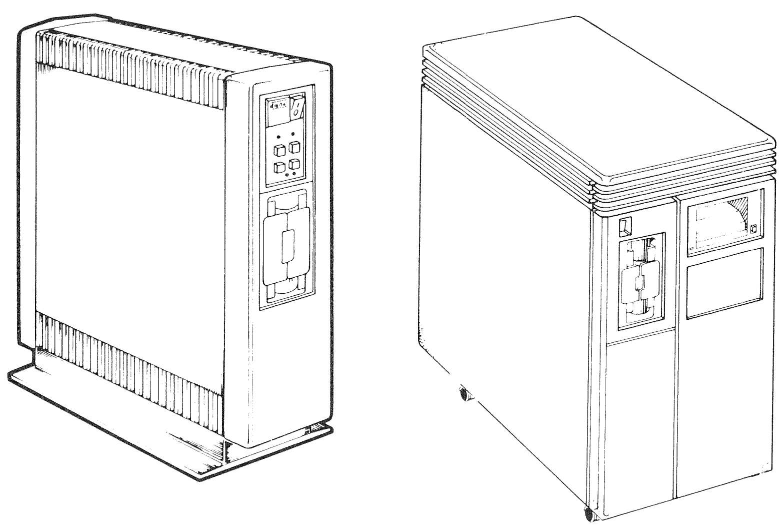
EK-MIC11-SG-001

MicroPDP-11 Systems

Maintenance Guide



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Introduction

This manual is one of a set that describes the MicroPDP-11 systems in a BA23-A or BA123-A enclosure. The manual is intended for service personnel. The *MicroPDP-11 Systems Owner's Manual* (EK-MIC11-OM) describes the unpacking, installation, checkout, and normal operation of the MicroPDP-11 systems in the BA23-A enclosure. The *MicroPDP-11 Systems Owner's Manual,* DIGITAL P.N. AZ-GLIAA-MC, provides the identical information for the BA123-A enclosure.

The *MicroPDP-11 Systems Technical Manual* describes the enclosures as well as providing option, configuration, and diagnostic information. Refer to EK-MIC11-TM for BA23-A enclosure information, and AZ-GLHAA-MC for BA123-A enclosure information.

The *KDJ11-B CPU User's Guide* (EK-KDJ1B-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 Illustrated Parts Breakdown* (EK-0LCP5-IP) shows the mechanical breakdown of the MicroPDP-11 in the BA23-A mounting enclosure. The *MicroPDP-11 Illustrated Parts Breakdown* (EK-BA123-IP) shows the mechanical breakdown of the MicroPDP-11 in the BA123-A mounting enclosure.

Notes, Cautions, and Warnings

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

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

Related Documents*

MicroPDP-11 Systems Owner's Manual†	EK-MIC11-OM
MicroPDP-11 Systems Owner's Manual‡	AZ-GLIAA-MC
MicroPDP-11 Systems Service Maintenance Guide†‡	EK-MIC11-SG
MicroPDP-11 System Illustrated Parts Breakdown†	EK-0LCP5-IP
MicroPDP-11 System Illustrated Parts Breakdown‡	EK-BA123-IP
MicroPDP-11 Systems Technical Manual†	EK-MIC11-TM
MicroPDP-11 Systems Technical Manual‡	AZ-GLHAA-MC
KDJ11-B 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
RQDX2 Controller Module User's Guide	EK-RQDX2-UG
RQDX3 Controller Module User's Guide	EK-RQDX3-UG
Microcomputer Interfaces Handbook	EB-20174-20
Microcomputers and Memories Handbook	EB-18451-20

You can order these documents from:

Digital Equipment Corporation
Accessories and Supplies Group
P.O. Box CS2008
Nashua, NH 03061

Attention: Documentation Products

Glossary Location

Glossary references are located at the end of the book. Additional glossary references are located in the glossary of common computing terms found in the owner's manual for your system.

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

† BA23-A enclosure

‡ BA123-A enclosure

Acronyms Used in this Document

A list of acronyms that appear in this document follows. Note that signal names, acronyms displayed in messages, and acronyms utilized by diagnostic programs are not included in this list.

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange. Also a 7- or 8-bit standard for 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
DIP	Dual in-line package
DMA	Direct memory access
DU	Disk unit
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
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
PP	Purge and poll (refers to a diagnostic procedure)
PROM	Programmable read only memory
PSW	Processor status word
RAM	Random access memory
ROM	Read only memory
SA	Starting address (refers here to a location within the CSR)
SDLC	Synchronous data-link control
SLU	Serial line unit, used here in associated with a CPU module
SYS ERR	System error
UART	Universal asynchronous receiver/transmitter. A device that performs parallel-to-serial and serial-to-parallel conversion.
VOLT SEL	Voltage select

1.1 IDENTIFYING THE SYSTEM (ENCLOSURE)

This manual describes the three Q22-Bus enclosures listed in Table 1-1.

Table 1-1 Q22-Bus Enclosures

Enclosure/ Illustration	CPU	System Name	Enclosure Discussion
BA11-S Fig. 1-1	KDF11-BA	PDP-11/23 PLUS	Appendix B
BA23-A Fig. 1-2	KDJ11-BC, BB	MicroPDP-11/73	Chapter 7
	KDJ11-BF	MicroPDP-11/83	Chapter 7
	KDF11-BE*, BF	MicroPDP-11/23	Chapter 7
BA123-A Fig. 1-3	KDJ11-BC, BB	MicroPDP-11/73	Chapter 9
	KDF11-BE*, BF	MicroPDP-11/83	Chapter 9

* KDF11-BE has been replaced with KDF11-BF

These enclosures are shown in the following figures.

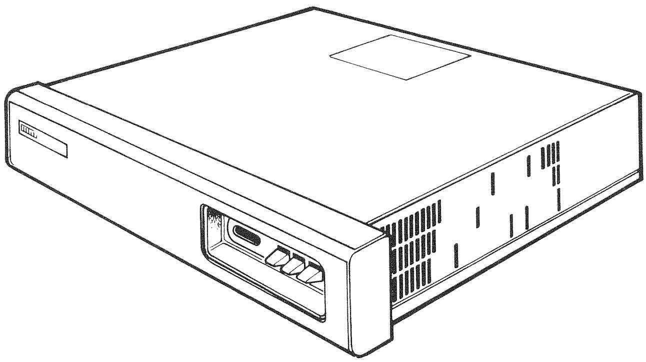

Figure 1-1 BA11-S Enclosure (PDP-11/23 PLUS system only)

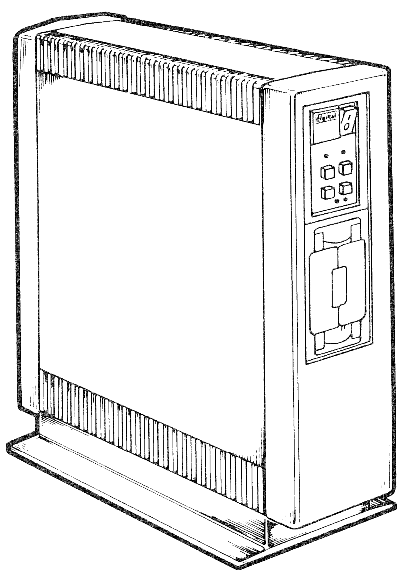

Figure 1-2 BA23-A Enclosure

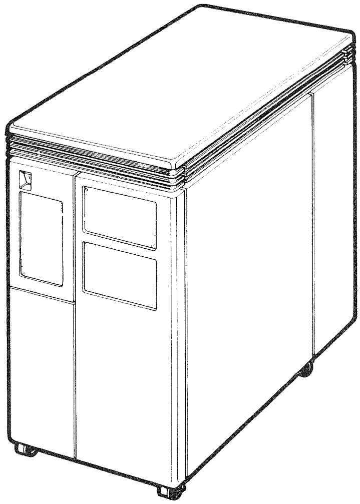

Figure 1-3 BA123-A Enclosure

1.2 IDENTIFYING THE SYSTEM (CPU)

This manual describes the five CPU types listed in Table 1-2.

Table 1-2 Central Processing Unit (CPU) Types

CPU Type	Module	Model Name	CPU Discussion
KDF11-BA	M8189	PDP-11/23 PLUS	Chapter 3
KDF11-BE or BF	M8189	MicroPDP-11	Chapter 3
KDJ11-BB	M8190-AB	MicroPDP-11/73	Chapter 2
KDJ11-BC	M8190	MicroPDP-11/73	Chapter 2
KDJ11-BF	M8190-AE	MicroPDP-11/83	Chapter 2

The following sections tell how to identify the CPU.

1.2.1 Identifying the CPU (System Off)

When the system is off, you can identify the CPU by any of the following:

- The computer model name.
- The module number printed on the module handle (Table 1-3).
- The enclosure. A PDP-11/23 PLUS is mounted in a BA11-S enclosure. The MicroPDP-11/23, MicroPDP-11/73, and MicroPDP-11/83 systems are mounted in BA23-A or BA123-A enclosure (Figures 1-1 through 1-3).
- The ROMs installed on the KDF11-B (M8189) module (Table 1-4).

Table 1-3 Module Number Identification

CPU Type	Module Number on the Module
KDF11-BA, BE, BF	M8189
KDJ11-BC	M8190
KDJ11-BB	M8190-AB
KDJ11-BF	M8190-AE

Table 1-4 M8189 ROMs Identification

ROMs Installed	CPU Type
23-339E2 and 23-340E2	KDF11-BA
23-238E4 and 23-239E4	KDF11-BE
23-183E4 and 23-184E4	KDF11-BF

A PDP-11/23 PLUS system (KDF11-BA) in a BA11-S enclosure can be upgraded in the field to MicroPDP-11/23 operation (KDF11-BE or BF) by installing new ROMs and changing jumpers on the CPU. (See Table 3-2 for jumper differences.) To determine if the BA11-S system has been upgraded, check the ROMs on the CPU module, the jumper settings, and/or the power-up self-test screens.

1.2.2 Identifying the CPU (System On)

If the system is operating, you can identify the CPU by the power-up self-test messages displayed on the terminal console as follows:

- The KDF11-BA CPU powers up in Octal Debugging Technique (ODT) and displays a very abbreviated message (Figure 1-4).
- The KDF11-BF CPU displays a "9 Step Memory Test" message (Figure 1-5).
- The KDJ11-B CPUs display a "Testing in Progress" message (Figure 1-6).

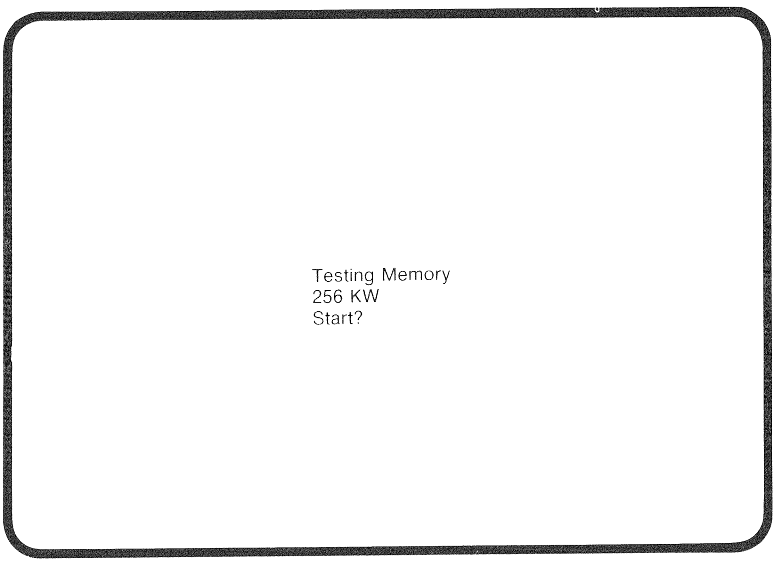

Figure 1-4 KDF11-BA Startup Message

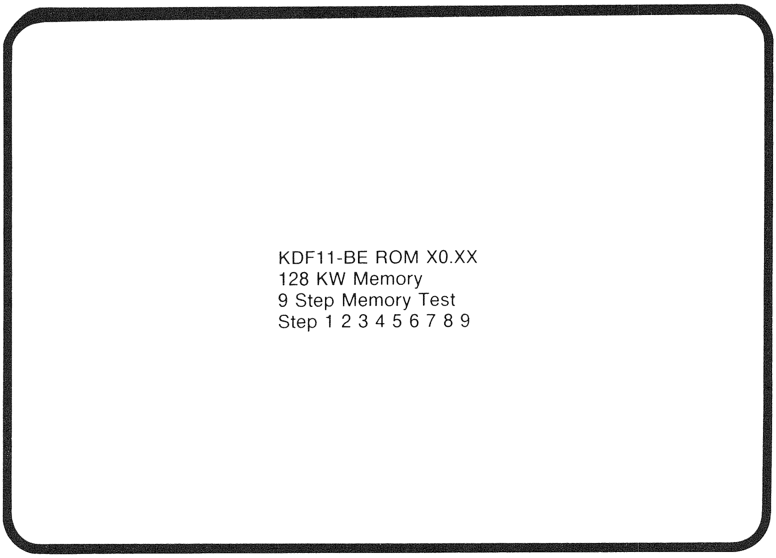

Figure 1-5 KDF11-BE or BF Startup Message

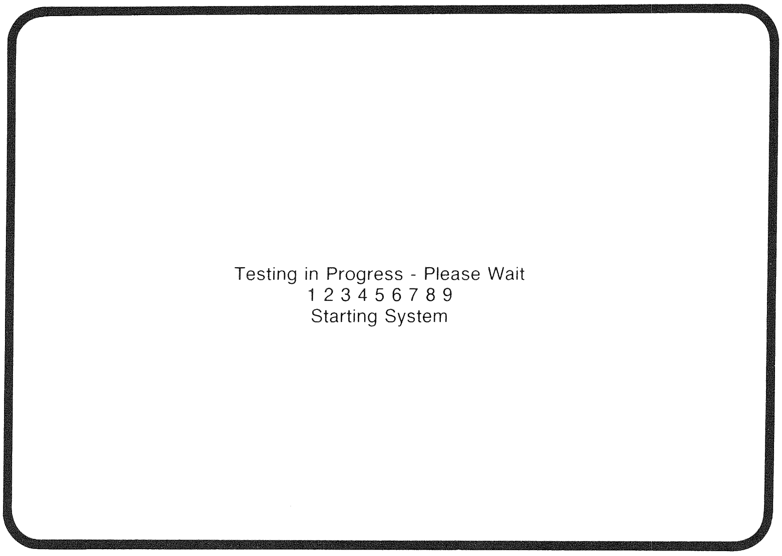

Figure 1-6 KDJ11-BC Startup Message

Once the CPU type is identified, refer to the sections in this book listed in Table 1-5. These sections will provide a detailed discussion, diagnostics information, and configuration information for each CPU.

