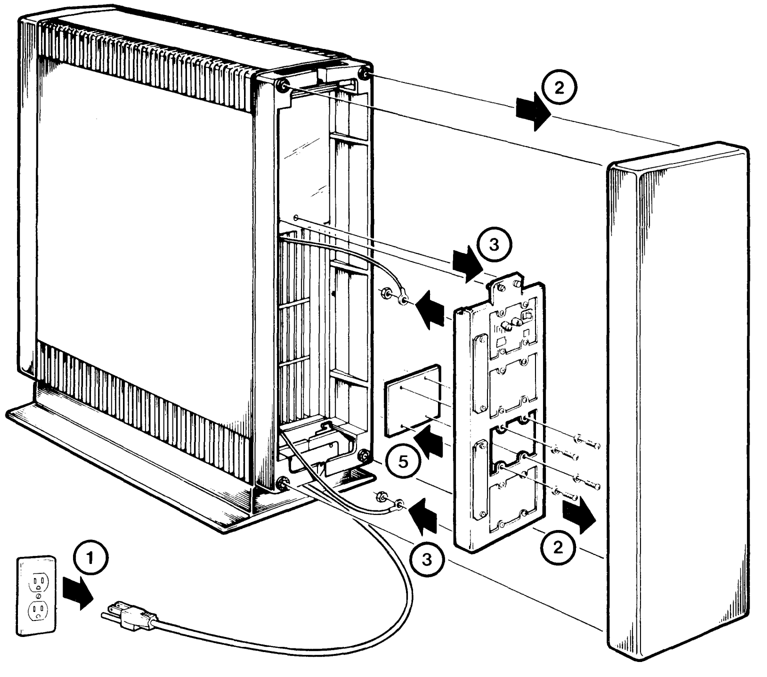


Figure 6-32 Rear I/O Insert Panel Removal

Appendix A
Backplane Pin Assignments

Digital Equipment Corporation's plug-in modules, including those installed in the MicroPDP-11 systems, all use the same contact (pin) identification system. Figure A-1 shows the contact finger identification for a typical quad-height module. Each connector contains 36 lines (18 lines on each side of the printed circuit board). Tables A-1 to A-8 list the backplane pin assignments for modules installed in the MicroPDP-11 systems.

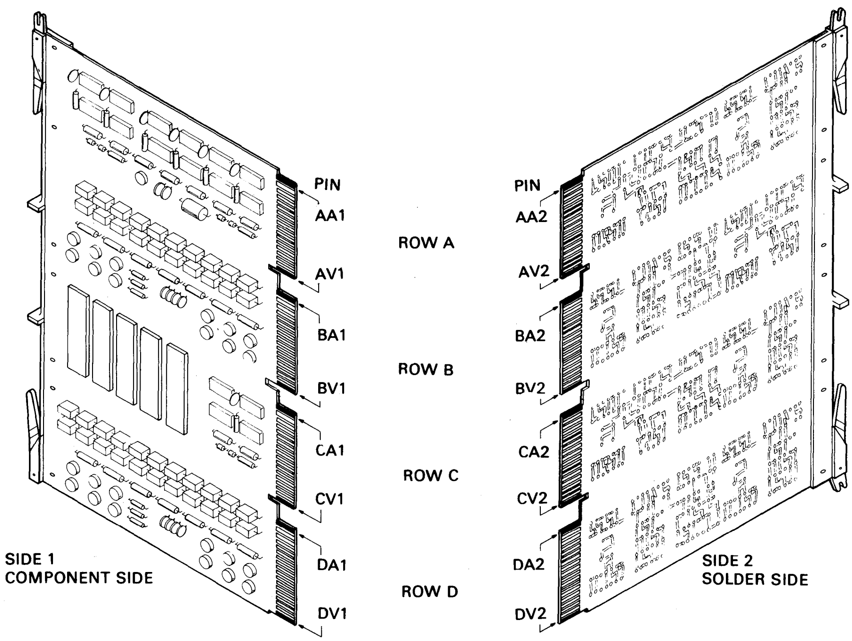


Figure A-1 Quad-Height Module Contact Finger Identification

Table A-1 KDJ11-B (M8190)/KDF11-BE (M8189) Module Backplane Pin Assignments (Rows A and B)

Bus Pin	A Connector: Side 1	A Connector: Side 2	B Connector: Side 1	B Connector: Side 2
A	BIRQ5 L	+5 V	BDCOK H	+5 V
B	BIRQ6 L	–	BPOK H	–
C	BDAL16 L	GND	BDAL18 L	GND
D	BDAL17 L	+12 V	BDAL19 L	+12 V
E	–	BDOUT L	BDAL20 L	BDAL02 L
F	SRUN L	BRPLY L	BDAL21 L	BDALO3 L
H	SRUN L	BDIN L	PUP CD1J L	BDAL04 L
J	GND	BSYNC L	GND	BDAL05 L
K	–	BWTBT L	–	BDAL06 L
L	–	BIRQ4 L	–	BDAL07 L
M	GND	MCENB H	GND	BDAL08 L
N	BDMR L	BIAK L	BSACK L	BDAL09 L
P	BHALT L	BBS7 L	BIRQ7 L	BDAL10 L
R	BREF L	–	BEVENT L	BDAL11 L
S	–	BDMGO L	–	BDAL12 L
T	GND	BINIT L	GND	BDAL13 L
U	–	BDAL00 L	–	BDAL14 L
V	–	BDAL01 L	+5 V	BDAL15 L

– Pins not used.

Table A-2 KDJ11-B (M8190)/KDF11-BE (M8189) Module Backplane Pin Assignments (Rows C and D)

Bus Pin	C Connector: Side 1	C Connector: Side 2	D Connector: Side 1	D Connector: Side 2
A	–	+5 V	–	+5 V
B	–	–	–	–
C	–	GND	–	GND
D	–	–	–	–
E	–	–	–	–
F	–	–	–	–
H	–	–	–	–
J	–	–	–	–
K	–	–	–	–
L	–	–	–	–
M	–	BIAKI L	–	–
N	–	BIAKO L	–	–
P	–	–	–	–
R	–	BDGMI L	–	–
S	–	BDGMO L	–	–
T	GND	–	GND	–
U	–	–	–	–
V	–	–	–	–

– Pins not used.

Table A-3 MSV11-PK (M8067) Module Backplane Pin Assignments (Rows A and B)

Bus Pin	A Connector: Side 1	A Connector: Side 2	B Connector: Side 1	B Connector: Side 2
A	–	+5 V	BDCOK H	+5 V
B	–	–	–	–
C	BDAL16 L	GND	BDAL18 L	GND
D	DBAL17 L	+12 V	BDAL19 L	+12 V
E	+5 V BBU	BDOUT L	BDAL20 L	BDAL02 L
F	–	BRPLY L	BDAL21 L	BDAL03 L
H	–	BDIN L	–	BDAL04 L
J	GND	BSYNC L	GND	BDAL05 L
K	REFKILL	BWTBT L	-5 V MEAS*	BDAL06 L
L	–	–	-5 V MARGIN*	BDAL07 L
M	GND	BIAKI L†	GND	BDAL08 L
N	–	BIAKO L†	–	BDAL09 L
P	–	BBS7 L	–	BDAL10 L
R	BREF L	BDMGI L†	–	BDAL11 L
S	+12 V BBU	BDMGO L†	–	BDAL12 L
T	GND	BINIT L	GND	BDAL13 L
U	SA16K‡	BDAL00 L	–	BDAL14 L
V	+5 V BBU	BDAL01 L	+5 V	BDAL15 L

– Pins not used.
* Must be hardwired on backplane or damage to MOS device may result.
† Hardwired via etch on module.
‡ When SA16K (starting address 16 K) jumper is removed, there is no connection to this pin (used in memory test only).