Table 1-5 CPU References

CPU	Discussion	Diagnostics	Configuration
KDF11-BA	Appendix B	Chapter 4	Appendix A
KDF11-BE or BF	Chapter 3	Chapter 4	Appendix A
KDJ11-BC or BB	Chapter 2	Chapter 4	Appendix A
KDJ11-BF	Chapter 2	Chapter 4	Appendix A

2.1 INTRODUCTION

A BA23-A enclosure containing a KDJ11-BC or KDJ11-BB CPU module is referred to as a MicroPDP-11/73 system. It contains the following modules:

- KDJ11-BC or KDJ11-BB CPU module
- MSV11-PL memory module
- RQDXn controller module supporting mass storage devices
- Communication module, usually a DZQ11 or DHV11
- (Optional) TQK50 controller module supporting a TK50 tape drive

A BA23-A enclosure containing a KDJ11-BF CPU module is referred to as a MicroPDP-11/83 system. It contains the following modules:

- KDJ11-BF CPU module
- MSV11-JD or MSV11-JE memory module
- RQDXn controller module supporting mass storage devices
- Communications module, usually a DZQ11 or DHV11
- (Optional) TQK50 controller module supporting a TK50 tape drive

This chapter describes the following:

- KDJ11-B* module (MicroPDP-11/73 and MicroPDP-11/83 systems)

  Baud rate select switch
  Switch and jumper settings (Section 2.2)
  Location of the KDJ11-B module (Section 2.2.4)
  Features and use of KDJ11 dialog and setup modes (Sections 2.4 and 2.5)

- MSV11-P memory module

  Jumper setting
  Pin settings (Section 2.6)

- MSV11-J memory module

  Jumper setting
  Pin settings (Section 2.7)

- MSV11-Q memory module

  Jumper setting
  Pin settings (Section 2.8)

> **NOTE**
> **Chapter 5, Mass Storage and Backup Options, contains descriptions of the RQDX controllers and other Q22-Bus mass storage and backup devices.**
>
> **Chapter 6, Q-Bus Communications and I/O Options, contains descriptions of various Q22-Bus communications options.**

* KDJ11-B means any version of the KDJ11 CPU module

2.2 KDJ11-B CPU MODULE

The KDJ11-B (M8190) module connects to a cabinet kit (DIGITAL P.N. CK-KDJ1B-KA) containing a console Serial Line Unit (SLU) panel (Figure 2-1) and two cables. The SLU panel is on the rear I/O distribution panel of the BA23 and BA123 enclosures. 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 7, BA23-A 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-A enclosure.

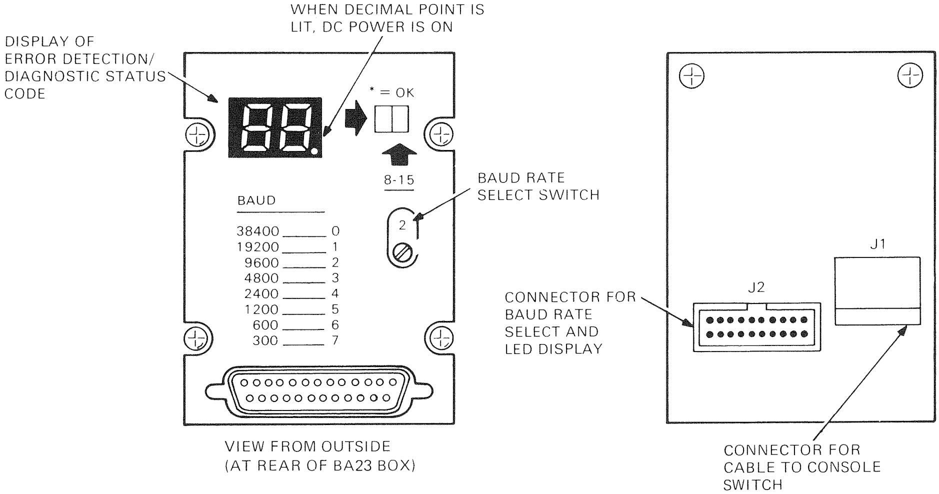

Figure 2-1 KDJ11-B SLU Display Panel

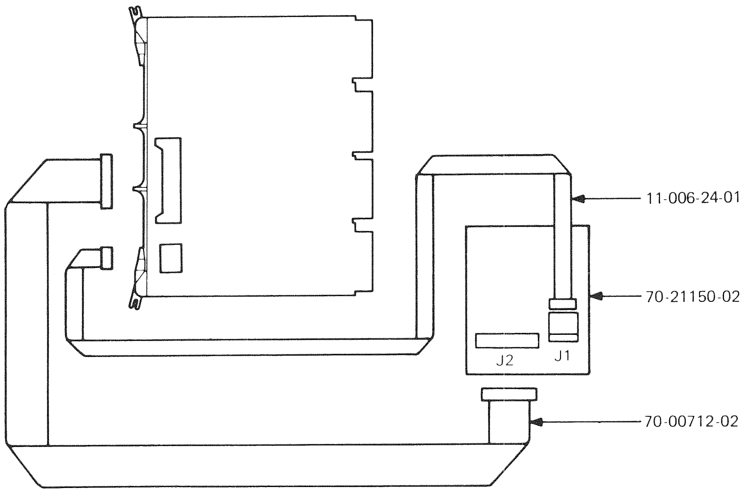

Figure 2-2 KDJ11-B Internal Cabling

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: FPJ11-AA)
- KDJ11-BC: 15 MHz without FP (FP upgrade not available)
- KDJ11-BF: 18 MHz with FP (FPJ11-AB) and Private Memory Interconnect (PMI)

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

* Floating-Point (FP) instruction set.

- 32-Kbyte boot and diagnostic facility with LED indicators
- Console SLU
- Line frequency clock

The KDJ11-B CPU module contains two Erasable PROMs (EPROMs) and one Electrically Erasable PROM (EEPROM). 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 will not be 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 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.

Figure 2-3 shows the location of the EPROMs, the EEPROM, a Dual In-line Package (DIP) switch, diagnostic Light Emitting Diodes (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).

If you replace the 24-pin EEPROM in chip location E115, insert pin 1 of the EEPROM in pin 3 of the socket.

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.

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 Section 4.3 for definitions of the codes and detailed diagnostic information.

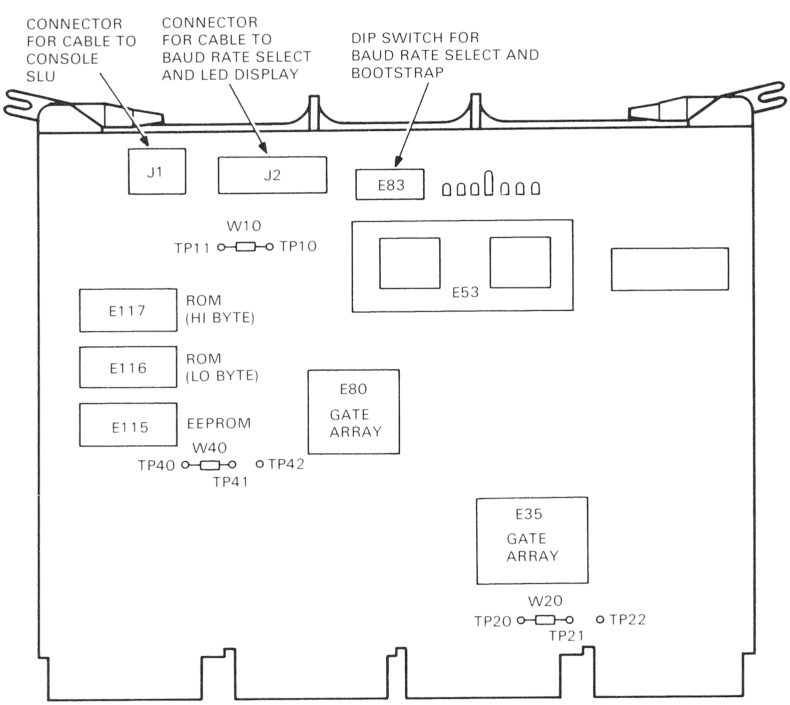

Figure 2-3 KDJ11-B Module Layout

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**
38,400	0	8
19,200	1	9
9,600	2*	10
4,800	3†	11
2,400	4	12
1,200	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 switch. It contains eight switches that can optionally 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 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~~ 6
Off	On	Off	Boot device ~~2~~ 5
Off	On	On	Boot device ~~3~~ 4
On	Off	Off	Boot device ~~4~~ 3
On	Off	On	Boot device ~~5~~ 2
On	On	Off	Boot device ~~6~~ 1
On	On	On	If switch 1 is Off, power up to ODT. If switch 1 in 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.

* 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	38,400
On	On	Off	19,200
On	Off	On	9,600
On	Off	Off	4,800
Off	On	On	2,400
Off	On	Off	1,200
Off	Off	On	600
Off	Off	Off	300

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

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 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-A enclosure backplane, or in slot 2, 3, or 4 of a BA123-A 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 should there be a 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, or in slots 1 through 4 of a BA123-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 4.2), 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 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 4.5.)

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 (RD5n)
- RL01/RL02
- TSV05/TK50