Table A-4 MSV11-PK (M8067) Module Backplane Pin Assignments (Rows C and D)

Bus Pin	C Connector: Side 1	C Connector: Side 2	D Connector: Side 1	D Connector: Side 2
A	–	+5 V	–	–
B	–	–	–	–
C	–	–	–	–
D	–	–	–	–
E	–	–	–	–
F	–	–	–	–
H	–	–	–	–
J	–	–	–	–
K	–	–	–	–
L	–	–	–	–
M	–	BIAKI L*	–	–
N	–	BIAKO L*	–	–
P	–	–	–	–
R	–	BDGMI L*	–	–
S	–	BDGMO L*	–	–
T	–	–	–	–
U	–	–	–	–
V	–	–	–	–

– Pins not used.
* Jumpered on module.

Table A-5 DZV11-A (M7957) Module Backplane Pin Assignments (Rows A and B)

Bus Pin	A Connector: Side 1	A Connector: Side 2	B Connector: Side 1	B Connector: Side 2
A	–	+5 V	BDCOK H	+5 V
B	–	–	–	–
C	–	GND	–	GND
D	–	+12 V	–	+12 V
E	–	BDOUT L	–	BDAL02 L
F	–	BRPLY L	–	BDAL03 L
H	–	BDIN L	–	BDAL04 L
J	–	BSYNC L	–	BDAL05 L
K	–	BWTBT L	–	BDAL06 L
L	–	BIRQ L	–	BDAL07 L
M	–	BIAKI L	–	BDAL08 L
N	–	BIAKO L	–	BDAL09 L
P	–	BBS7 L	–	BDAL10 L
R	–	BDMGI L	–	BDAL11 L
S	–	BDMGO L	–	BDAL12 L
T	GND	BINIT L	GND	BDAL13 L
U	–	BDAL00 L	–	BDAL14 L
V	–	BDAL01 L	+5 V	BDAL15 L

– Pins not used.

Table A-6 DZV11-A (M7957) Module Backplane Pin Assignments (Rows C and D)

Bus Pin	C Connector: Side 1	C Connector: Side 2	D Connector: Side 1	D Connector: Side 2
A	–	+5 V	–	–
B	–	–	–	–
C	–	–	–	–
D	–	–	–	–
E	–	–	–	–
F	–	–	–	–
H	–	–	–	–
J	–	–	–	–
K	–	–	–	–
L	–	–	–	–
M	–	BIAKI L*	–	–
N	–	BIAKO L*	–	–
P	–	–	–	–
R	–	BDGMI L*	–	–
S	–	BDGMO L*	–	–
T	–	–	–	–
U	–	–	–	–
V	–	–	–	–

– Pins not used.
* Jumpered on module.

Table A-7 RQDX1 (M8369) Module Backplane Pin Assignments (Rows A and B)

Bus Pin	A Connector: Side 1	A Connector: Side 2	B Connector: Side 1	B Connector: Side 2
A	–	+5 V	–	+5 V
B	–	–	BPOK L	–
C	BDAL16 L	GND	BDAL18 L	GND
D	DBAL17 L	+12 V	BDAL19 L	+12 V
E	–	BDOUT L	BDAL20 L	BDAL02 L
F	–	BRPLY L	BDAL21 L	BDAL03 L
H	–	BDIN L	–	BDAL04 L
J	GND	BSYNC L	GND	BDAL05 L
K	–	BWTBT L	–	BDAL06 L
L	–	BIRQ4 L	–	BDAL07 L
M	GND	BIAKI L	GND	BDAL08 L
N	BDMR L	BIAKO L	BSACK L	BDAL09 L
P	–	BBS7 L	–	BDAL10 L
R	BREF L	BDMGI L	–	BDAL11 L
S	–	BDMGO L	–	BDAL12 L
T	GND	BINIT L	GND	BDAL13 L
U	–	BDAL00 L	–	BDAL14 L
V	–	BDAL01 L	+5 V	BDAL15 L

– Pins not used.

Table A-8 RQDX1 (M8639) Module Backplane Pin Assignments (Rows C and D)

Bus Pin	C Connector: Side 1	C Connector: Side 2	D Connector: Side 1	D Connector: Side 2
A	–	+5 V	–	+5 V
B	–	–	–	–
C	–	GND	–	GND
D	–	–	–	–
E	–	–	–	–
F	–	–	–	–
H	–	–	–	–
J	GND	–	GND	–
K	–	–	–	–
L	–	–	–	–
M	GND	BIAKI L*	GND	–
N	–	BIAKO L*	–	–
P	–	–	–	–
R	–	BDGMI L*	–	–
S	–	BDGMO L*	–	–
T	GND	–	GND	–
U	–	–	–	–
V	–	–	–	–

– Pins not used.
* Jumpered on module.

B.1 DISK UNIT NUMBER DESIGNATION

The microcode of the first RQDX1, RQDX2, or RQDX3 module labels the associated disk units as DU0, DU1, DU2, and DU3. Table B-1 shows these disk unit designations for the MicroPDP-11 and PDP-11/23 PLUS systems when add-on disk units are associated with the system. Make sure you label each disk unit. Drive unit labels come with the base computer system.

An RQDX1 module supports only two fixed disk drives and one RX50 diskette drive.

An RQDX2 module supports only four fixed disk drives or two fixed disk drives and one RX50 diskette drive.

Table B-1 Disk Unit Designation

Disk Drive(s)	MicroPDP-11	PDP-11/23 PLUS
Internal RX50	DU0,DU1	N/A
Internal RX50	DU0,DU1	N/A
and		
Add-On RX50	DU2,DU3*	N/A
Internal RX50	DU1,DU2	N/A
and		
Internal RD5n	DU0	N/A
Internal RX50	DU2,DU3	N/A
and		
Internal RD5n	DU0	N/A
with		
Add-On RD5n	DU1	N/A

Table B-1 Disk Unit Designation (Cont.)

Disk Drive(s)	MicroPDP-11	PDP-11/23 PLUS
No internal		
Add-On RX50†	N/A	DU0,DU1
No internal		
Add-On RD5n	N/A	DU0
No internal		
Add-On RX50	N/A	DU0,DU1
and RX50	N/A	DU2,DU3
No internal		
Add-On RX50	N/A	DU1,DU2
and RD51/52	N/A	DU0
No internal		
Add-On RD5n	N/A	DU0
and RD5n	N/A	DU1
No internal		
Add-On RD5n	N/A	DU0
and RD5n	N/A	DU1
and RX50	N/A	DU2,DU3

* Refer to the *RQDX1 Owner's Manual* for correct jumper settings. Jumper setting should be done by trained field service personnel.

† Refer to the *11C23-UC, 11C23-UE Upgrade Installation Guide* for specific requirements for PDP-11/23 PLUS systems.

B.2 LOGICAL UNIT NUMBERS (LUN)

The logical unit numbers and the LUN jumpers provide for future expansion capability of more than one RQDX module per system. Jumpers on the RQDX controller module select the LUN. These jumpers determine the lowest unit number assigned to any RD5n and RX50 disk drives present in the system.

The RQDX module automatically sizes the logical unit configuration during initialization of the system to determine how many of the four possible units are actually present. The microcode automatically assigns disk unit numbers to any drives that are present. An RX50 diskette drive is two units. Table B-2 shows the standard LUN jumper configuration.

Table B-2 RQDX Standard Logical Unit Number Configuration

LUN Jumper	State	Unit Number
LUN 0	Out	0–3*
LUN 1	Out	
LUN 2	Out	
LUN 3	Out	
LUN 4	Out	
LUN 5	Out	
LUN 6	Out	
LUN 7	Out	

* Indicates that logical unit numbers 0–3 are assigned to this controller module. The controller automatically determines if less than four logical units are present. The system software displays these as DU0–DU3 on the screen.

The LUN jumper format allows you to set the starting number anywhere from zero and up. Only one jumper setting per module is allowed. Use the format in Table B-3 to configure a module with a starting LUN of other than zero.

Table B-3 RQDX Logical Unit Number Jumper Configuration

Jumper Setting 7 (128	6 64	5 32	4 16	3 8	2 4	1 2	0 1)	First Unit Number
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	1	1	3
0	0	0	0	0	1	0	0	4
0	0	0	0	0	1	0	1	5
0	0	0	0	0	1	1	0	6
0	0	0	0	0	1	1	1	7
0	0	0	0	1	0	0	0	8
0	0	0	0	1	0	0	1	9

Table B-4 shows an example of unit number designation when LUN jumper 4 is installed.