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 similar to the following:

```
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 procedure described 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)
- Delete

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

HELP – Displays a one-screen help file that provides a short description of 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 and 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 to 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. This discussion refers to version 7 ROMs only. Refer to Appendix G for a comparison of version 6 and version 7 ROMs. Refer to the *KDJ11-B 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 the setup table.
3	List/change boot translation in setup table.
4	List/change the automatic boot selection in setup table.
5	Reserved.
6	List/change the switch boot selection in the setup table.
7	List boot programs.
8	Initialize the setup table.
9	Save the setup table into the EEPROM.
10	Load EEPROM data into the setup table.
11	Delete an EEPROM boot.
12	Load an EEPROM boot into memory.
13	Edit/create an EEPROM boot.
14	Save boot into the EEPROM.
15	Enter ROM ODT.

NOTE
ROM ODT is different from J11 micro-ODT. Refer to Section 4.6 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 the 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.

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

Command/Definition						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 (default setting), a break condition from the console terminal is ignored. When this parameter is 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 (default setting), the system sends user-friendly messages to the console terminal. This parameter is normally used with automatic boot mode.

C: ANSI video terminal – Set this parameter to 1 (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. Set this parameter to 0 for a hard-copy console or a non-ANSI video terminal, such as the VT52. 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 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 the diagnostics and tries to boot a previously selected device (default setting).
2	Enters ODT (on-line debugging technique) 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 4.6).
3	Enters 24 mode. The ROM code loads the PSW (processor status word) 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 set to 0 (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 non-volatile memory.

G: PMG (processor mastership grant) count – Make sure the parameter is set 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 Direct Memory Access (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 (newer factory setting)

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

I: Force clock interrupts – When this parameter is set to 0 (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 request interrupts when the processor priority is 5 or less. When you change the setting to 1, 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. The 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 (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 of the memory CSR is a read/write bit). When set to 0, the ROM code bypasses the ECC test.

L: Disable long memory test – When this parameter is set to 0 (default setting), the processor runs a memory address shorts data test on all available memory. When this parameter is set to 1, the memory address shorts data test is bypassed 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 (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 set to 0 (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, then 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 the 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 drive

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 dual-diskette drive and RD52 fixed-disk drive use an RQDX1 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. In this example the RC25 controller is set to respond to a nonstandard address of 177760500.

The RX52 fixed-disk drive is unit 0 and the RX50 dual-diskette drive is units 1 and 2. The RC25 fixed- and removable-disk drive 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 the Automatic Boot Selection in the 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: MSCP 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 media device in turn and then tries each fixed media device.

You must select MSCP devices with a nonstandard CSR address (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

The command is reserved for future use.

2.5.6 Setup Command 6: List/Change the Switch Boot Selection

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 (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 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 the Setup Table into the 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 the 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. After typing the command, the program 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 and 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, DU (disk unit).
- **Device description:** normally 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 that the ROM code passes control to.

The command lists the available space in the EEPROM for boots and prompts you 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 the 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 Kwords (0–00157776). You can not access any other addresses or the I/O page from ROM ODT. Table 2-11 provides the ROM ODT commands. (Refer to the *KDJ11-B CPU User's Guide* for further information.)

Table 2-11 ROM ODT Commands

<table>
<tr><th>Command</th><th>Symbol</th><th>Use</th></tr>
<tr><td>Slash</td><td>/</td><td>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.</td></tr>
<tr><td colspan="3">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 ></td></tr>
<tr><td>RETURN</td><td><CR></td><td>Closes an open location.</td></tr>
</table>

Table 2-11 ROM ODT Commands (Cont.)

Command	Symbol	Use
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 MSV11-P MEMORY MODULE (-PK, -PL)

The MSV11-P memory is a quad-height module that occupies the slot following the CPU. This module contains 64 K Metallic Oxide Semiconductor (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. Table 2-12 shows the memory modules and their storage capacity.

Table 2-12 MSV11-P Memory Modules

Model	Module Number	Memory Capacity
MSV11-PK	M8067-K	256 Kbytes
MSV11-PL	M8067-L	512 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 2-4 shows the location of jumpers and wire-wrap pins and Table 2-13 describes their function.

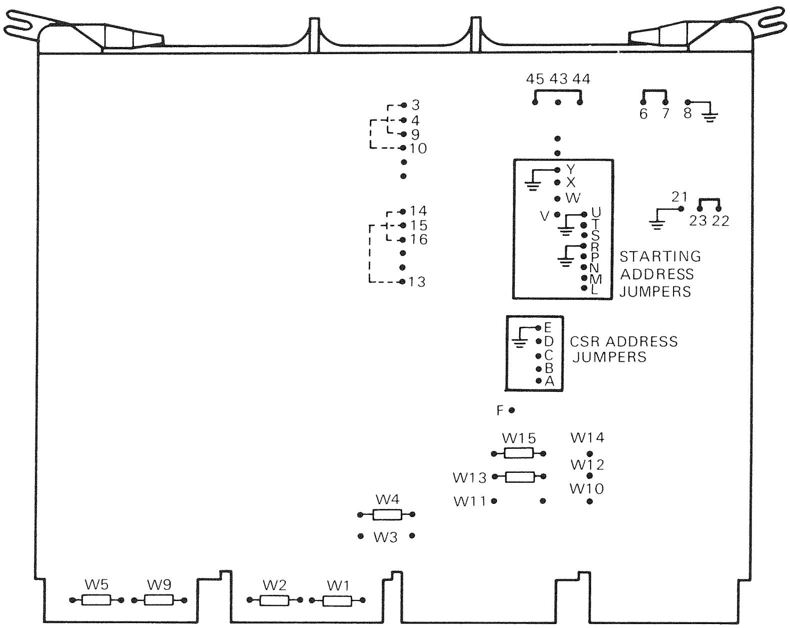

Figure 2-4 MSV11-P Module Layout

Table 2-13 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

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

2.6.1 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

2.6.1.1 CSR Address – Figure 2-4 shows the CSR address jumpers on the MSV11-P. Table 2-14 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 -PL models.

Table 2-14 MSV11-P CSR Configuration

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

2.6.1.2 Starting Address – The starting address depends on the amount of memory already in the system. Table 2-15 lists the jumper configuration for additional MSV11-P modules.

Table 2-15 MSV11-P Starting Address Configuration

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

For further information, refer to the *MSV11-P User's Guide* (EK-MSVOP-UG-001).

2.7 MSV11-JD AND MSV11-JE MEMORY MODULES (M8637)

The MSV11-JD and MSV11-JE (Figure 2-5) are Metal Oxide Semiconductor (MOS), Random Access Memory (RAM) modules. The modules have:

- Error Correction Code (ECC) for increased reliability
- A CSR to store status and error information
- Battery backup, available by resetting a jumper on the module
- Support for 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 Mbytes using 256 K RAMs.

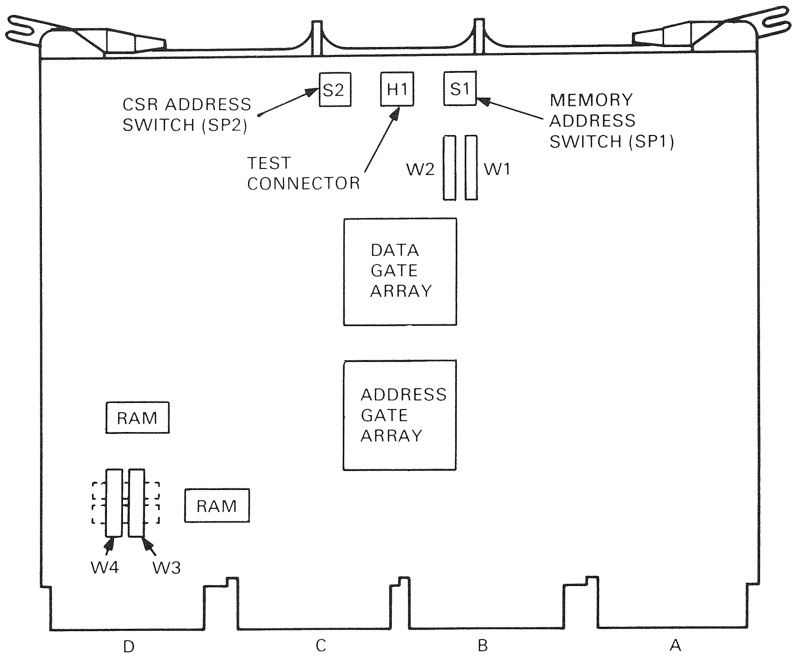

Figure 2-5 MSV11-JD, -JE Memory Module

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 2-16.

Table 2-16 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.

2.7.1 Error Correction

The MSV11-JD, -JE modules contain ECC logic that 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.

2.7.2 Battery-Backup

The MSV11-JD, -JE memory modules have 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
Neither the BA23-A nor the BA123-A MicroPDP-11 systems 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 2-6). The modules need a jumper change to configure them for battery-backup applications (Figure 2-7).

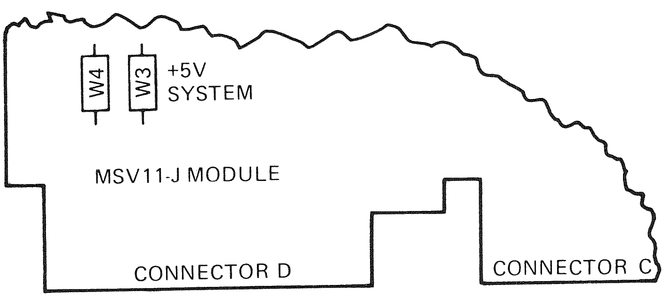

Figure 2-6 +5 V Jumper Connections

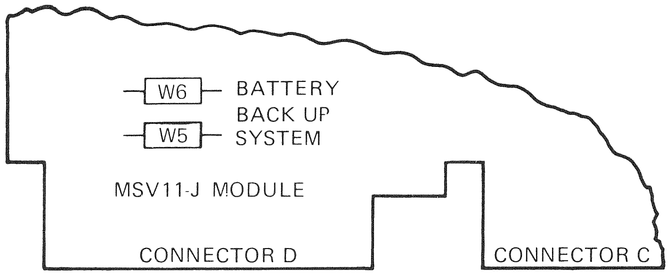

Figure 2-7 +5 VBB Battery-Backup Jumper Connections

2.7.3 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 the 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 master, use the Q22-Bus protocol.

2.7.4 Location of the MSV11-JD, -JE Memory

The location of the MSV11-JD, -JE in the MicroPDP-11/83 backplane determines the protocol used between the KDJ11-BF processor and the memory module (Figure 2-8). 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, nor can there be any open slots preceding the MSV11-JD, -JE modules.

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.

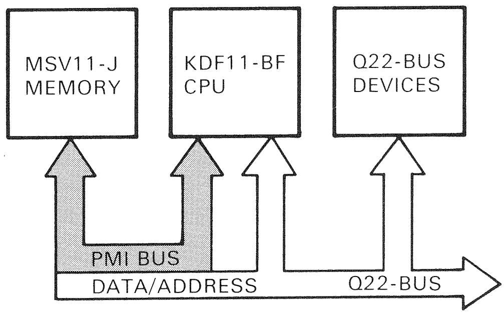

Figure 2-8 PMI/Q22-Bus Interface

2.7.5 Jumper Setting

The four factory installed jumpers (Figure 2-5), W1 through W4, establish the configuration of the module. Table 2-17 summarizes the possible MSV11-JD, -JE jumper configurations.

Table 2-17 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**
> **Neither the BA23-A nor the BA123-A MicroPDP-11 systems support battery-backup.**

2.7.6 MSV11-JD, -JE Switch Settings

The MSV11-JD, -JE modules contain two switchpacks. One is an eight-switch DIP and one is a four-switch DIP. The eight-switch DIP selects the starting memory address on an 8 K boundary. The four-switch DIP selects the CSR starting address. One of 16 possible CSR addresses may be selected.

2.7.7 Memory Address Switch Settings

The memory address switch (SP1 in Figure 2-5) is an eight-switch DIP. The switch settings are shown in Table 2-18. 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 2-18. 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 2-18.

Table 2-19 shows the most common configurations for the MSV11-JD and MSV11-JE memory address switches.

Table 2-18 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

Table 2-18 MSV11-JD, -JE Starting Memory Address Selection (Cont.)

Decimal (K Word)	Octal	Switch Setting (SP1) 1	2	3	4	5	6	7	8
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 2-19 Common Memory Starting Address, MSV11-J

Starting Address	SW2 Switches 1	2	3	4	5	6	7	8
MSV11-JD								
0	0	0	0	0	0	0	0	0
1 M byte	0	1	0	0	0	0	0	0
2 M bytes	1	0	0	0	0	0	0	0
3 M bytes	1	1	0	0	0	0	0	0
MSV11-JE								
0	0	0	0	0	0	0	0	0
2 M byte	1	0	0	0	0	0	0	0

2.7.8 CSR Address Switch Settings

The control and status register of the MSV11-JD, -JE allows program control of certain ECC functions and 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 772100 to 772136 for 18-bit systems and from 17772100 to 17772136 for 22-bit systems.

The CSR address switch (Figure 2-5) is a four-switch DIP which allows selection of one of these 16 CSR addresses. Table 2-20 shows the possible CSR address for 18-bit and 22-bit systems. The switch setting for a particular CSR address is the same whether the CSR is an 18-bit or 22-bit system.

For example, the switch setting is 1110 for a 22-bit CSR address of 17772134 or an 18-bit CSR address of 772134.

Table 2-20 MSV11-J CSR Address Selection

22-Bit CSR Address	18-Bit CSR Address	Switch Setting 1	2	3	4
17772100	772100	0	0	0	0
17772102	772102	0	0	0	1
17772104	772104	0	0	1	0
17772106	772106	0	0	1	1
17772110	772110	0	1	0	0
17772112	772112	0	1	0	1
17772114	772114	0	1	1	0
17772116	772116	0	1	1	1
17772120	772120	1	0	0	0
17772122	772122	1	0	0	1
17772124	772124	1	0	1	0
17772126	772126	1	0	1	1
17772130	772130	1	1	0	0
17772132	772132	1	1	0	1
17772134	772134	1	1	1	0
17772136	772136	1	1	1	1

1 = switch on
0 = switch off

2.7.9 MSV11-JD, -JE LEDs

Two LEDs on the MSV11-JD, -JE modules indicate power and error conditions (Figure 2-5). 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.

2.8 MSV11-Q MEMORY

The MSV11-Q is a Q22-Bus quad-height memory module with a 1, 2, or 4 Mbyte capacity using either 64 K or 256 K dynamic RAMs. There are two revision levels (Figures 2-9, 2-10) and three variants, listed in Table 2-21.

Table 2-21 MSV11-Q Variants

Revision Level*	Model	Number	Storage	RAM Size
A,C	MSV11-QA	M7551-AA	1 MB	56 K
C	MSV11-QB	M7551-BA	2 MB	256 K (half pop.)
C	MSV11-QC	M7551-CA	4 MB	256 K (full pop.)

* Revision level is identifiable by printed circuit board number:
A = 5017547A1 on upper right corner of component side
C = 5017547-01-C1 on upper left corner of component side

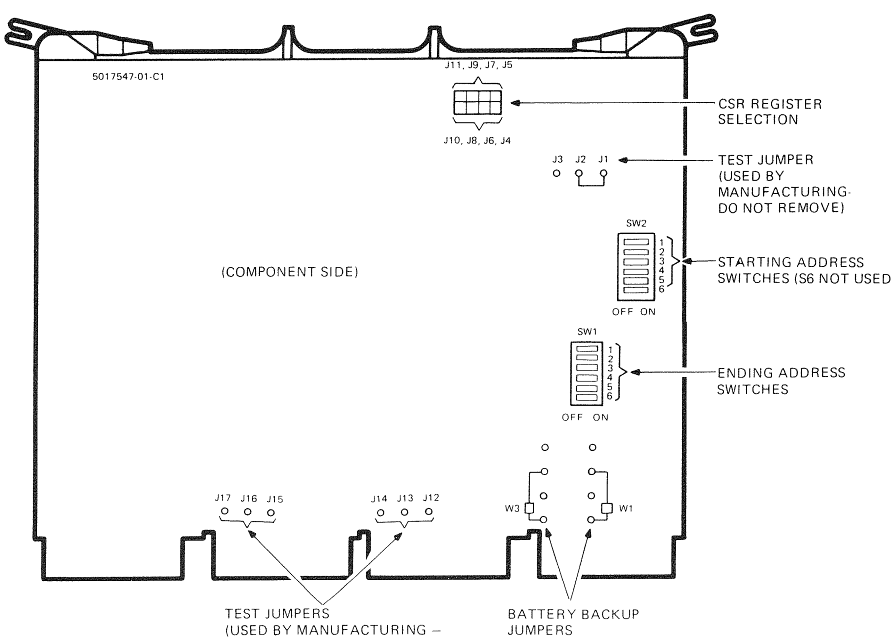

Figure 2-9 MSV11-QA Memory, Revision A

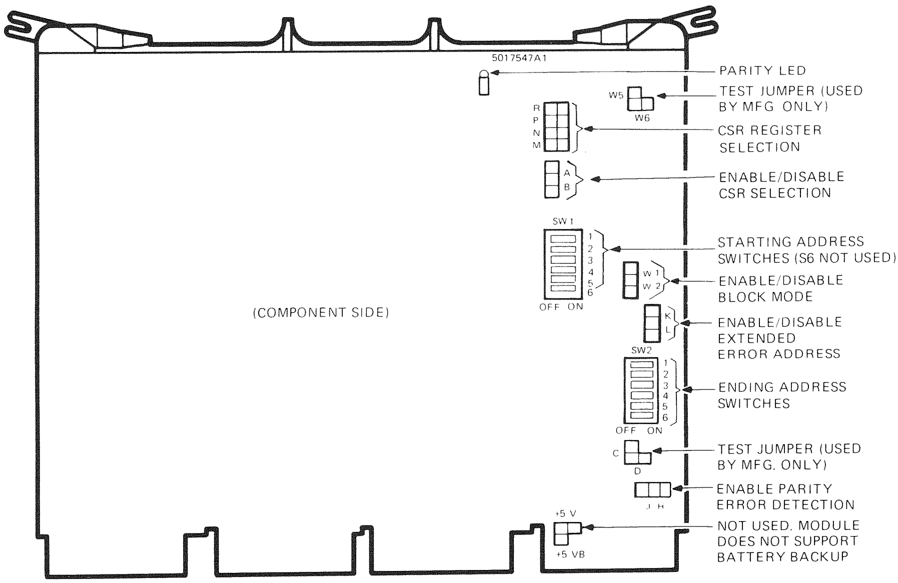

Figure 2-10 MSV11-QA, -QB, -QC Memory, Revision C

The MSV11-Q has a red LED. When lit, it indicates a parity error.

2.8.1 MSV11-Q Address Switches

Configure the MSV11-Q starting and ending addresses using DIP switches SW1 and SW2. Table 2-22 lists the switch settings.

Table 2-22 MSV11-Q Address Switches

Version	Board No. in System	Starting Address SW1 4	Starting Address SW1 5	Starting Address SW2 6	Ending Address SW2 4	Ending Address SW2 5
MSV11-QA Rev. A	1	0	0	0	1	1
	2	1	1	1	0	1
	3	0	1	1	1	0
	4	1	0	1	0	0
MSV11-QA Rev. C	1	0	0	0	1	1
	2	1	1	1	0	1
	3	0	1	1	1	0

Table 2-22 MSV11-Q Address Switches (Cont.)

Version	Board No. in System	Starting Address SW1 4	SW1 5	SW2 6	Ending Address SW2 4	SW2 5
	4	1	0	1	0	0
MSV11-QB Rev. C	1	0	0	0	0	1
	2	0	1	1	0	0
MSV11-QC Rev. C	1	0	0	0	0	0

0 = switch on
1 = switch off

SW2 switches 1, 2, and 3 are all on.
SW1 switches 1, 2, and 3 are all on. SW1 switch 6 is not used.

2.8.2 MSV11-Q CSR Address

The MSV11-Q CSR address is set using jumpers. Table 2-23 lists the settings.

Table 2-23 MSV11-Q CSR Address

Board No. in System	Jumpers				CSR Address X = 177721
Rev. A	R	P	N	M	
Rev. C	J4 to J5	J6 to J7	J8 to J9	J10 to J11	
1	In	In	In	In	X00 *
2	Out	In	In	In	X02
3	In	Out	In	In	X04
4	Out	Out	In	In	X06

* factory configuration

Table 2-24 lists the remaining jumpers and their function.

Table 2-24 MSV11-Q Factory Jumper Settings

Jumper	State	Location	Condition
Rev. A			
W1	In	W1/W2 (upper)	Block mode enabled
W6	In	W5/W6 (horizontal)	Manf. test (do not remove)
B	In	A/B (lower)	CSR selection enabled
C	In	C/D (vertical)	Manf. test (do not remove)
H	In	J/H (right) Enabled	Parity error detection
L	In	K/L (lower)	22-bit addressing selected
Rev. C			
J1 to J2,	In		Manf. test (do not remove)
-QA only: J13 to J14	In		Selects 64 K RAMs (do not remove)
J15 to J16	In		Selects 64 K RAMs (do not remove)
-QB, -QC: J16 to J17	In		Selects 256 K RAMs (do not remove)
J12 to J13	In		Selects 256 K RAMs (do not remove)
W3, W1	In		Battery backup configuration*

* Neither the BA23-A enclosure, nor the BA123-A enclosure support battery-backup.

For further information, refer to the *MSV11-Q MOS Memory User's Guide* (EK-MSV1Q-QG).

3.1 INTRODUCTION

A BA23-A enclosure containing a KDF11-BE or KDF11-BF CPU module is usually referred to as a MicroPDP-11/23 system. A MicroPDP-11/23 system contains a KDF11-B CPU module; an MSV11-P memory module; an RQDX1, RQDX2, or RQDX3 controller module supporting mass storage devices; and a communication module, usually the DZV11. A TQK50 controller module supporting a TK50 tape drive may also be present.

This chapter describes the following:

- KDF11-B module baud rate select switch
- Connection to the front control panel
- Switch and jumper setting
- Features and use of KDF11 console dialog mode

> **NOTE**
> **The KDF11-BE CPU module has been replaced with the KDF11-BF CPU.**

This chapter uses the term KDF11-B to represent all variants of the KDF11-B CPU. Refer to Appendix B, The PDP-11/23 PLUS System, for a discussion of the KDF11-BA jumper and switch settings.

Refer to Chapter 2, KDJ11-B Systems, for a description of the MSV11-P memory modules.

Refer to Chapter 5, Mass Storage and Backup Options, for descriptions of various Q22-Bus mass storage and backup devices.

Refer to Chapter 6, Q-Bus Communications and I/O Options, for descriptions of various Q22-Bus communications options.

3.2 KDF11-B CPU ASSEMBLY

The KDF11-B module connects to a cabinet kit containing a console Serial Line Unit (SLU) panel and two cables (Figure 3-1). The SLU is installed in the rear Input/Output (I/O) distribution panel of the BA23-A 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 (see Section 7.3).

The SLU panel contains two D-type 25-pin connectors. Refer to Table 3-1 for the pin and signal information for these connectors. The SLU panel also contains 2 baud rate select switches which enable the independent selection of the SLU baud rates.

Table 3-1 SLU Connector Pin Function

Pin	Signal
1	Protective or Earth Ground
2	Transmitted Data
3	Received Data
4	RTS – Request to Send
6	DSR – Data Set Ready
7	Logic or Signal Ground
20	DTR – Data Terminal Ready

A discussion of the KDF11-B CPU follows. Refer to Appendix B for a discussion of the KDF11-BA CPU module. For a discussion of other variants of the KDF11-B modules, refer to the *KDF11-BA CPU User's Guide.*

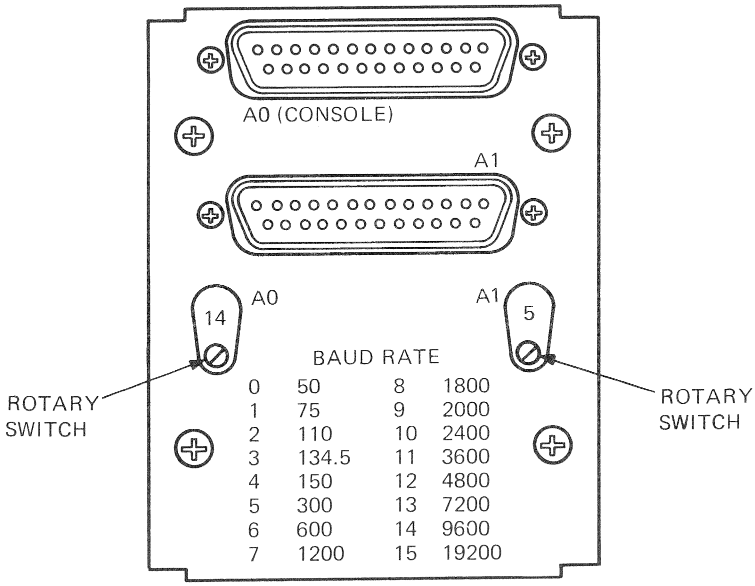

Figure 3-1 KDF11-B SLU Panel

3.3 KDF11-B CPU

The KDF11-B 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 Light Emitting Diodes (LEDs) for power and diagnostic status.

The KDF11-B 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 3-2 shows the location of these jumpers and switches, as well as the chip socket and LED locations.

Install the KDF11-B CPU module in the first slot of the BA23-A backplane. MSV11-P memory module(s) immediately follow the CPU.

Five LEDs on the KDF11-B 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 4.3.2 for a description of these four diagnostic LEDs.

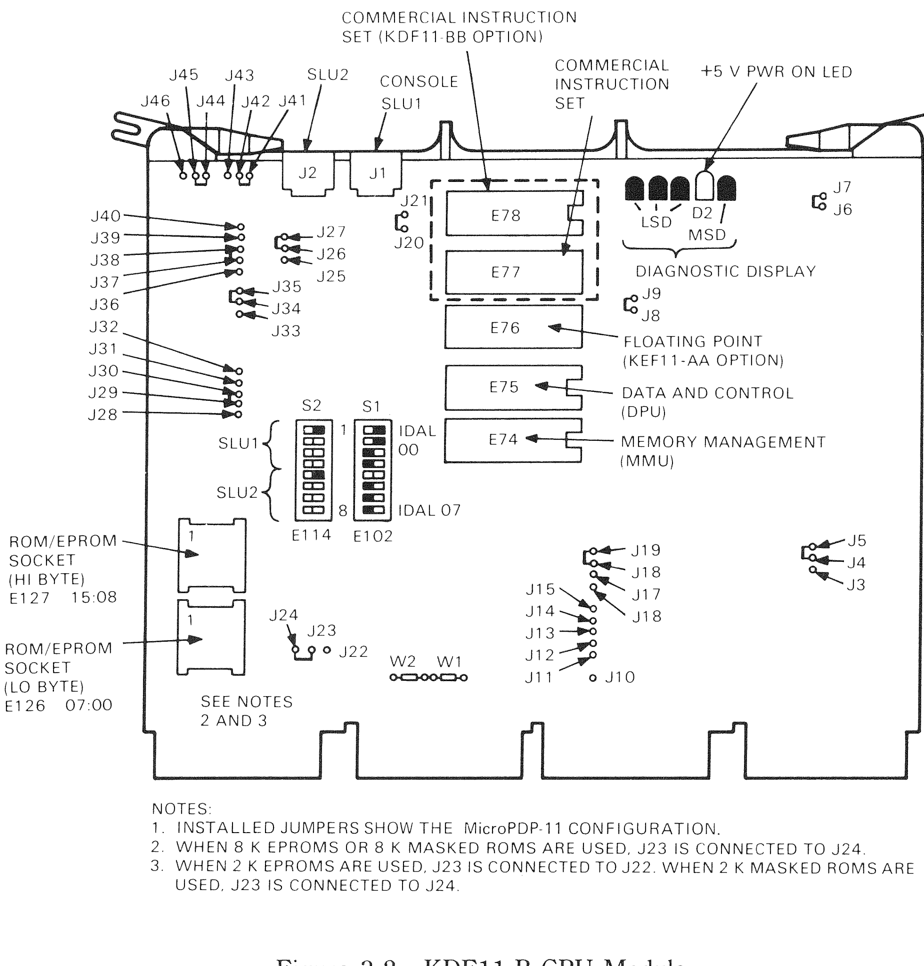

Figure 3-2 KDF11-B CPU Module

Table 3-2 shows the factory configuration of the jumpers.

Table 3-2 KDF11-B Module Factory Jumper Configuration

Jumpers	State	Function
J4-J5	In	Disables the CPU halt feature from the console 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 the output of the 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 S2-3. Enables baud rate rotary switches to select console SLU baud rate.
J43-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 3-3 shows the factory configuration for the two switch packs.

Table 3-3 KDF11-B Module Factory Switch Configuration

Switch	State	Function
S1-8	On	ANSI mode console terminal
S1-7	On	Does quick verify memory diagnostic
S1-6	Off	
S1-5	Off	
S1-4	On	Selects MSCP auto-boot
S1-3	On	
S1-2	On	
S1-1	On	

The factory configuration of J41 to J42 In, and 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	Sets second SLU for 9600 baud
S2-4	Off	
S2-3	Off	
S2-2	Off	
S2-1	On	Sets console SLU for 9600 baud

The input controls for the diagnostic/boot ROM are the 8 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 3-4 shows the bootstrap switch settings.

Table 3-4 KDF11-B Diagnostic/Bootstrap Switch Settings (E102)

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 auto 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	
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	Includes RD51, RD52, and RC25.
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	
X	X	0	0	1	1	0	0	Select MSCP drive 4	
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	1	0	0	0	Select TK50 drive 0	
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	
X	X	1	1	0	1	1	1		
X	X	1	1	1	0	0	0	Select DECnet DUV11	

Table 3-4 **KDF11-B Diagnostic/Bootstrap Switch Settings (E102) (Cont.)**

Switch Setting 8	7	6	5	4	3	2	1	Function
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

1 = on
0 = off
X = does not matter

* Factory Configuration.
† For KDF11-BF only.

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

3.4 KDF11-B BAUD RATE SELECT SWITCHES

The baud rate select switches on the SLU insert panel:

- Have 16 positions each (Figure 3-1).
- 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 3-5 shows the switch setting and corresponding baud rate.

Table 3-5 KDF11-B Baud Rate Switch Settings

Switch Setting	Baud Rate	Switch Setting	Baud Rate
0	50	8	1,800
1	75	9	2,000
2	110	10	2,400
3	134.5	11	3,600
4	150	12	4,800
5	300	13	7,200
6	600	14	9,600
7	1,200	15	19,200

When a KDF11-BA is upgraded in the field (new ROMs installed) to a KDF11-BF CPU, the baud rate for both the console SLU and the second SLU is set by the S2 switch pack (E114). Refer to Table 3-6 for these settings.

Table 3-6 S2 (E114) Switch Pack Settings

Baud		Second SLU			Console SLU			
Rate	S2-8	S2-7	S2-6	S2-5	S2-4	S2-3	S2-2	S2-1
50	On	On	On	On	On	On	On	On
75	On	On	On	Off	On	On	On	Off
110	On	On	Off	On	On	On	Off	On
134.5	On	On	Off	Off	On	On	Off	Off
150	On	Off	On	On	On	Off	On	On
300	On	Off	On	Off	On	Off	On	Off
600	On	Off	Off	On	On	Off	Off	On
1,200	On	Off	Off	Off	On	Off	Off	Off
1,800	Off	On	On	On	Off	On	On	On
2,000	Off	On	On	Off	Off	On	On	Off
2,400	Off	On	Off	On	Off	On	Off	On
3,600	Off	On	Off	Off	Off	On	Off	Off
4,800	Off	Off	On	On	Off	Off	On	On
7,200	Off	Off	On	Off	Off	Off	On	Off
9,600	Off	Off	Off	On	Off	Off	Off	On
19,200	Off	Off	Off	Off	Off	Off	Off	Off

3.5 KDF11-B AUTOMATIC BOOT MODE

When set to the factory configuration, the KDF11-B automatically runs diagnostic self-tests (described in Section 4.2). 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 4.5).

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 (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 V0XX        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
```