Table B-4 RQDX Unit Number and Jumper Format

Jumper Installed	Unit Number Specified
4	16 = first unit
	17 = second unit
	18 = third unit
	19 = fourth unit

Appendix C
Formatting a MicroPDP-11 System

C.1 PROCEDURE

Before you start this procedure, make sure you write-protect any other fixed disk drives present in the system.

(User responses are in **bold**.)

Insert the Field Service Test Diskette 4 (CZXD4D0) in drive. Press the **Return** key.

Type **R ZRQB??** after the . (period) prompt. Press the **Return** key.

This runs the diagnostic program. The question marks allow any revision of the program to be used. When formatting an RD52 make sure you have Version 5 or later. Earlier versions format the RD52 or RD53 as though they were an RD51 (11 Mbytes).

A response similar to the following appears on the terminal.

DR>

You must respond to this prompt with a command to run the program.

Type **START**. Press the **Return** key. Then answer the following question.

CHANGE HW (L)?

This is a program that answers hardware question and is prebuilt to format unit 0 with default answers.

Type **N** (no). Press the **Return** key.

CHANGE SW (L)

This program answers software questions.

Type **N**. Press the **Return** key.

ENTER DATE (in mm-dd-yy format) (A)?

Type the current date. For example, 06-15-85. Press the **Return** key.

ENTER UNIT NUMBER TO FORMAT <0>

This is usually either drive unit 0 or 1. Type **0** if you are formatting the first fixed disk drive installed on the system. Type 1 if you are formatting the second disk drive installed on the system. See Appendix B, Logical Unit Number Designations, for additional information.

Type **0** or **1**. Press the **Return** key.

USE EXISTING BAD BLOCK INFORMATION?

This activates the reformat mode – reads the manufacturer's information on the disk and cylinder.

Type **Y** (yes). Press the **Return** key.

> **NOTE**
> **The program takes approximately 12 minutes to complete. The N (no) response takes approximately 30 minutes to complete.**

CONTINUE IF BAD BLOCK INFORMATION IS INACCESSIBLE

Type **Y** (yes). Press the **Return** key.

ENTER A NON-ZERO SERIAL NUMBER:

Type your serial number (located on the top of the disk drive). Press the **Return** key.

The system displays a message similar to the following:

FORMAT BEGUN

After about 12 minutes, the system displays a completion message similar to the following:

FORMAT COMPLETED

Remove the diskette.

If formatting is not successful, the system displays a message when the error occurs.

C.2 FORMATTING HELP AND INFORMATION

The following is a list of messages generated by the formatter, their probable cause, and what to do. Errors 1, 2, and 3 occur almost immediately; error 4 can occur up to 1 minute after starting; error 5 from 1 to 10 minutes; and errors 6 and 7, after 10 minutes.

(1) UNIT IS NOT WINCHESTER OR CANNOT BE SELECTED.

Unit selected is either unavailable or is an RX50. Check to make sure the fixed disk is not write-protected.

Make sure the jumper on the disk drive is set correctly (see Chapter 6, FRU Removal and Replacement Procedures).

(2) INITIAL FAILURE ACCESSING FCT(2)

The Format Control Table cannot be read. Try Reconstruct mode; see Section C.3 for information. If that fails, replace the disk.

(3) FACTORY BAD BLOCK INFORMATION IS INACCESSIBLE

Occurs only in reformat mode when bad block data is not accessible. Run in Reconstruct mode; see Section C.3 for information.

(4) SEEK FAILURE DURING ACTUAL FORMATTING

There is a hardware error. Check for hardware problems.

(5) REVECTOR LIMIT EXCEEDED

The disk is bad. Replace the disk.

(6) RCT WRITE FAILURE

Write to disk failed after successful formatting and surface analysis. Check write-protect status.

(7) FAILURE CLOSING FCTS

Disk is marked as unformatted.

C.3 FORMATTING MODE

Three questions select the type of format mode that is run; reformat, restore, or reconstruct mode. In order the three questions are:

1. Use existing bad block information?
2. Down-line load?
3. Continue if bad block information is inaccessible?

The first two questions determine which mode is run. The second question does not appear unless the first question is answered N (no). An answer of N to question 3 causes the diagnostic to stop and print a message if a bad spot is found.

- **REFORMAT MODE** – If your answer to question 1 is **Y**, no further questions are asked. The format program reads the manufacturer's bad blocks from a block on the disk. It then formats all of the disk except for these bad blocks. This takes about 12 minutes. If it fails, try restore mode.
- **RESTORE MODE** – If your answer to question 1 is **N**, the program asks you to type in a list of the bad blocks. It then formats all of the disk except for the bad blocks you specify. You can input the bad blocks using the list that comes with the drive. It asks you for the serial number. This number is found on the top of the RD52 disk drive. The program only allows you to type in the last eight digits of the serial number. Restore mode takes about 15 minutes.
- **RECONSTRUCT MODE** – If you answer **N** to both questions 1 and 2, the program searches the disk and identifies all of the bad blocks. It does not use the manufacturer's bad block information. It then formats all of the disk except for the bad blocks it identified. This takes about 30 minutes.

Appendix D
Configuration Worksheet

D.1 INTRODUCTION

This appendix provides instructions and a sample worksheet for generating floating CSR addresses for modules installed in Q-Bus systems. Samples are shown in Table D-1 of the following systems:

Sample 1	CSR	Sample 2	CSR	Sample 3	CSR
DPV11	17760270	DZV11	17760100	1st DZV11	17760100
MSCP	17760334	DPV11	17760310	2nd DZV11	17760110
DHV11	17760520	DMV11	17760340	3rd DZV11	17760120
DMSCP*	17760374	DPV11	17760330		
DHV11	17760540	DMV11	17760360		
		DMSCP	17760414		
		TMSCP†			
		DHV11	17760540		

* DMSCP – Disk mass storage control protocol device.

† TMSCP – Tape mass storage control protocol device.

Table D-2 is a blank worksheet for you to copy and use when you determine the configuration of a system.

D.2 INSTRUCTIONS

Use the following procedure for generating floating CSR addresses for Q-Bus systems.

Table D-1 is ranked from 1 to 34 where rank one is the highest rank. The octal value for each rank is located in the column labeled Octal Size (in bytes). Use the following rules when you are adding octal values of 20 and 40.

D.2.1 Rules for Adding Octal Values of 20 and 40

1. When the octal value of a rank is 20, you can only enter an address of n00, n20, n40, or n60. Enter the next possible address for that rank (see the examples in Table D-1), at ranks 11 and 12, 23 and 24, and 30 and 31.
2. When the octal value of a rank is 40, you can only enter an address of n00 or n40. Enter the next possible address for that rank. See the example in Table D-1 at ranks 26 and 27.

D.2.2 Procedure

1. Find the highest ranking module with a floating CSR to be installed in the system; assign this module its first possible floating address. Table D-1 shows the CSR address of installed modules in brackets ([ ]).
2. If you are installing more than one module of the same type, assign a CSR address to each additional module. Determine these CSR addresses by adding the octal value for that module to the previous address you assigned.

Table D-1, sample 3, shows the CSR addresses for three DZV11 modules installed in a system.

3. Assign a "blank" value after the last module of each type that you install. Determine the "blank" value by adding the octal size value for that module to the last address you have assigned for the module. "Blank" values are shown in braces ({ }) (see the entries at rank 8, Table D-1).
4. Add the octal size value of the next lower rank to the "blank" value and enter the sum. This number becomes your new working number. Make sure you observe the rules for octal values of 20 and 40.
5. Add the octal size value for each rank as you move down the list to the next module you are installing in your system. Observe the rules for octal values of 20 and 40.
6. If the sum of your working number and the next octal size value exceeds n74, the next entry starts the next block of 100s. For example, if the sum equals 280, your next entry is 300.