3.6 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 the 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 module. It 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 Kwords 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 function is part of the BOOT command on ANSI terminals.)

4.1 INTRODUCTION

This chapter describes the following topics:

- Startup self-test (Section 4.2)
- KDJ11-B (M8190) testing procedures and messages (Section 4.3)
- KDF11-B (M8189) testing procedures and messages (Section 4.4)
- Console emulator mode (Section 4.5)
- Octal Debugging Technique (ODT) commands (Section 4.6)
- Tests that can be loaded from user diskettes (Section 4.7)
- Other diagnostic media (Section 4.8)
- Testing with DEC/X11 run-time exerciser (Section 4.9)
- Testing with XXDP+ diagnostic programs (Section 4.10)
- Troubleshooting procedures for the BA23 and BA123 enclosure (Section 4.11)

4.2 START-UP 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. The self-test tests the following:

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

The self-test begins by testing a small portion of the CPU module and then progressively tests more and more of the base system. The system enters automatic boot mode upon successful completion of the startup test (see Chapter 2). When the self-test discovers an error or failure, the system displays a message. Refer to Section 4.3.1 for an explanation of the KDJ11-B messages. Refer to Section 4.4.1 for an explanation of the KDF11-B messages. Section 4.11 provides a flow chart to help you isolate a failing Field Replaceable Unit (FRU).

4.3 KDJ11-B TESTING PROCEDURE

The self-test program contains 40 separate parts, beginning with test 77 and counting down to 30 octal. The Serial Line Unit (SLU) display panel displays the number of the current self-test. The SLU panel also displays boot messages (27 to 00 octal). Table 4-1 provides a summary of these tests and messages.

Table 4-1 Self-Test Listing

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 K words
51	Cache test using memory
50	Memory data byte tests for all memory
47	Parity and error correction code (ECC) for all memory
46	Memory address line shorts for all memory

Table 4-1 Self-Test Listing (Cont.)

Number	Description
45 to 31	*
30	Test exit – test completed successfully
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.

4.3.1 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 4.3.2. Table 4-2 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 Most Significant Bit (MSB) and the lower three LEDs represent the octal Least Significant Bit (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 4-2 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-protect 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> O** followed by a **4** and then press the **Return** key 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 in Table 4-2.