Table D-1 Sample Worksheet for Generating CSR Addresses

Rank No.	Module	First Fixed Address	First Possible Floating Address	Octal Size (in bytes)	Sample 1	Sample 2	Sample 3
1			17760010	10			
2			17760020	20			
3			17760030	10			
4	DUV11	N/A	17760040	10			
5			17760050	10			
6			17760060	10			
7			17760070	10			
8	DZV11	N/A	17760100	10	**[100]{110}**	**[100]{110}**	**[120]{130}**
9			17760110	10	120	140	
10			17760120	10	130	150	
11			17760130	10	140	160	
12			17760140	20	160	200	
13			17760150	10		170	210
14		17774400	17760160	10	200	220	
15			17760200	20	220	240	
16			17760210	10	230	250	
17			17760220	10	240	260	
18		17777170	17760230	10	250	270	
19			17760240	10	260	300	
20			17760250	10	270	310	
21			17760260	10	300	320	
22	DPV11	N/A	17760270	10	**[270]{300}**	**[310]{320}**	**[330]{340}**
23			17760300	10	310	330	350
24	DMV11	N/A	17760320	20	320	**[340]{360}**	**[360]{400}**
25			17760330	10	330	370	410
26	DMSCP	17772150	17760334	4	**[334]{340}**	**[374]{400}**	**[414]{420}**

Table D-1 Sample Worksheet for Generating CSR Addresses (Cont.)

Rank No.	Module	First Fixed Address	First Possible Floating Address	Octal Size (in bytes)	Sample 1	Sample 2	Sample 3
27			17760340	40	400	440	440
28			17760360	20	420	460	460
29			17760400	20	460	500	500
30	TMSCP	17774500	17760404	4	464	504	**[504]{510}**
31			17760420	20	500	520	520
32	DHV11	N/A	17760440	20	**[520]{540}**	**[540]{560}**	**[540]{560}**
33			17760500	40	600	600	600
34			17760540	40	640	640	640

D.3 BLANK WORKSHEET

Use this table to configure your system if it does not match the common configurations shown in Table 4-5, Chapter 4, Configuration.

Table D-2 Blank Worksheet for Generating CSR Addresses

Rank No.	Module	First Fixed Address	First Possible Floating Address	Octal Size (in bytes)	Sample
1			17760010	10	
2			17760020	20	
3			17760030	10	
4	DUV11	N/A	17760040	10	
5			17760050	10	
6			17760060	10	
7			17760070	10	
8	DZV11	N/A	17760100	10	
9			17760110	10	
10			17760120	10	
11			17760130	10	

Table D-2 Blank Worksheet for Generating CSR Addresses (Cont.)

Rank No.	Module	First Fixed Address	First Possible Floating Address	Octal Size (in bytes)	Sample
12			17760140	20	
13			17760150	10	
14		17774400	17760160	10	
15			17760200	20	
16			17760210	10	
17			17760220	10	
18		17777170	17760230	10	
19			17760240	10	
20			17760250	10	
21			17760260	10	
22	DPV11	N/A	17760270	10	
23			17760300	10	
24	DMV11	N/A	17760320	20	
25			17760330	10	
26	DMSCP	17772150	17760334	4	
27			17760340	40	
28			17760360	20	
29			17760400	20	
30	TMSCP	17774500	17760404	4	
31			17760420	20	
32	DHV11	N/A	17760440	20	
33			17760500	40	
34			17760540		

Appendix E
TK50 Extended Diagnostics

E.1 INTRODUCTION

Troubleshooting the TK50 tape drive generally involves one or more of the following:

- Running the system user test.
- Running the program from the system boot/diagnostic ROM.
- Running the extended field service tests.

Refer to your system owner's manual for user test instructions. Refer to Chapter 2, MicroPDP-11 Base Systems, and Chapter 5, Diagnostics, for system boot/diagnostic ROM test descriptions and procedures.

This appendix provides the following information:

- Extended testing of the tape drive.
- Extended test user interface and message format.
- Extended test descriptions.

E.2 EXTENDED TESTING OF THE TAPE DRIVE

When you turn on your TK50 subsystem or run the user test, you may see one or more messages displayed on your terminal. The TK50 level 1 microdiagnostics run at power-up and are contained in the host processor. The program is responsible for testing the controller module and initializing and reporting results of the level 2 microdiagnostics that reside in the TQK50 controller ROMs. The TK50 level 2 microdiagnostics test basic drive functions.

These tests can also be started by the host and run under the XXDP+ supervisor. The following sections provide information for extended testing of the TK50 tape drive using the field service diagnostics provided with the host system or with the TK50 tape drive.

If a fault occurs:

- Call your service representative or
- Run the XXDP+ diagnostic tests to isolate the failing component.

> **NOTE**
> **These procedures require extensive knowledge of the XXDP+ diagnostic software and should only be carried out by trained service representatives.**

Use the following tests to isolate faults related to the TK50 tape drive or the M7546 tape controller module:

- CZTKAn* Functional Diagnostics/Verify Mode runs the Level 1 microdiagnostics and tests power-up and the controller.

  Functional Diagnostics/Execute Mode runs the level 2 microdiagnostics and tests the TK50 drive.

- CZTKBn* Data Reliability Test runs under the XXDP+ supervisor. It tests error rate overtime and detects functional faults. It does not test to the FRU level.

* n = revision letter.

A brief discussion of each of these test starts at Section E.5. Refer to your system's technical manual for directions and a general discussion of the XXDP+ Supervisor and the DEC/X11 run-time exerciser. For additional information on the diagnostic system, refer to:

- *DEC/X11 User's Manual* (AC-F053-MC).
- *DEC/X11 Cross-Reference Manual* (AC-F055C-MC).
- *XXDP+/SUPR User's Manual* (AC-F348A-MC)

E.3 CXTKA USER INTERFACE

When you run these tests under the XXDP+ Supervisor, the program prompts you for answers to the following hardware questions. These questions allow you to establish certain operational parameters of the program.

E.3.1 Hardware Questions

This set of questions must be answered when the program is first started.

CHANGE HARDWARE (L)? – Answer yes for the first pass of the program.

This question is asking if you want to reconfigure the unit under test. No is the default.

NUMBER OF UNITS (D) – Enter 1-n where n is the total number of units being tested.

UNIT X – Enter 1 , 2, or 3 . . .

The program repeats these questions the number of times you specify by your response to the NUMBER OF UNITS question. Enter only one number in response to the UNIT X question.

BASE ADDRESS (O) – Enter the CSR address for the module being tested.

The first module in the system has a CSR address of 17774500. Additional modules have a floating CSR address of 17760nnn.

VECTOR (O) – Enter 260

UNIT NUMBER – Enter the MSCP specified unit number for each unit; for example, MU0, MU1.

E.3.2 Software Questions

Answering the software questions is optional. Use a <CR> or <CTRL/Z> to obtain the default values. Most of the optional functionality of the program is either handled automatically by the program or through established procedures provided by the XXDP+ Supervisor. For example, the program bypasses the level 2 microdiagnostics if no cartridge is present in the drive.

If you want to change the default settings for these questions, refer to the XXDP+ software documents for information.

E.4 CZTKA MESSAGE FORMAT

The TK50 diagnostic programs display messages in two formats as shown in the following examples:

E.4.1 Format 1

Host level 1 testing programs use:

CZTKA DVC FTL ERR eee ON UNIT ll TST tt SUB ss PC; XXXXXXX
SA REG CONTENTS INCORRECT
IN INIT SEQUENCE STEP #: n
SA EXPECTED: YYYYYY SA RECEIVED: ZZZZZZ

*****FAILING FRU: CNTL

- eee = A discrete error number defined by the program.
- ll = The logical unit number assigned to the unit-in-error when you answered the hardware question.
- tt = The test number during which the error occurred.
- ss = The subtest number.
- XXXXXX = The program location of the error call.
- n = The step number of the UQSSP (U/Q-Bus storage system protocol) initialization sequence that detected the error condition.
- YYYYYY = The expected contents of the SA register for this step.
- ZZZZZZ = The actual SA register contents.

E.4.2 Format 2

Controller level 2 testing programs use:

CZTKAA DEV FTL ERR eee ON UNIT ll TST tt SUB ss PC: XXXXXX
DRIVE COULD NOT OVERWRITE
FAILING U-DIAG #:6
TRACK: nn PHYS. BLK: pppppp ERR TYP: YYY RETRIES: rr
DRIVE ERROR BYTE: ddd

******FAILING FRU: DRV

- eee = A discrete error number defined by the program.
- ll = The logical unit number assigned to the unit-in-error when you answered the hardware question.
- tt = The test number during which the error occurred.
- ss = The subtest number.
- XXXXXX = The program location of the error call.
- nn = Logical track number where the error occurred.
- pppppp = Physical block number at which the error occurred.
- YYY = The type of error as defined by the TK50 diagnostic error log specification.
- rr = The number of retries, if any, while trying to overcome the error.
- ddd = The drive error condition detected by the drive. This line is not included if no drive error is detected.

E.5 CZTKA FUNCTIONAL DIAGNOSTIC/VERIFY MODE (LEVEL 1 MICRODIAGNOSTICS) TEST DESCRIPTIONS

The following test descriptions have the following points in common:

- All errors listed in the test descriptions cause the unit to be dropped from the test.
- Scope loops return to the beginning of the test containing the error if the operator has chosen to loop-on-error (LOE flag set).

E.5.1 Test 1: Existence Verification Test

Test 1 verifies the existence of the IP and SA registers by addressing them. An error here could be caused by:

- An incorrect address setting in the controller DIP switch setting.
- Faulty controller logic.
- An operator error in specifying a base address (the CSR address).

E.5.2 Test 2: SA Register Wrap Test

Test 2 sets the WR (wrap) bit, enters the diagnostic wrap mode, and then writes and reads a floating 1 pattern to and from the SA register. The sequence repeats with a floating 0 pattern.

A failure to echo the written data results in a callout to the controller. If loop-on-error is set, the program loops on the failing write and read.

E.5.3 Test 3: Initialization Test and Power-Up Microdiagnostics

Test 3 disables the interrupts and then:

- Verifies that all step transitions occur within the allotted time.
- Verifies that all host supplied information is correctly echoed by the controller.
- Verifies that no interrupts occur as a result of the step transitions.
- Verifies that no interrupts occur at the vector assigned to the unit.

A failure in this test indicates a failing controller.

E.5.4 Test 4: Vector and Interrupt Level Test

Test 4 repeats test 3 but with interrupts enabled to test the TQK50 controller vector and interrupt level. This test verifies that an interrupt occurs at each step transition.

A failure in this test indicates a failing controller.

E.5.5 Test 5: BR Level Test

Test 5 ensures that the TQK50 controller cannot interrupt when the CPU priority is set to 7.

A failure in this test indicates a failing controller.

E.5.6 Test 6: Purge and Poll Test

The host sets the "PP" (purge and poll) bit and simulates a UQSSP (U/Q-Bus storage systems protocol) handshake for a bus adapter purge. The host then requests the controller to begin poll testing. The controller initiates DMA (direct memory access) activity, in both directions, to the communications area identified by the host. The controller ends this test, leaving the communications area cleared.

Ring depth in this test is set to 1, the minimum value, to reduce potential impact on host memory if a failure occurs.

A failure in this test indicates a failing controller.

E.5.7 Test 7: Maximum Ring Buffer Test

Test 7 is similar to test 5 except the program uses the maximum allowed ring depth. The ring depth value is equal to 128 command and 128 response slots of 32 bits per slot.

A failure in this test indicates a failing controller.

E.5.8 Test 8: Extended Address Test

Test 8 establishes the communications area in the highest available memory locations and tests the upper 6 bits of address logic on the controller module.

The program bypasses this test if the system contains only 28 K words of memory.

A failure in this test indicates a failing controller.

E.5.9 Test 9: Get DUST Status Test

Test 9 requests and tests the DUST status of each unit for:

- No command modifiers set.
- Illegal command modifiers set.

The program issues the get DUST status command to the unit under test. This command is available in the DUP (diagnostics utilities protocol). The system tests the DUST status packet received from the unit against a known good mask. If the bits received do not match the mask, the program reports an error.

A failure in this test indicates a faulty controller.

E.5.10 Test 10: Execute Level 2 Microdiagnostics

Test 10 calls up the level 2 microdiagnostics resident on the controller and reports the finding of these tests. Test 10 checks for:

- Full communication between the controller and the drive.
- Functional tests on the drive.

Most errors reported by this test occur in the drive.

E.6 CZTKA FUNCTIONAL DIAGNOSTICS/EXECUTE MODE (LEVEL 2 MICRODIAGNOSTICS) TEST DESCRIPTIONS

The level 2 microdiagnostics test the read and write operations of the TK50 tape drive. The program prompts the user to insert a scratch tape cartridge into the tape drive. The host bypasses these tests if no tape is present. These diagnostic report recoverable errors. It reports nonrecoverable errors as fatal device errors.

Test 10 (Section E.5.10) initiates the following sequence of tests twice to make sure that both channels of the head receive equal testing. The program runs the entire sequence first at the physical BOT (beginning of tape) using head channel 1. The program positions the tape at the EOT (end of tape) and repeats the sequence using head channel 2. At the completion of the test, the tape rewinds and is left at the physical BOT.

The following test descriptions provide a summary of each of the level 2 microdiagnostic tests.

E.6.1 Test 1: Simple Read/Write Test

Test 1 verifies basic write/read capability.

Test 1 writes several blocks of 1F and 2F data to the tape. The tape rewinds, and the information is read back. The program performs a compare operation of the read back function.

E.6.2 Test 2: Streaming Read/Write Test

Test 2 verifies that the drive can write and read over a fairly long distance while in a normal operational mode.

Test 2 writes various data patterns on a single track and on a set length of tape while the tape is streaming. The tape rewinds and reads while the tape is streaming.

E.6.3 Test 3: Thrashing Read/Write Test

Test 3 verifies that the tape tracking and tension are not affected by frequent direction changes.

Test 3 writes data patterns on a single track and inserts delays between the write blocks to force thrashing. After rewinding, the program reads the blocks with forced delays between reads.

E.6.4 Test 4: Peak Shift Test

Test 4 verifies that the write precompensation logic is functioning properly.

Test 4 repeats test 2 using the worst case MFM (modified frequency modulation) peak shift patterns.

E.6.5 Test 5: Signal Sag Test

Test 5 detects self-erasure of recorded data.

Test 5 writes a set length of tape with blocks of 2F data. The tape rewinds and moves back and forth while stepping the head up and down. The program positions the tape at the logical BOT for the recorded track and reads back.

E.6.6 Test 6: Overwrite Test

Test 6 guarantees that the drive is capable of overwriting previously recorded data.

Test 6 writes a MW data pattern over a set length of tape on a signal track. The tape rewinds, and the program rewrites a data pattern.

E.6.7 Test 7: Track Access Test

Test 7 verifies tape tracking and the drives ability to successfully record and retrieve data on adjacent tracks.

Test 7 writes a set number of blocks of data on a signal track. The tape rewinds and steps to the next track. This sequence repeats until all the tracks are written. The program then rewinds the tape and reads back all the blocks from all the tracks.

E.6.8 Test 8: Positioning Test

The first time through Test 8, the program positions the tape at the physical EOT. This lets the entire testing sequence to repeat using channel 2 of the head. The second entry into this test causes the tape to be positioned back at the physical BOT.

This test includes a watch-dog timer to guard against a hung drive condition.

E.7 CZTKB DATA RELIABILITY TEST

The Data Reliability Test runs under the XXDP+ Supervisor and establishes the performance quality of each unit being tested. The data reliability program detects functional faults, but it does not isolate faults to the FRU level. The Data Reliability Test requires 28 K of memory.

This program supports all the PDP-11 Diagnostic Supervisor flags with the following exceptions:

- LOE – Loop-on-error
- IDR – Inhibit drop units

E.8 CZTKB PROGRAM OPERATION

The program positions the tape at the BOT marker and then passes all the available tape over the tape head to the EOT marker on the tape. When this has been done twice, one pass of the program is complete. The data reliability test takes 1 hour and 10 minutes when it is run in default mode. If the field engineer tells it to run other tests or to run multiple passes, the time is considerably longer.

The program prompts you for answers to the following hardware questions which must be answered when the program is started.

CHANGE HARDWARE – Type yes if this is the first time the program is run on the unit under test.