4.3.2 KDJ11-B Console Terminal Messages

When an error occurs during the self-test, the system displays a message on the console terminal. Figure 4-1, parts 1 and 2, show an example of such a message.

```
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
```

Figure 4-1 Error Message Screen, Part 1

```
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 4-1 Error Message Screen, Part 2

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.

4.4 KDF11-B TESTING PROCEDURES

The automatic self-tests stored in on-board boot ROMs verify the CPU operation.

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

After successful completion of the self-test, the system searches for an operating system to boot. If a bootable operating system is found, the system displays a message similar to the following:

BOOTING FROM DU1
Loading ——————-
Please wait ....

4.4.1 KDF11-B Messages

If any part of the self-test or boot diagnostics fail, the console terminal displays a message. 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)

Table 4-3 provides a description of 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 (N)?

Some errors cause the system to halt any type of program (Section 4.4.3). In this case, control passes to the console emulator mode. This mode allows you to simulate error conditions using ODT (Section 4.6) commands.

Table 4-3 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).

4.4.2 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 4-4 identifies the possible errors.

Table 4-4 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 8 KW 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.

4.4.3 KDF11-B System Halt

When a program halts, 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.

4.5 CONSOLE EMULATOR MODE

The system enters console emulator mode when one 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, it enters console emulator mode, and 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 below. Refer to the *Microcomputers 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.

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

Octal Debugging Technique (ODT) 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. When in ODT, express all addresses, registers, and memory location contents in octal notation. Letters and symbols make up the command set for ODT.

The hardware-implemented ODT command set is a subset of commands in a larger software-implemented ODT program. The hardware program, which resides on the KDJ11-B and KDF11-B modules, serves primarily for diagnosis of 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 4-5 provides a basic listing of 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 4-5 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.)

4.7 USER TEST DISKETTES

The user test diskette set contains the User-Friendly Diagnostic (UFD) diskettes and the Field Service diagnostic diskettes.

4.7.1 User-Friendly Diagnostics (UFD)

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

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

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

Running the UFD does not require any knowledge of software diagnostic systems or procedures. To run the UFD:

- Load the first diskette into the first diskette drive and boot the system.
- Select **T** from the User Diagnostics Menu, part 1 (Figure 4-2), and press the **Return** key.
- Follow the directions on the screen which include loading scratch media in all storage devices.

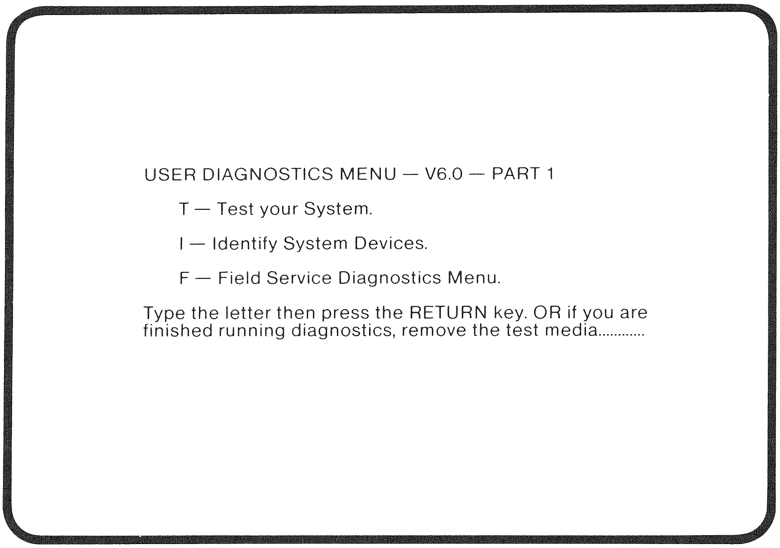

Figure 4-2 User Diagnostics Menu, Part 1

NOTE
The version number on your screen may be different.

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

If the tests detect an error, the system automatically prompts for the installation of the second UFD diskette and the running of additional diagnostics. Follow the directions on the screen.

- The system displays the User Diagnostics Menu, part 2 (Figure 4-3).
- Type **Y** and press the **Return** key to run the individual tests.

```
USER DIAGNOSTICS MENU - V6.0 - PART 2
  Y - Test Individual System Devices
  I - Identify System Devices
  F - Field Service Diagnostics Menu
```

Figure 4-3 User Test Diagnostics Menu, Part 2

These additional tests locate the FRU that has failed. Refer to your *MicroPDP-11 Systems Owner's Manual*, Chapter 4, Troubleshooting, for additional information.

4.7.2 Field Service Diagnostics

The user test diskettes also contain a Field Service Diagnostics Menu. When you access this menu, the system test can be looped for ten minutes or until you stop it by typing **<CTRL> C**. When stopped, the console terminal displays status and error information.

The Field Service Diagnostics Menu also allows access to the XXPD+ monitor. Once in the monitor, an XXDP+ on-line help file is available by typing **H**.

> **NOTE**
> **Only trained service personnel familiar with XXDP+ software should access the XXDP+ monitor or use the Field Service diskettes described in Section 4.7.3.**

To access the Field Service Diagnostics Menu:

- Install the UFD diskette in drive 1 and boot the system.
- At the User Diagnostics Menu, type **F** and press the **Return** key.

The system displays the Field Service Diagnostics Menu (Figure 4-4). Select the desired test by typing the appropriate character and pressing the **Return** key.

```
            FIELD SERVICE DIAGNOSTICS MENU - V6.0 - PART 1

XXXX CAUTION: This Menu is intended for FIELD SERVICE use only

    S - System Test is run for about 10 minutes and the complete
        error and status messages are reported. This test can
        be terminated by typing C.

    R - Repeated System Tests are run until terminated by typing
        C. Complete error and status messages are reported.

    X - XXDP+ monitor is entered. Refer to the XXDP+ Users Guide.

    U - Return to User Diagnostics Menu
```

Figure 4-4 Field Service Diagnostics Menu

4.7.3 Field Service Test Diskettes

A set of Field Service diskettes is provided for use by trained service personnel. These diskettes make use of 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:

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

> **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.**

4.8 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.

4.9 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 4.6) to examine system registers and memory locations.

4.9.1 Run-Time Exerciser Messages

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

- System errors
- Data errors
- Status errors

4.9.1.1 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 4.8.2 for directions.

4.9.1.2 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 Assembled Program Count (APC) value in the program listing. The APC location display contains the program call that caused the error message.

4.9.1.3 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.

The status error message includes a STATC value. This 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.

4.9.2 Selecting and Deselecting Program Modules

You can run programs individually or in groups by using the select (SEL) and deselect (DES) commands. These commands allow you to:

- Select or deselect program modules one at a time
- Select or deselect all modules

These commands operate only within the system exerciser program. They cannot be executed without first starting the exerciser. Table 4-6 shows the commands and their function.

Table 4-6 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 status (STAT) 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.

4.9.3 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.

4.10 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 4-7 for a partial list of these programs. These diskettes also contain other XXDP+ programs for testing additional options.

Table 4-7 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.

4.10.1 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.

4.10.2 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.

4.10.3 Restarting Programs

You can configure the XXDP+ diagnostic programs to do the following:

- Run continuously
- Halt at the end of a pass
- 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.

4.10.4 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 so that it performs a loop on error. The program listing directs you to change software switch register 176 to 1000 in order to do this.

- 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.

4.11 TROUBLESHOOTING THE BA23 AND BA123 ENCLOSURES

The start-up diagnostics automatically run the CPU and memory module self-tests. Tables 4-1, 4-2, and 4-3 list the number produced by this testing and a probable FRU failure.

To begin the troubleshooting procedure, determine exactly what was being done when the system failed. This includes:

- Operating system being run
- Application being run
- Media installed
- Switch setting
- Indicator lights (lit or not lit)
- User input

This information might prove helpful when attempting to re-create the failure.

As a second step, inspect the system for problems that can be seen. This includes incorrect switch settings, loose cables, and incorrectly installed modules. Refer also to the troubleshooting check list located in Chapter 4, Troubleshooting, of your Systems Owner's Manual.

The user test and Field Service diskettes provide further testing of the system. To isolate the problem to a failing FRU, follow the flow chart shown in Figure 4-5. Refer to Chapter 8 or Chapter 10, FRU Removal And Replacement Procedures, for the appropriate removal and replacement procedures for your system.

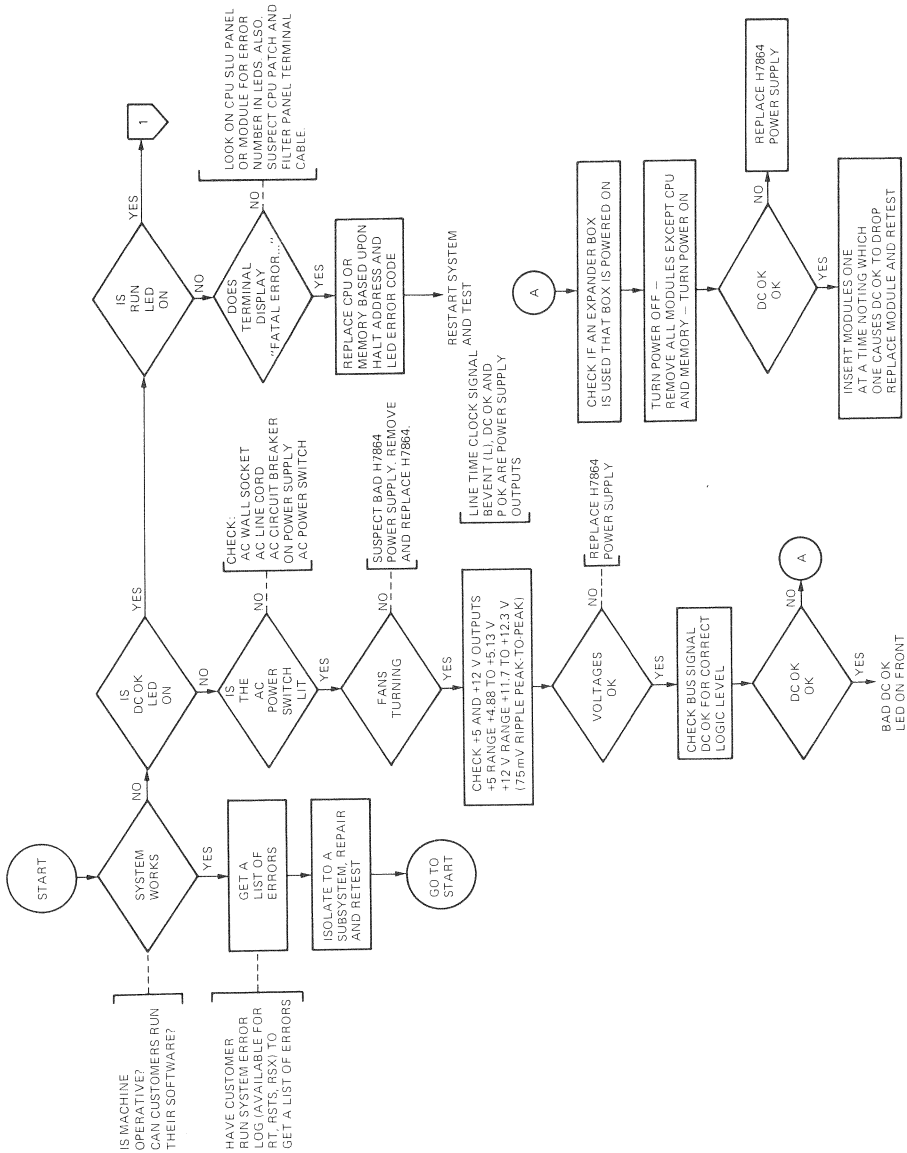

Figure 4-5 Troubleshooting Flow Diagram (Sheet 1 of 2)

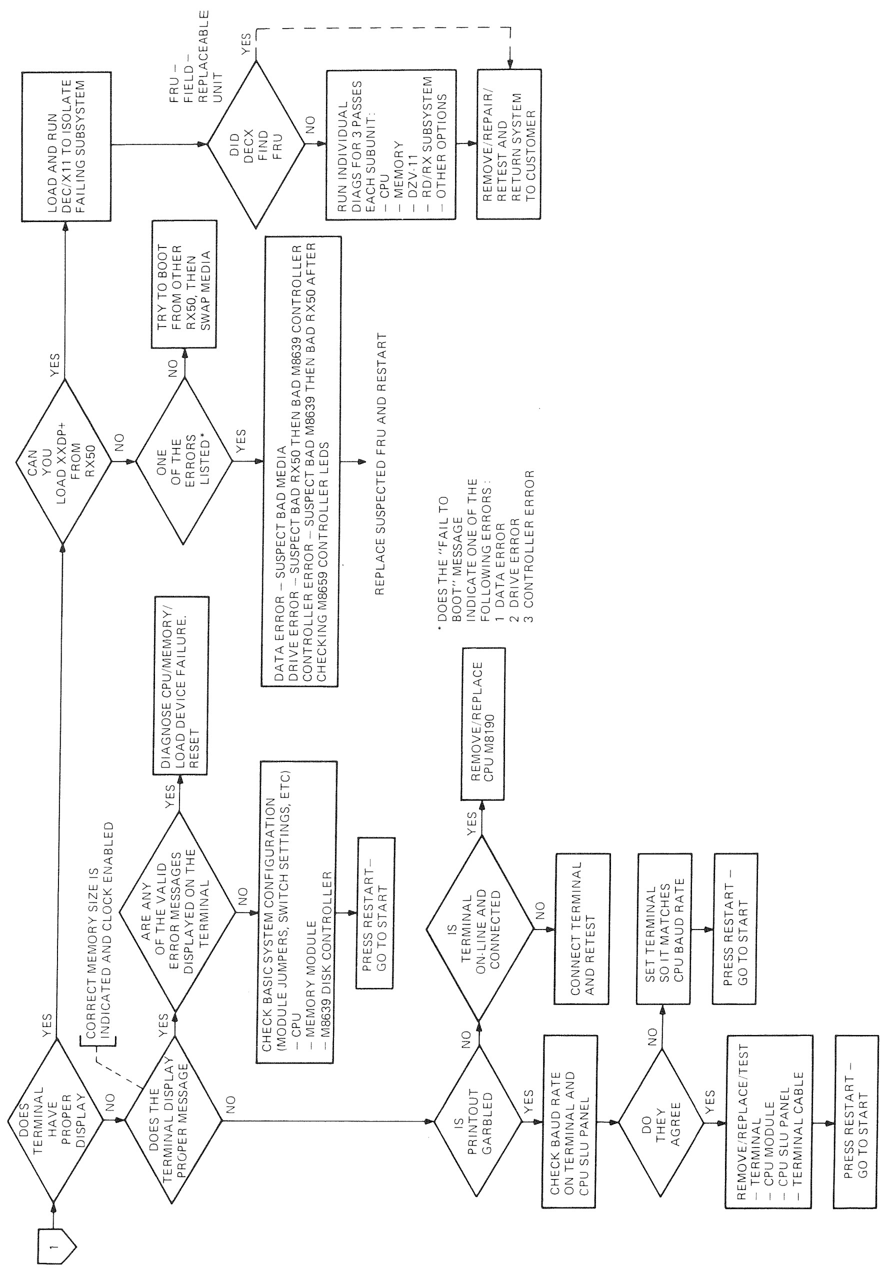

Figure 4-5 Troubleshooting Flow Diagram (Sheet 2 of 2)

5.1 INTRODUCTION

This chapter describes mass storage and backup devices that can be installed with the MicroPDP-11 systems in the BA23-A or BA123-A enclosures. This chapter discusses the following options:

- Mass storage devices

  RC25 disk subsystem (Section 5.2)
  RD51, RD52, and RD53 fixed-disk drives (Section 5.3)
  RQDX1, RQDX2, and RQDX3 disk controller modules (Section 5.4)
  RQDX1-E and RQDXE extender modules (Section 5.5)
  RX50-AA diskette drive (Section 5.6)
  RL02 disk subsystem (Section 5.7)

- Mass storage backup devices

  TQK25-EP tape drive and controller module (Section 5.8)
  TQK50-KA tape drive and controller module (Section 5.9)

This chapter also provides factory configuration of all switches and jumpers.

Formatting instructions for the RD51, RD52, and RD53 fixed-disk drives are provided in Section 5.3.2 and Appendix C.

Refer to the *LSI Systems Service Manual* (EK-LSIFS-SV-005) for additional information for each of these mass storage and backup options.

5.2 RC25 DISK SUBSYSTEM

The RC25, a standalone mass storage device, has a capacity of 52 Mbytes. It contains two eight-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.

BA23-A controller kit

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

BA123-A controller kit

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

The KLESI-QA cabling kit provides the connection between the disk drive and the enclosure. The kit contains one type A filter connector, a cable that connects the filter to the controller module (M7740), and a round cable that connects the RC25 to the I/O distribution panel (Figure 5-1).

The Control Status Register (CSR) address of the first M7740 adapter module is fixed. You can change it using the Dual In-line Package (DIP) switch, E44 (Figure 5-2). Table 5-1 lists the factory setting. The interrupt vector is set under program control.

Table 5-1 M7740 CSR Address

	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits
Factory Setting	**E44 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**← Switches**
17772150	1	0	1	0	0	0	1	1	0	1	0*
Possible addresses if second MSCP device:											
17760334	0	0	0	0	0	1	1	0	1	1	1†
1776-354	0	0	0	0	0	1	1	1	0	0	

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

NOTE
The M7740 and M8639 (RQDX controller) are both Mass Storage Control Protocol (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. Refer to Appendix A for further information.

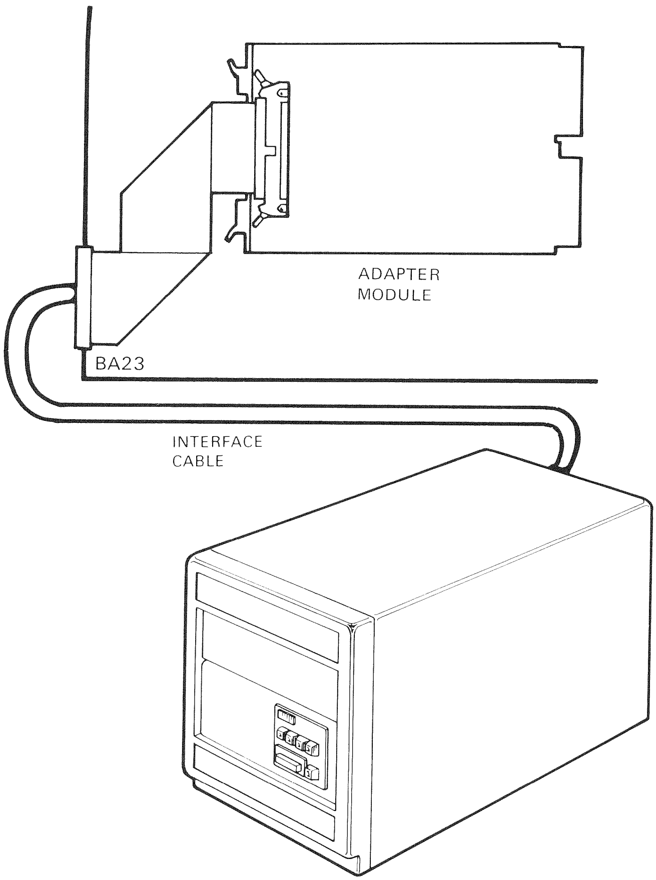

Figure 5-1 RC25 Disk Subsystem

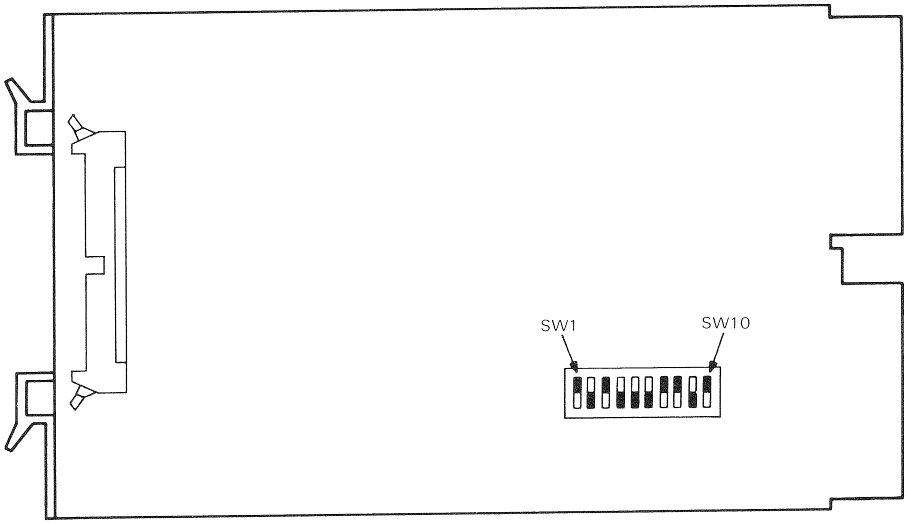

Figure 5-2 M7740 Module Layout

5.3 RD51, RD52, AND RD53 DISK DRIVES

BA23-A system

Factory installed:	RD5nQ-AA (disk kit) n = 1, 2, or 3
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
- 17-00286-00: 34-pin cable to signal distribution panel

BA123-A system

Factory installed:	RD5nQ-BA (disk kit) n = 1, 2, or 3
Field upgrade:	Same as factory installed option

An RD5nQ-BA kit includes the following:

- RD5n-A: Disk drive
- 17-00282-01: 20-pin cable to signal distribution panel
- 17-00286-01: 34-pin cable to signal distribution panel
- 70-22393-01: Control panel assembly

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 a BA123-A enclosure, a cable from the power supply must be connected to each drive (see Section 9.7).

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

When you install these drives in a BA23-A enclosure in port 0 (left slot), the signal cables connect to J2 and J7 on the backplane. When you install these drives in port 1 (right slot), the signal cables connect to J1 and J5 on the backplane.

5.3.1 Factory Configuration

The following sections provide the factory configuration for the RD5n disk drives.

5.3.1.1 RD51 – Table 5-2 lists the read/write board jumper setting for the RD51 DIP shunt jumper (Figure 5-3).

Table 5-2 RD51 DIP Shunt Pack Factory Setting

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

5.3.1.2 RD52 – The RD52 read/write printed circuit board has five pairs of pins (Figure 5-4). To configure an RD52 drive in a BA23-A enclosure as DU0 (installed in port 0), place the jumper clip on DS3. To configure an RD52 drive in a BA23-A enclosure as DU1 (installed in port 1), place the jumper clip on DS4.

To configure an RD52 drive in a BA123-A enclosure, one (any one) of the four pairs of pins on the left must be connected with a jumper.

In a BA123-A enclosure, a drive is selected by the position of its signal cables in the M9058 signal distribution board, not by the drive select pins. See Figure 9-8 for the correct cabling.

5.3.1.3 RD53 – 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 installed in a BA23-A enclosure as drive DU0 (installed in port 0), depress switch 3. To configure the RD53 as DU1 (installed in port 1), depress switch 4.

To configure an RD53 drive installed in a BA123-A enclosure, depress either switch 3 or switch 4 on the rear edge of the read/write board.

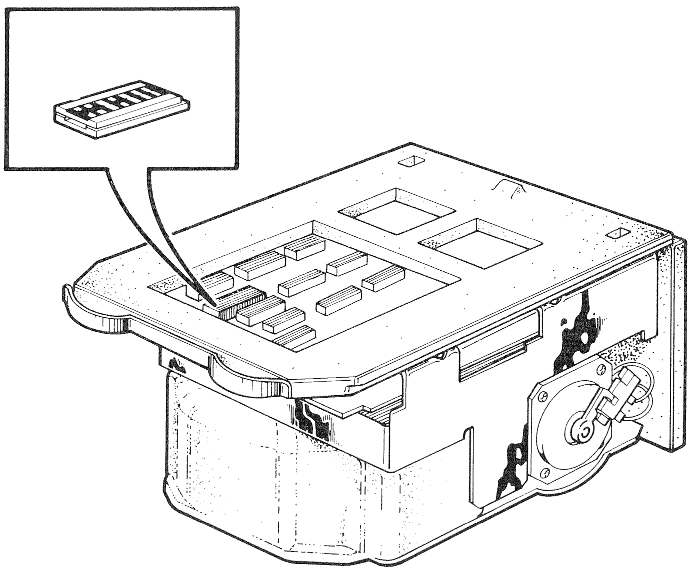

Figure 5-3 RD51 Disk Drive and Shunt Jumper

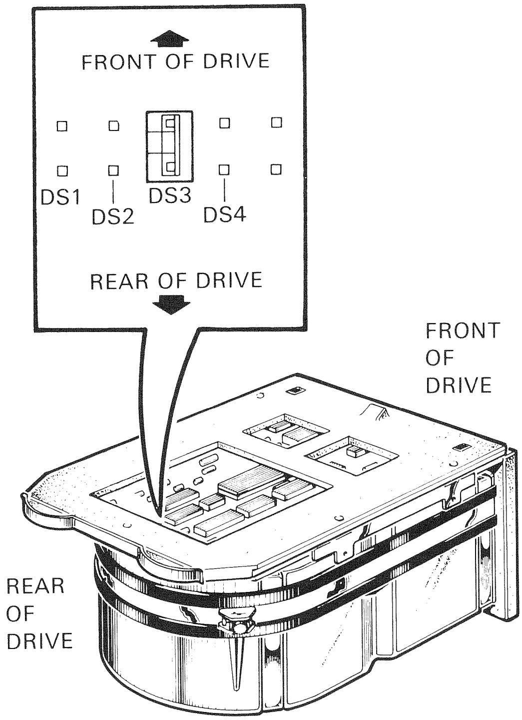

Figure 5-4 RD52 Disk Drive and Jumpers

5.3.2 Disk Formatting

Replacement disk drives must be formatted with the ZRQB?? binary program to be compatible with the RQDX controller module. This program is part of the XXDP+ diagnostic software system which is on the Field Service test diskettes. Use version C0 or later to format an RD52 or RD53 disk drive. The 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 (Press Return 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 RD51/2)
Enter date in MM-DD-YY format (A)?	(Use the format shown)
Format begun	(This will take about 30 minutes)

Format completed, X revectored LBNs
RDRX EOP 1
0 total errs

For further information refer to:

- Appendix C
- *RD52-D, -R Fixed-Disk Drive Subsystem Owner's Manual*
- *11C23-UE/11C23-UC RD52 Upgrade Installation Guide*

5.4 RQDX1, RQDX2, AND RQDX3 DISK CONTROLLERS

BA23-A enclosure

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 (RQDX3)

A BA23-A RQDX1, RQDX2, or RQDX3 controller kit includes the following:

- RQDX1, RQDX2, or RQDX3 controller module