NUMBER OF UNITS – Type in the number of units to be tested.

TKIP ADDRESS – Type in the base address of the unit, for example, 774500.

TK VECTOR ADDRESS – Type the vector for the module being tested. The first module has a vector of 260.

T/MSCP UNIT NUMBER – Type in the unit name, for example, MU0.

Answering the software questions is optional. Use a <CR> or <CTRL/Z> to obtain the default values. The following list provides the default values for each question.

CHANGE SW	No default
ENABLE TIME OF DAY CLOCK (L)	(N)
INPUT HOUR IN 24 HOUR FORMAT (OMIT LEADING zeros) (D)	(0)
INPUT MINUTES (OMIT LEADING zeros (D)	(0)
CHANGE CONTROLLER PARAMETERS (L)	(N)
ENABLE CONTROLLER ERROR CORRECTION (L)	(Y)
ENABLE CONTROLLER ERROR RECOVERY (L)	(Y)
ENABLE BAD BLOCKING (L)	(Y)
CHANGE PRINTER PARAMETERS (L)	(N)
ENABLE SOFT ERROR REPORT PRINTING (L)	(N)
ENABLE READ SOFT ERRORS ONLY (L)	(N)
CLEAR MEDIA TABLE ON EVERY PASS (L)	(N)
ENABLE MEDIA DEFECTS TABLE PRINTOUTS (L)	(N)
ENABLE PROGRAM VARIABLES DUMP ON ERROR (L)	(N)
ENABLE CLEAR STATUS ON FATAL ERROR (L)	(N)
CHANGE TEST PARAMETERS (L)	(N)
DATA PATTERN (D)	(O)
RUN TEST 3 ONLY (L)	(Y)
ENABLE DATA COMPARES IN TEST 5 (L)	(Y)
ENABLE PRINT READ BUFFER IN TEST 5 (L)	(N)
CHANGE COMMAND SEQUENCE (L)	(N)

E.9 CZTKB ERROR REPORTING

The data reliability test provides a variety of information in its error printouts. The following sections briefly discuss error reporting.

E.9.1 Commands

All error printouts contain a field indicating the command on which the error was detected. Table E-1 lists these abbreviated commands.

Table E-1 Error Printout Commands

Abbreviation	Definition
RD	Read
CMP	Compare host data
SPC	Space records (position)
SKP	Skip tape marks (position)
SPO	Space objects (position)
AVL	Available
SUC	Set unit characteristics
ABO	Abort
GUS	Get unit status
WRT	Write
ACC	Access
WTM	Write tape mark
ERS	Erase
ERG	Erase gap
ONL	Online
REW	Rewind
GCS	Get command status
SCC	Get controller characteristics

E.9.2 Status/Log Packet and Program Errors

Each message also includes one line of text describing the type of fault that can originate in any one of three sources. Table E-2 shows three possible messages and their sources.

Table E-2 Sample Messages and Their Source

Sample Message	Source
Invalid command issued	Status error code
Data overrun	Error log packet
Program command timeout	Program detected error condition

E.9.3 Drive Errors

When a drive error occurs, the response packet contains a substatus code. This code is the drive error byte as returned by the drive. The program places this value in the upper bits of the status field. Table E-3 lists these status values, the corresponding error numbers, and the cause of the failure.

Table E-3 Data Reliability Test Status Drive Errors

Status	Error	Description
000013	00	Write lock violation
002013	04	Communication exception (timeout, etc.)
003013	06	Wrong track error (following a turnaround)
010013	10	Synchronization failure – read/write
100413	81	Failure to load to BOT
101013	82	Failure to unload tape into cartridge
101413	83	General motor or tach failure
102013	84	Motor A failure
102413	85	Motor B failure
103013	86	Drive lost control of tape or bad tach
103413	87	Excessive drag in tape transport
104013	88	Failure to stop tape or remain stopped
104413	89	Cartridge insert error
105013	8A	Cartridge extract error
105413	8B	CU attempted to move tape with drive in error
106013	8C	Deceleration timeout error
106413	8D	Second attempt to balance reels in unit failed
110013	90	8155 RAM memory failure in self-test
110413	91	8155 timer failed
111013	92	Read amplit (Hd 1) to low in calibrate
111413	93	Read amplit (Hd 2) to low in calibrate
112413	95	EOT sensed in R/W/S
113013	96	BOT sensed in R/W/S
113413	97	Drive block address overflow
114013	98	Drive block address underflow
114413	99	Servo-error excessive speed variations
115013	9A	Failure in tracking – presently not used
115413	9B	Command error – not recognized
116013	9C	Illegal command – incompatible with drive state
116413	9D	Write lock error
117013	9E	Write gate at wrong time

Table E-3 Data Reliability Test Status Drive Errors (Cont.)

Status	Error	Description
117413	9F	No write gate for calibration track write
120013	A0	Error sensing cal track 1 – bad head
120413	A1	Error sensing cal track 2 – bad head
121013	A2	Detection of edges of cal trk 1 out of spec
121413	A3	Detection of edges of cal trk 2 out of spec
122013	A4	Offset of cal trk 2 from 1 is too great
122413	A5	Search for bottom edge of tape failed
123013	A6	Bottom tape edge tolerance error
123413	A7	Drive is overheating
124013	A8	No current in LED of BOT sensor (cable)
124413	A9	Halt switch sense lines motor A questionable
125013	AA	Tachometer failure

E.9.4 Hard Error Reports

Hard error reports occur when a recovery process is not successful. The user can disable these reports. Hard error reports typically have the following format:

```
CZTKB HRD ERR 0014 ON UNIT 00 TST 003 SUB 000 PC: 020460
HARD DATA ERROR
COMMAND: RD T/MSCP UNIT: 000 (O)
PASS:    1 (D) DATA PAT: 01 (O)
RECORD BYTE COUNT: 457 (D)
OBJECT CNT :  000000026352 (O)

RESPONSE PACKET
  HIGH WORD                        LOW WORD
  000000 (O)                       026532 (O)
  000000 (O)                       000000 (O)
  000050 (O)                       010240 (O)
  000000 (O)                       000733 (O)
  000000 (O)                       000000 (O)
  000000 (O)                       000000 (O)
  000000 (O)                       000000 (O)
  000000 (O)                       001413 (O)
  000000 (O)                       000733 (O)
```

E.9.5 Soft Error Reports

Soft error reports occur when a recovery process is successful. The user can disable these reports. Soft error reports include the number of retries necessary to successfully complete the current operation. These reports typically have the following format:

```
CZTKB SFT RD ERR 00014 ON UNIT 00 TST 003 SUB 000 PC: 020460
ECC RECOVERED DATA ERROR
COMMAND: RD T/MSCP UNIT: 000 (O)
PASS:    1(D) DATA PAT: 01 (O)
OBJECT CNT :  000000026352 (O)
TAP OBJ CNT:  000000026352 (O)
TRK NUM:    6 (D)   LEVEL:    0 (O)    RETRIES:    1 (D)
LOG BLK NUM:                0 (D)       PHYS BLK NUM:          9932 (D)
DRV CODE:                 000 (O)       DRV FLGS:               041 (O)
DRV STATE:             000000 (O)       INTERN STATUS:          002 (O)
TAP CNT 0:                227 (O)       TAP CNT 1:              015 (O)
TAP CNT 2:                035 (O)       RD/WR STATE:         000000 (O)
OPER FLGS:             000000 (O)
```

E.10 CZTKB TEST DESCRIPTION

The following test descriptions summarize each of the data reliability tests.

E.10.1 Test 1: Basic Function Test

Test 1 executes a subset of the available commands on the unit under test. It serves as a quick verify test and makes sure the unit can move tape and read/write without error.

E.10.2 Test 2: Quick Verify Read/Write Test

Test 2 rewinds the tape, writes a record set, writes to the LEOT (logical end of tape), and rewinds. The program repositions the tape to the just-written record set and reads the current record set before skipping to the LEOT.

This test repeats 5 times or until it encounters a fatal error. Test 2 permits retries, fixed record length, fixed number of records/sets, and predetermined data patterns.

E.10.3 Test 3: Complex Read/Write Test

Test 3 rewinds the tape, writes N records, writes a tape mark, and then repeats this sequence until the EOT is reached where it writes 2 tape marks. The tape rewinds, reads N records, and spaces 1 record (should see unexpected tape mark). This sequence repeats until the program reaches the LEOT.

Test 3 uses all data patterns, including random data, and randomly selects the number of records (N) and the record size. This sequence permits hardware retries and runs until EOT, LEOT, or a fatal error is encountered.

E.10.4 Test 4: Write Interchange Tape

Test 4 rewinds the tape and then writes until EOT or it encounters a fatal error. Test 4 keeps track of the number of records and files that are written. If a fatal error occurs, the tape rewinds and the program prevents the unit from executing any further write operations.

E.10.5 Test 5: Read Unknown Tape

Test 5 rewinds the tape and then reads until EOT or it encounters a fatal error. Test 5 keeps track of the number of records and files that are read. If a fatal error occurs, the tape rewinds and the program prevents the unit from executing any further read operations.

> **NOTE**
> **Tests 4 and 5 can be used to perform a media interchange test for multiple drives. The program does not attempt to determine if the unit writing the tape or the unit reading the tape is at fault when an error occurs.**

Appendix F
RQDXE (M7513) Jumper Configurations

F.1 INTRODUCTION

Use the RQDXE extender module when you have an RQDX2 or RQDX3 controller module and you want to add an RX50 or fixed disk drive subsystem, or an additional disk drive in a BA23-A expansion box.

> **NOTE**
> **The BA23-A supports only one fixed disk drive installed in the enclosure. Never install two fixed disk drives in a BA23-A enclosure used as a host or as an expansion box.**

The RQDX2 and RQDX3 controller modules support four fixed disk drives or two fixed disk drives and an RX50 diskette drive.

The RQDXE supports a variety of arrangements of additional disk drives. This appendix provides the jumper configurations for these arrangements.

Refer to Chapter 2, Section 2.12, for guidelines when you install an RQDXE extender module and additional fixed disk drives.

F.2 RQDXE (M7513) JUMPER CONFIGURATIONS (COMMON ARRANGEMENTS)

In the following examples, the term host is used for simplicity to imply the enclosure in which the RQDX2 or RQDX3 controller module resides.

In the following illustrations, Port 0 is on the left and Port 1 is on the right. Make sure the jumpers on the fixed disk drives are set correctly. Refer to Chapter 5, Section 5.3, for information.

The letter X implies that the port is empty or contains a device not supported by the RQDX2 or RQDX3 controller module.

Subsystems, available from Digital, are tabletop or rackmounted RX50 diskette drive or RD fixed disk drive units. Each subsystem contains its own power supply and is designed to communicate with the host computer through an extender module installed in the host's backplane.

F.2.1 Factory Configuration

Figure F-1 shows three fixed disk drive and RX50 diskette drive arrangements using the RQDX2 or RQDX3 controller and the RQDXE extender modules. The factory configuration supports all three arrangements.

Table F-1 shows the RQDXE factory configuration. This configuration supports one RX50 and two fixed disk drives. You can use this configuration with dual BA23-A systems or with a subsystem.

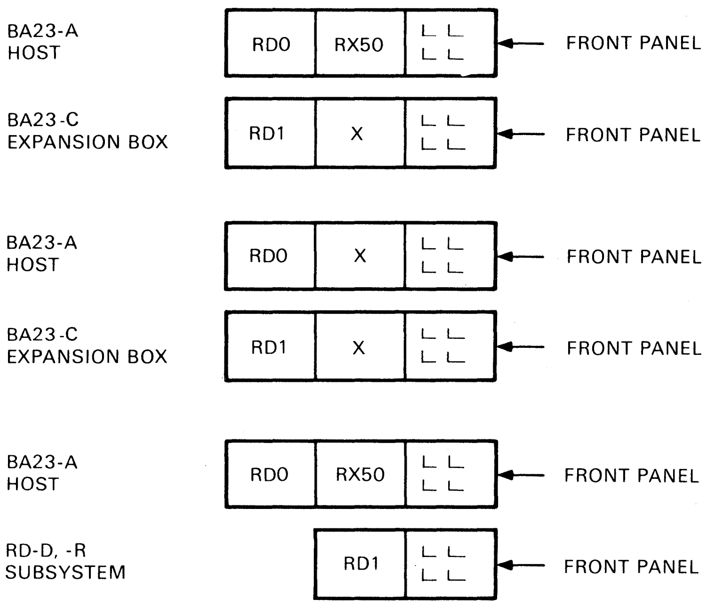


Figure F-1 Three Possible Disk Drive Arrangements (Factory Setting)

Table F-1 RQDXE Jumper Setting (Factory Configuration)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A3 B1 to B3	E1 to E2 F1 to F3 F2 to F4 H3 to H4	K2 to K4	L1 to L3 L4 to M2	N1 to N2 N4 to P2

F.2.2 Jumper Setting for Three Fixed Disk Drives

Figure F-2 shows a configuration using the RQDXE extender module with three fixed disk drives, one in the BA23-A enclosure and two subsystems.

Table F-2 shows the RQDXE jumper setting to support three RD5n(s).

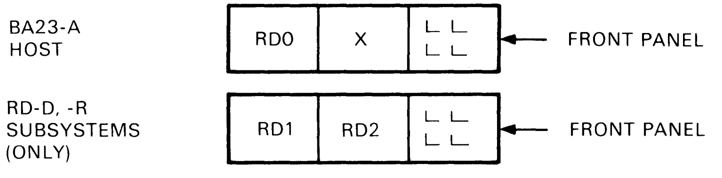


Figure F-2 Three Fixed Disk Drives with an RQDXE (Arrangement 1)

Table F-2 RQDXE Jumper Setting for Three RD5n Disk Drives (Arrangement 1)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A3	E1 to E2	K1 to K3	L3 to M1	N1 to N2
B1 to B3	F1 to F3	K2 to K4	L4 to M2	N4 to P2
C2 to C4	H1 to H2			
D2 to D4	H3 to H4			

F.3 ADDITIONAL RQDXE JUMPER SETTINGS

The following examples show a variety of arrangements of fixed disk drives and RX50 diskette drives using the RQDX2 or RQDX3 controller and RQDXE extender modules. The jumper configurations provided in the following tables support the disk drive arrangements shown in the accompanying illustrations.

F.3.1 Additional Arrangements, Example 1

Figure F-3 shows a configuration using an RQDXE with an RX50 and a fixed disk drive.

Table F-3 shows the jumper configuration to support this arrangement.

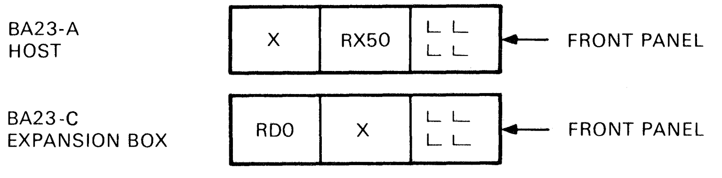


Figure F-3 An RX50 and a Fixed Disk Drive with an RQDXE

Table F-3 RQDXE Jumper Setting for an RX50 and Fixed Disk Drive

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A2	E1 to E2	K1 to K2	L3 to L4	N1 to N3
B1 to B2	F3 to F4		M2 to M4	N4 to P2
	H3 to H4			

F.3.2 Additional Arrangements, Example 2

Figure F-4 shows a configuration using an RQDXE with an RX50 and two fixed disk drive subsystems.

Table F-4 shows the jumper configuration to support this arrangement.

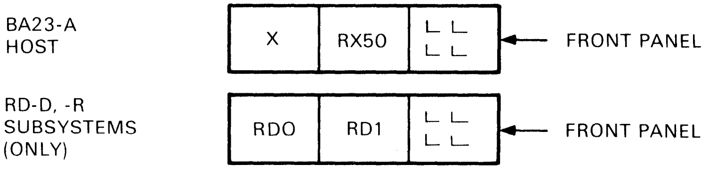


Figure F-4 An RX50 and Two RD5n Disk Drives with an RQDXE (Arrangement 1)

Table F-4 RQDXE Jumper Setting for an RX50 and Two Fixed Disk Drives (Arrangement 1)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A2	E1 to E2	K1 to K2	L3 to L4	N1 to N3
A3 to A4	F1 to F2	K3 to K4	M1 to M2	N4 to P2
B1 to B2	F3 to F4			
B3 to B4	H3 to H4			

F.3.3 Additional Arrangements, Example 3

Figure F-5 shows a configuration using an RQDXE with a fixed disk drive and an RX50 in a BA23-A expansion box or subsystems.