- BC02D-ID 50-pin cable, RQDX to signal distribution panel

BA123-A enclosure

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

A BA123-A RQDX1, RQDX2, or RQDX3 controller kit includes the following:

- RQDX1, RQDX2, or RQDX3 controller module
- 17-00861-01 50-pin cable, RQDX to signal distribution panel
- 17-00862-01 40-pin, M9058 to four RD console boards
- M9058 signal distribution board

The optional RQDX1-E (M7512) and RQDXE (M7513) extender modules and their associated cables provide the RQDX1, RQDX2, and RQDX3 controller signals to any external drive connected to the host (Section 5.5).

The RQDX1, RQDX2, and RQDX3 controllers provide the interface for fixed-disk and diskette drives to the Q22-Bus. These intelligent controllers have on-board microprocessors. Data transfers using Direct Memory Access (DMA). Programs in the host system communicate with the controller and drives using the 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.

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

NOTE
An RQDX1 controller must be the last module installed in the BA23-A or BA123-A backplanes. The BA123-A enclosure ships with an RQDX2 or RQDX3 controller.

The RQDX2 and RQDX3 control a maximum of four fixed-disk drives, or two fixed-disk drives and an RX50 diskette drive.

NOTE
A BA23-A enclosure supports only one fixed-disk drive installed at any one time.

Figure 5-5 shows the jumper and LED locations for the RQDX1 and RQDX2 controllers. The RQDX3 controller module is not shown.

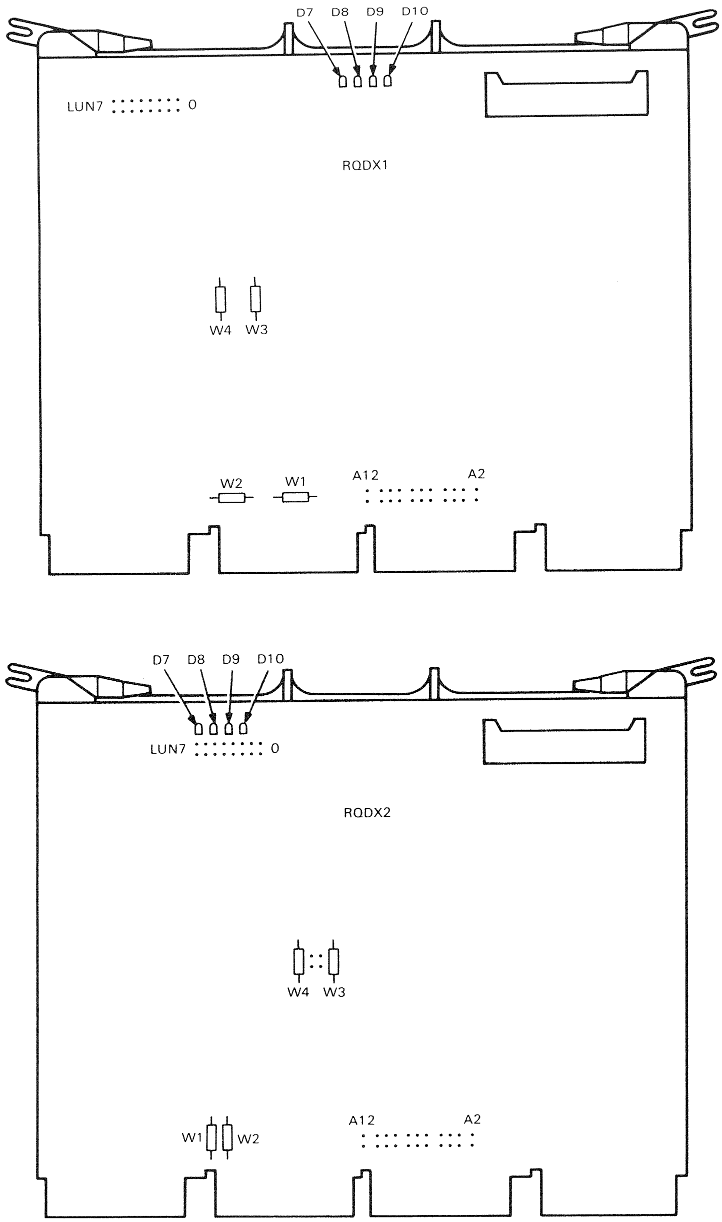

Figure 5-5   RQDX1 and RQDX2 Controller Modules

The starting address of all the RQDX modules is fixed at 17772150. The starting address of a second RQDX module installed in the system is a floating address and must be set. The first RQDX controller is assigned a fixed interrupt vector of 154, which is set under program control. If you install a second RQDX controller, the interrupt vector floats (refer to Appendix A). Table 5-3 lists the factory configuration.

Four Light Emitting Diodes (LEDs) on the RQDX modules provide diagnostic information. Refer to the *RQDX1 Controller Module User's Guide* (EK-RQDX1-UG), the *RQDX2 Controller Module User's Guide* (EK-RQDX2-UG), or the *RQDX3 Controller Module User's Guide* (EK-RQDX3-UG) for information.

Table 5-3 RQDX1, RQDX2, and RQDX3 Factory Jumper Configuration

Module Number	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	← Add. Bits (Jumpers)
1	17772150	1	0	1	0	0	0	1	1	0	1	0	← factory
Possible settings for a second RQDX controller													
2	17760334	0	0	0	0	0	1	1	0	1	1	1	
	17760354	0	0	0	0	0	1	1	1	0	1	1	
	17760374	0	0	0	0	0	1	1	1	1	1	1	

1 = installed
0 = removed
Logical Unit Number (LUN) jumpers 1–8 are removed.

You must also configure the LUN jumpers (0–7) on the module. The factory configuration of all jumpers removed is correct for the first module installed in a system. If you install a second module, install a jumper onto pin 2. This assigns its LUNs to a value of 4–7. The jumpers represent a binary weighted value and can be configured to begin at any LUN from 0–35. Refer to Appendix D for further discussion and examples.

5.5 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. Both these extender modules are designed primarily for use with a BA23-A enclosure. The PDP-11/23 PLUS system in a BA11-S enclosure also supports these extender modules. Install the M7512 or the M7513 module in rows A and B of the slot directly below the RQDX1, RQDX2, or RQDX3 controller module.

When installing an RQDX1-E extender module, use the following guidelines:

- Use the RQDX1-E (M7512) extender module when you have an RQDX1 controller module.
- Install the RQDX1-E (M7512) in the same backplane directly below the RQDX1 controller module.
- Make sure that the extender module is the last module installed in the BA23 backplane.

When installing an RQDXE extender module, use the following guidelines:

- Use the RQDXE (M7513) extender module when you have an RQDX2 or RQDX3 controller module.
- Install the RQDXE (M7513) in the same backplane directly below the RQDX2 controller module.
- Note that neither the RQDX2 or RQDX3 nor the RQDXE module needs to be the last module installed in the backplane.

When you install RD51, RD52, or RD53 fixed-disk drives with an RQDX controller and RQDX extender module in a BA23-A enclosure, the following rules apply:

- Always place the first fixed-disk drive (DU0) in port 0 (left mass storage slot) of the enclosure containing the RQDX controller module.
- Set the device select switch to 3 (DU0) on any fixed-disk drive installed in port 0 of the enclosure or expansion unit. (This rule also applies to any subsystem installed with a BA23-A enclosure.)

  NOTE
  A subsystem is an RX or RD desktop or rack mounted disk drive with its own power supply.

- Set the device select switch to 4 (DU1) on any fixed-disk drive installed in port 1 (right mass storage slot) of the enclosure or expansion unit. (This rule also applies to any subsystem installed with a BA23-A enclosure.)
- Do not set the device select switch to 1 or 2 on any fixed-disk drive. These switch settings are reserved for RX50 diskette drives.

Refer to Appendix D, Logical Unit Number Designation, for further information.

5.5.1 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 a BA23-C expansion box. The RQDX1 controller supports two fixed-disk drives and one RX50 diskette drive.

Figure 5-6 shows the jumper locations on the M7512 module.

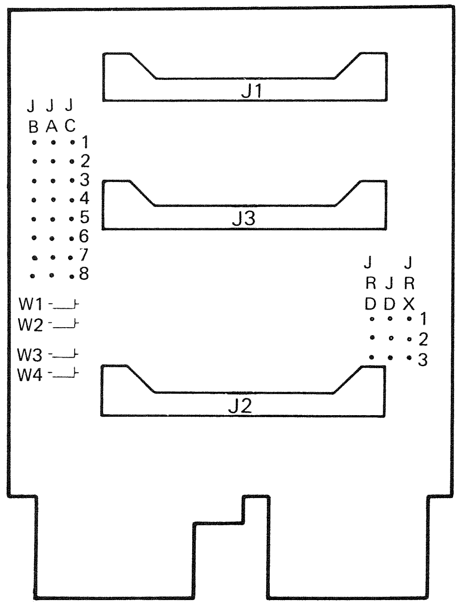

Figure 5-6 RQDX1-E Module

Table 5-4 provides the RQDX1-E factory configuration of these jumpers. Use this configuration with a BA23-A enclosure and a BA23-C expansion box, or with a BA23-A enclosure/disk drive subsystem arrangement. The factory configuration is set to connect the expansion unit or subsystem to connector J3.

Table 5-4 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 to JC1
JA1 - JA8		JA2 to JC2
JC1 - JC8		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).

5.5.2 RQDXE (M7513) Extender Module

Use the RQDXE extender module when you have an RQDX2 or RQDX3 controller module and you want to add subsystems or an additional fixed-disk drive in a BA23-C expansion box. The RQDX2 and RQDX3 modules support four fixed-disk drives or two fixed-disk drives and an RX50 diskette drive.

> **NOTE**
> **A BA23-A enclosure used as the host or a BA23-C expansion box supports only one fixed-disk drive per enclosure, even though the RQDX2 and RQDX3 controller and RQDXE extender modules can support four fixed-disk drives.**

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

The M7513 module (Figure 5-7) 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.

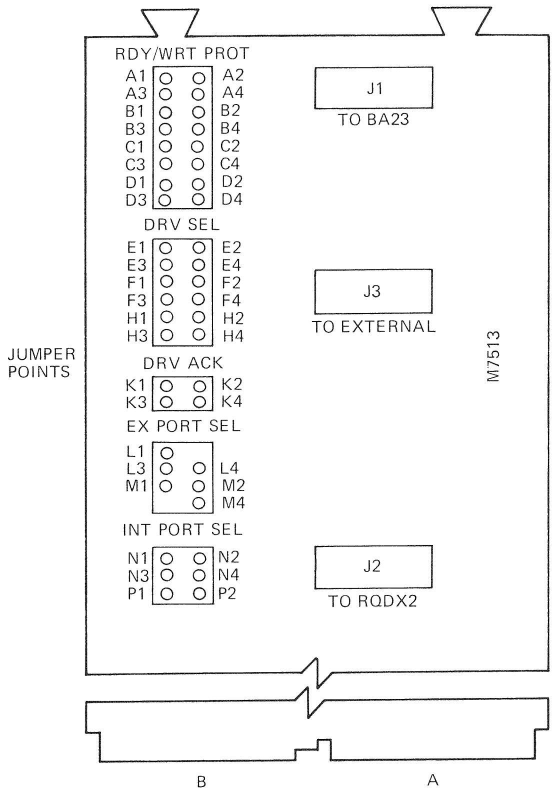

Figure 5-7 RQDXE (M7513) Extender Module

Table 5-5 shows three typical fixed-disk and RX50 arrangements using the RQDX2 or RQDX3 and the RQDXE extender module. The factory jumper configuration supports all three arrangements shown.

Table 5-6 shows the RQDXE (M7513) factory configuration. This configuration supports one RX50 and two fixed-disks. You can use this configuration with a BA23-A enclosure and a BA23-C expansion box, or with a BA23-A enclosure and a subsystem.

Table 5-5 Three Possible Arrangements Using the RQDXE

Option No.	Arrangement	Port 0 (Left Slot)	Port 1 (Right Slot)	Orientation
1	Host*	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 for simplicity. All that this implies is the enclosure in which the RQDX2 controller resides.

† X implies the port is empty or contains a device not supported by the RQDX controller.

‡ A subsystem is an RX or RD desktop or rackmounted disk drive with its own power supply.

Table 5-6 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 5-7 shows a configuration using the RQDXE (M7513) with three fixed-disk drives.

Table 5-8 shows the RQDXE (M7513) jumper setting to support three fixed-disk drives. Use this configuration only with a BA23-A enclosure and dual subsystems.

Table 5-7 Three Fixed-Disks With an RQDXE

Arrangement	Port 0 (Left Slot)	Port 1 (Right Slot)	Orientation
Host	RD0	X →	Front Panel
Dual Subsystem (Only)	RD1	RD2 →	Front Panel(s)

Table 5-8 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			

Refer to Appendix E for additional configurations. Refer to the *RQDXn Controller Module User's Guides* for further information.

5.6 RX50 DISKETTE DRIVE

BA23-A enclosure

Factory installed:	RX50-AA
Field upgrade:	Same as factory installed
Cabinet kit:	RX50-AA diskette drive 17-00285-02 34-pin RX50 cable to signal distribution panel

BA123-A enclosure

Factory installed:	RX50-BA
Field upgrade:	Same as factory installed
Cabinet kit:	RX50-BA diskette drive 17-00867-01 34-pin RX50 cable to signal distribution board

The RX50 (Figure 5-8) is a random-access, dual-diskette storage device that uses two single-sided 13.3-cm (5.25-inch) 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.

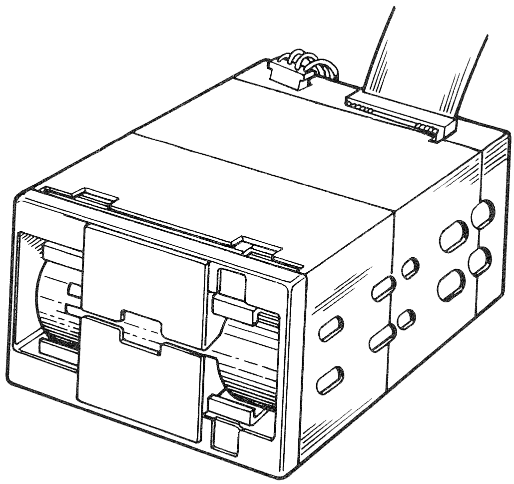

Figure 5-8 RX50 Diskette Drive

5.7 RL02 DISK SUBSYSTEM

BA23-A enclosure

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

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 rackmountable, 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 5-9) consists of the disk drive and a cabinet kit.

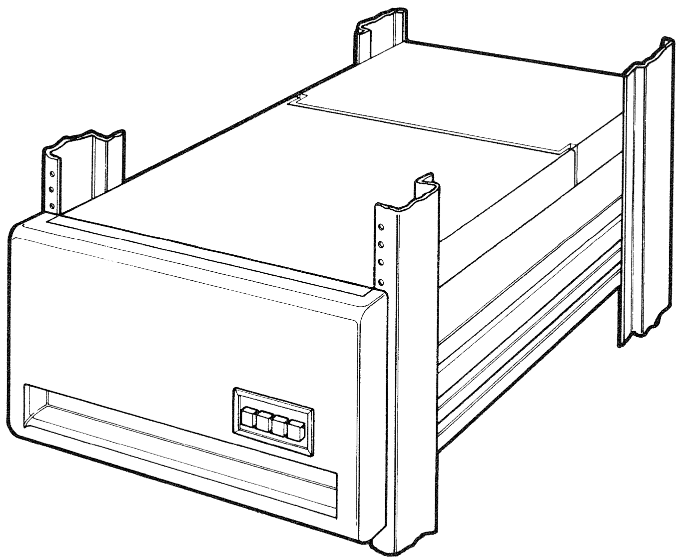

Figure 5-9 RL02 Disk Drive Subsystem

The RLV12 controller (Figure 5-10) is a quad-height module that transfers data between the Q22-Bus and the RL02 using DMA.

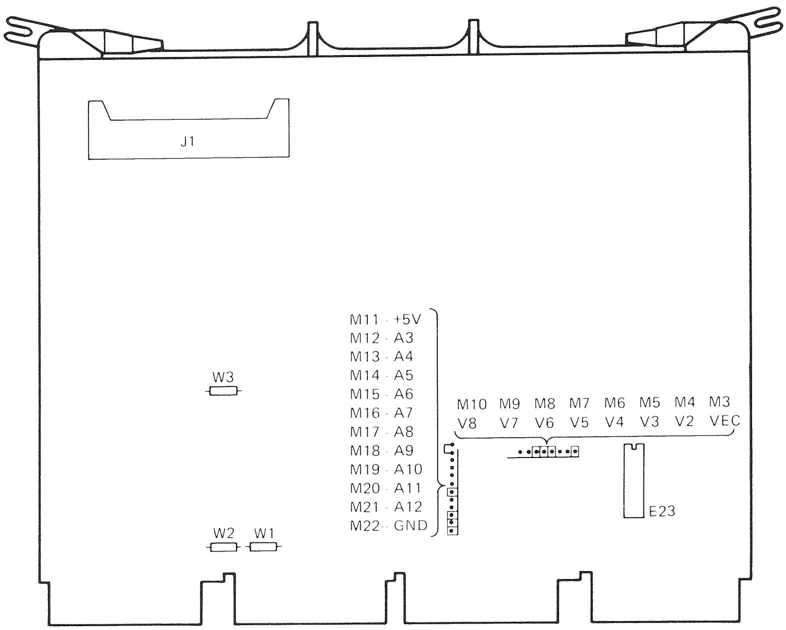

Figure 5-10 RLV12 Module Layout

The CSR address and interrupt vector are fixed. Tables 5-9 and 5-10 list the factory settings.

Table 5-9 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 5-10 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 pin M3

0 = no connection

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

5.8 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 TQK25-EP tape drive subsystem (Figure 5-11) consists of two major components:

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