Table F-5 shows the jumper configuration to support this arrangement.

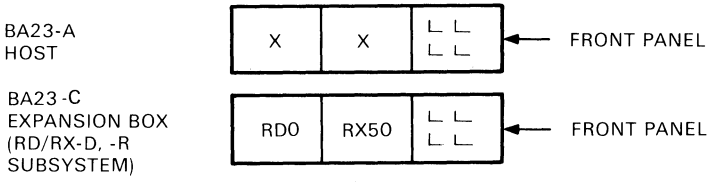


Figure F-5 A Fixed Disk Drive and an RX50 in a BA23-A Expansion Box

Table F-5 RQDXE Jumper Setting for a Fixed Disk Drive and an RX50 in a BA23-A Expansion Box

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A2	E2 to E4	K1 to K2	L3 to L4	N1 to N3
B1 to B2	F3 to F4		M2 to M4	N4 to P2
C3 to C4	H1 to H3			
D3 to D4				

F.3.4 Additional Arrangements, Example 4

Figure F-6 shows an alternate configuration using an RQDXE with an RX50 and two fixed disk drive subsystems.

Table F-6 shows the jumper configuration to support this arrangement.

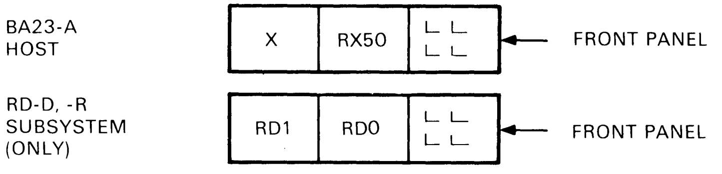


Figure F-6 An RX50 and Two Fixed Disk Drives (Arrangement 2)

Table F-6 RQDXE Jumper Setting for an RX50 and Two Fixed Disk Drives (Arrangement 2)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A3	E1 to E2	K1 to K3	L3 to M1	N1 to N3
A2 to A4	F1 to F3	K2 to K4	L4 to M2	N4 to P2
B1 to B3	F2 to F4			
B2 to B4	H3 to H4			

F.3.5 Additional Arrangements, Example 5

Figure F-7 shows another alternate configuration using an RQDXE with two fixed disk drives and an RX50 diskette drive in a BA23-A expansion box or subsystems.

Table F-7 shows the jumper configuration to support this arrangement.

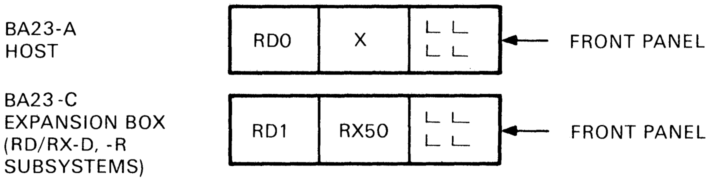


Figure F-7 Two Fixed Disk Drives and an RX50 (Arrangement 3)

Table F-7 RQDXE Jumper Setting for Two Fixed Disk Drives and an RX50 (Arrangement 3)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A1 to A3	E2 to E4	K1 to K2	L1 to L3	N1 to N2
B1 to B2	F1 to F3		L4 to M2	N4 to P2
C3 to C4	H1 to H3			
D3 to D4				

F.3.6 Additional Arrangements, Example 6

Figure F-8 shows an alternate configuration using an RQDXE with three fixed disk drives, one in a BA23-A enclosure and two as subsystems.

Table F-8 shows the jumper configuration to support this arrangement.

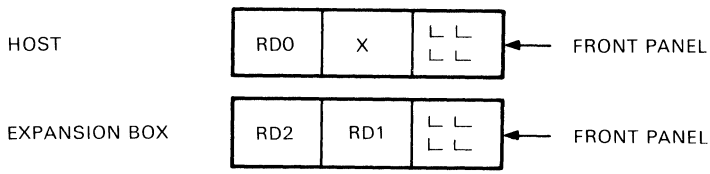


Figure F-8 Three Fixed Disk Drives (Arrangement 2)

Table F-8 RQDXE Jumper Setting for Three Fixed Disk Drives (Arrangement 2)

RDY and WRT PROT	Drive SEL	Drive ACK	External Port SEL	Internal Port SEL
A3 to A4	E1 to E2	K1 to K2	L3 to L4	N1 to N2
B3 to B4	F1 to F2	K3 to K4	M1 to M2	N4 to P2
C3 to C4	F3 to H1			

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C, MR-14882; 1-1, MR-15162; 1-2, MR-15212; 1-3, MR-15183; 1-4, MR-13454; 1-5, MR-15168; 1-6, MR-15167; 1-7, MR-15165; 1-8, MR-15164; 1-9, MR-11887; 1-10, MR-9416; 1-11, MR-15213; 1-12, MR-9535; 1-13, MR-13345; 1-14, MR-15163; 2-1, MR-14070; 2-2, MR-14922; 2-3, MR-14069; 2-4, MR-9407; 2-5, MR-13096; 2-6, MR-14071; 2-7, MR-15984; 2-8, MR-15982; 2-9, MR-15981; 2-10, MR-15983; 2-11, MR-14081, MR-14234; 2-12, MR-13058; 2-13, MR-15295; 3-1, MR-14072; 3-2, MR-15584; 3-3, MR-14074; 3-4, MR-15588; 3-5, MR-14271; 3-6, MR-15196; 3-7, MR-14798; 3-8, MR-15589; 3-9, MR-14075; 3-10, MR-15585, MR-15580; 3-11, MR-14236; 3-12, MR-15582; 3-13, MR-14077; 3-14, MR-15199; 3-15, MR-14076; 3-16, MR-15187; 3-17, MR-14797; 3-18, MR-15581; 3-19, MR-14078; 3-20, MR-15200; 3-21, MR-15244; 3-22, MR-15583; 3-23, MR-14079; 3-24, MR-15586; 3-25, MR-14235; 3-26, MR-15587; 3-27, MR-15172; 3-28, MR-14080; 3-29, MR-14040; 3-30, MR-13047; 3-31, MR-14081, MR-14234; 3-32, MR-13058; 3-33, MR-14041; 3-34, MR-14042; 3-35, MR-14084; 3-36, MR-15173; 3-37, MR-14082; 3-38, MR-15160; 3-39, MR-14083; 4-1, MR-15288; 4-2, MR-15190; 4-3, MR-15293; 4-4, MR-15338; 4-5, MR-15294; 5-1, MR-15159, MR-15161; 5-2, MR-15214, MR-15215; 6-1, MR-15164; 6-2, MR-15184; 6-3, MR-15174; 6-4, MR-15175; 6-5, MR-12047, MR-15185; 6-6, MR-15176; 6-7, MR-15177; 6-8, MR-15178; 6-9, MR-15179; 6-10, MR-15219; 6-11, MR-15218; 6-12, MR-15217; 6-13, MR-15220; 6-14, MR-15224; 6-15, MR-15693; 6-16, MR-15193; 6-17, MR-15180; 6-18, MR-15181; 6-19, MR-15182; 6-20, MR-15208; 6-21, MR-15207; 6-22, MR-15169; 6-23, MR-15170; 6-24, MR-15194; 6-25, MR-15225, MR-15226; 6-26, MR-15222; 6-27, MR-15227; 6-28, MR-15211; 6-29, MR-15228, MR-15223; 6-30, MR-15188; 6-31, MR-15221; 6-32, MR-15195; A-1, MR-5456; F-1, MR-15973; F-2, MR-15974; F-3, MR-15975; F-4, MR-15976; F-5, MR-15977; F-6, MR-15978; F-7, MR-15979; F-8, MR-15980