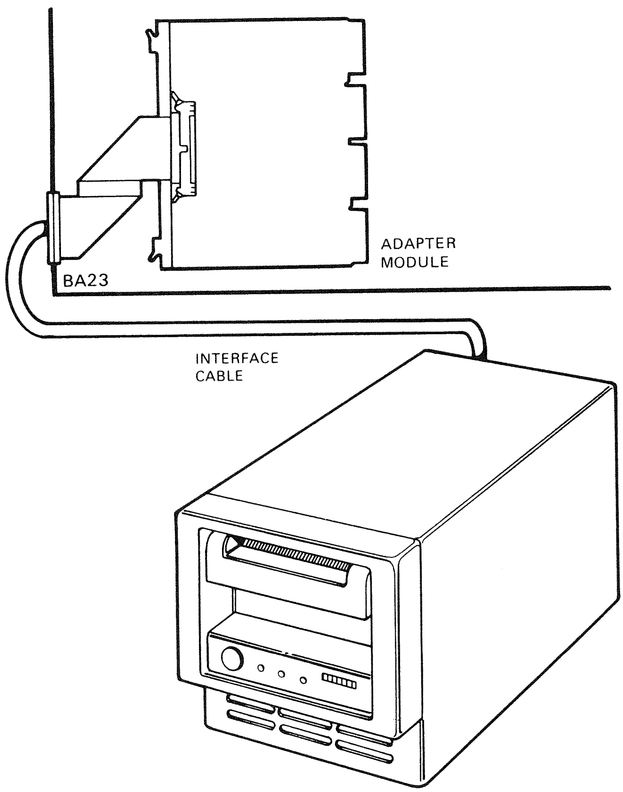

Figure 5-11 TK25 Tape Drive Subsystem

The TK25 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 5-12) provides the interface between the tape drive and the Q22-Bus.

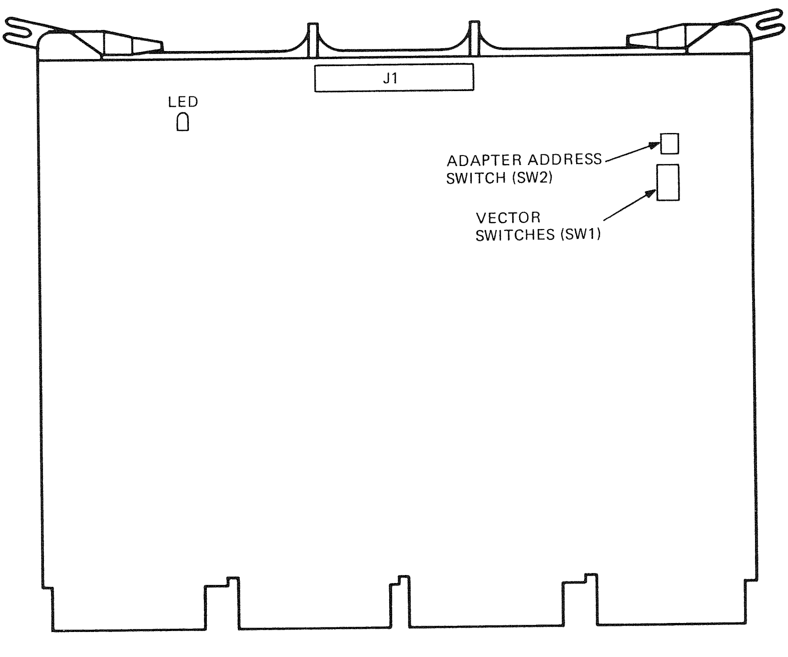

Figure 5-12 M7605 Module Layout

The CSR address and interrupt vector for the M7605 adapter module are both fixed and are set using DIP switches SW1 and SW2 (Figure 5-12). Tables 5-11 and 5-12 list the settings.

Table 5-11 M7605 CSR Address

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

Table 5-12 M7605 Interrupt Vector

	V8	V7	V6	V5	V4	V3	V2	
Factory Setting	SW1 1	2	3	4	5	6	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 Guide* (EK-0TK25-UG)
- *TK25 Tape Drive Customer Installation Guide* (EK-T25TD-IN)
- *TQK25 Q-Bus CPU Kit Installation Guide* (EK-T25QA-IN)

5.9 TQK50-KA TAPE DRIVE SUBSYSTEM

BA23-A enclosure

Factory installed:	TK50-AA (tape drive with cartridge) TQK50-AA controller module and 76.2-cm (30-inch) signal cable and BA23-A specific access door
Field upgrade:	Same as factory installed option

BA123-A enclosure

Factory installed:	TK50-AA (tape drive with cartridge) TQK50-BA controller module and 76.2-cm (30-inch) signal cable
Field upgrade:	Same as factory installed option

NOTE
Both parts must be ordered.

BA23-A enclosure

TK50 Subsystem:	TK50-DA, -RA (120 V) or TK50-DB, -RB (240 V) TQK50-AB controller module and 35.56-cm (14-inch) cable with I/O insert panel

BA123-A enclosure

TK50 Subsystem:	TK50-DA, -RA (120 V) or TK50-DB, -RB (240 V) TQK50-BB controller module and 53.34-cm (21-inch) cable with I/O insert panel

Refer to Section 5.9.6 for additional cabinet kit information.

The TQK50 (Figure 5-13) is a streaming tape drive subsystem that provides 100 Mbytes of backup data storage. The media is magnetic tape cartridges.

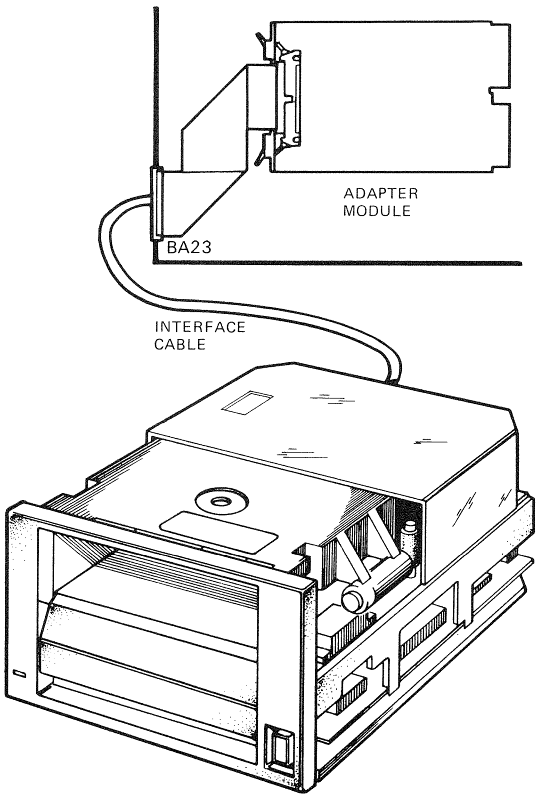

Figure 5-13 TQK50 Tape Drive Subsystem

The TK50 drive contains the tape mechanism with supporting electronics.

5.9.1 TQK50 (M7546) Tape Controller

The TQK50 controller provides the interface for a TK50 tape drive to the Q22-Bus. This intelligent controller has on-board microprocessors. Data transfers using DMA. Programs in the host system communicate with the controller and tape drive using MSCP.

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

Your systems owner's manual contains TK50 operating instructions.

Figure 5-14 shows the jumpers, switches, and LEDs for the TQK50 controller. The CSR address for this module is 17774500. The interrupt vector is set to 260 and is under program control.

The starting address of any additional TQK50 modules installed in your 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.

The interrupt vector of any additional TQK50 module installed in the system floats. Refer to Appendix A for additional information. Table 5-13 shows the factory configuration of the jumpers.

Table 5-13 M7546 Fixed CSR Address

Module Number	Factory Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	← Add. Bits (Jumpers*)
First	17774500	1	1	0	0	1	0	1	0	0	0	0	(factory)
Possible addresses for second controller:													
Second	17760404	0	0	0	0	1	0	0	0	0	0	1	
	17760444	0	0	0	0	1	0	0	1	0	1	1	

1 = jumper installed
0 = jumper removed
* The Jumper nearest the module fingers is A2

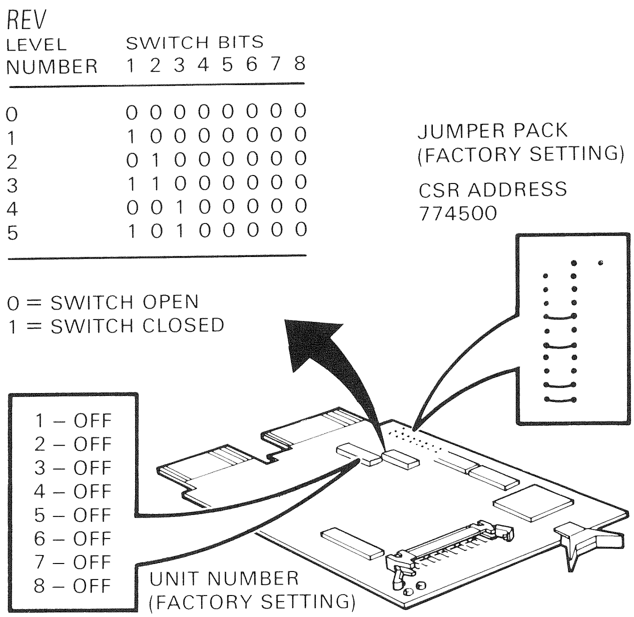

Figure 5-14 TQK50 (M7546 Jumpers And Switches

5.9.2 Unit Number DIP Switch

The unit number DIP switch must be set to correspond to the jumper setting. Table 5-14 shows the unit number switch pack settings and the unit number name.

Table 5-14 Unit Number Switch Pack Settings

Jumpers Set for Address	Unit Number 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

5.9.3 Revision Level DIP Switch

The revision level DIP switch is factory set. 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 5-15 shows the switch setting.

Table 5-15 Revision Level Switch Pack

Revision 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

5.9.4 TQK50 LEDs

Two LEDs, located on the front of the module, indicate module status. The level 1 (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 TMSCP INIT (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.

5.9.5 TK50 LEDs

The TK50 tape drive load/unload switch contains an internal red LED. There is a green LED to the left of the load/unload switch. The red light indicates handle and fault conditions. The green light indicates tape and power conditions.

Under normal operating conditions, the red LED indicates the following states:

- Red LED on always means that the handle may not be raised.
  - Lights for two seconds during power-up self test.
  - Remains on during operation of a tape.
  - Remains on during unloading of a tape.

- Red LED off means that it is all right to lift the handle and insert or remove a tape cartridge.
- Red LED blinking means the tape is loading or rewinding.
  - The handle can be raised slowly during the loading of a tape (10 to 15 seconds).
  - The handle can be raised slowly during the rewinding of a tape.
- Fast flashing always means there is a fault condition. The handle can not be raised.
  - Press and release the load/unload button four times.
  - If the problem persists, there is a hardware fault. Before any testing of the tape drive, stop the operation of the tape drive, remove the tape drive and manual rewind, unload and remove the tape.

Under normal operating conditions the green LED indicates the following states:

- Green LED on indicates one of the following:
  - Power is present. It is all right to lift the cartridge release handle (red LED off).
  - Tape is fully loaded (red LED on).
- Green LED blinking means the tape is in motion.
  - Slowly during read/write executions (red LED on).
  - Slowly during rewinding of a tape (red LED blinking).
  - Irregularly during calibration of a new tape (red LED off).

5.9.6 Additional TQK50 Cabinet Kits

Table 5-16 shows the specific enclosure and the TQK50 variations that include the M7546 Q-Bus controller module and cable. The controller accommodates the Tape Mass Storage Control Protocol (TMSCP) on the Q-Bus. One controller handles one TK50 tape drive.

Table 5-16 TQK50 Part Number and Description

Part Number	Description
TQK50-AA*	Controller, 30-inch cable and BA23 specific access door. Used with a BA23 enclosure.
TQK50-AB†	Controller and 14-inch cable with I/O panel insert. Used with a BA23 enclosure.
TQK50-BA*	Controller and 30-inch cable. Used with a BA123 enclosure.
TQK50-BB†	Controller and 21-inch cable with I/O panel insert. Used with a BA123 enclosure.
TQK50-CB†	Controller and 36-inch cable with I/O panel insert. Used in cabinet mount BA23 with H3490 I/O panel.
TQK50-PB†	Controller and 30-inch cable with I/O panel insert. Used in PDP-11/23-B (PLUS) with H349 I/O panel.
TQK50-RB*†	Controller and 120-inch cable with bracket to mount I/O panel insert on cabinet rails. Used in non-FCC compliant Q-Bus enclosures with no I/O panel. For field upgrade only.

* Supports a TK50 tape drive installed in the enclosure.

† Supports an external TK50 tape drive installed with the enclosure.

6 Q-Bus Communications and I/O Options

6.1 INTRODUCTION

This chapter describes the communication and Input/Output (I/O) options currently supported by the BA23-A and BA123-A enclosures.

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

> **NOTE**
> **Appendix A lists the current and bus loads for these options. Refer to Appendix H for external loopback connector information.**

6.1.1 Ordering Options

Option order numbers differ depending on whether an option is to be installed at the factory, or by a service representative 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, it is necessary to order a base module and the appropriate cabinet kit. For example:

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

6.1.2 Module Configuration

Each module in a system has a Control Status Register (CSR) address (sometimes called base or device address) and an interrupt vector, both of which must be set when you install the module. The CSR address and interrupt vector are either fixed or floating.

A fixed address (or vector) 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 the other modules in the system. The ranges are as follows:

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

Appendix A 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:

	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3 ← Add. Bit
Switch 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:

	V8	V7	V6	V5	V4	V3 ← Vector Bits
Switch 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.

6.2 DEQNA ETHERNET INTERFACE

Factory installed:	DEQNA-KP
Module number:	M7504 (three module LEDs)
Field upgrade:	DEQNA-M Base module CK-DEQNA-KA BA123-A Cabinet kit CK-DEQNA-KB BA23-A 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 / 1.74 miles). The DEQNA can transmit data at a rate of 1.2 Mbytes per second through coaxial cable.

The module should be the highest priority Direct Memory Access (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 6-1).

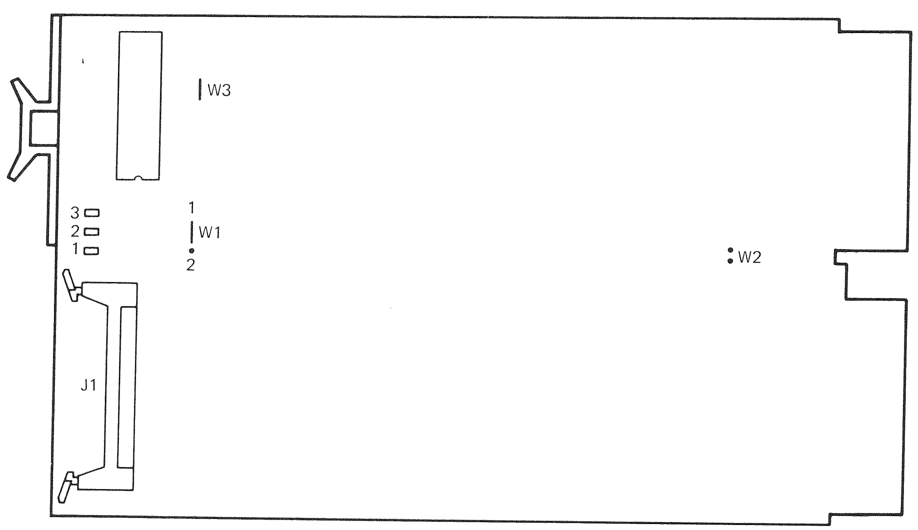

Figure 6-1 DEQNA Ethernet Module (M7504) Layout

Jumper 1 (W1) determines the CSR address assignment. Table 6-1 shows the DEQNA CSR addresses.

Table 6-1 DEQNA Ethernet CSR Addresses

Module No.	CSR Address
1	17774440
2	17774460

If you install two DEQNAs, move jumper W1 of the second DEQNA onto the left and center pins. These addresses are fixed.

The interrupt vector is written into a read/write register by software. No hardware configuration is required. Table 6-2 shows the DEQNA interrupt vectors.

Table 6-2 DEQNA Ethernet Interrupt Vectors

Module No.	Interrupt Vector
1	120
2	floating

Jumpers 2 and 3 are set at the factory and do not need to be changed.

Jumper W2 is normally removed. When removed it provides fair access to all DMA devices using the Q22-Bus by causing the DEQNA to wait 5 μsecs before re-requesting the bus. Jumper W3 is normally installed, it disables a sanity timer at initialization.

Figure 6-2 shows the internal cabling for the DEQNA module.

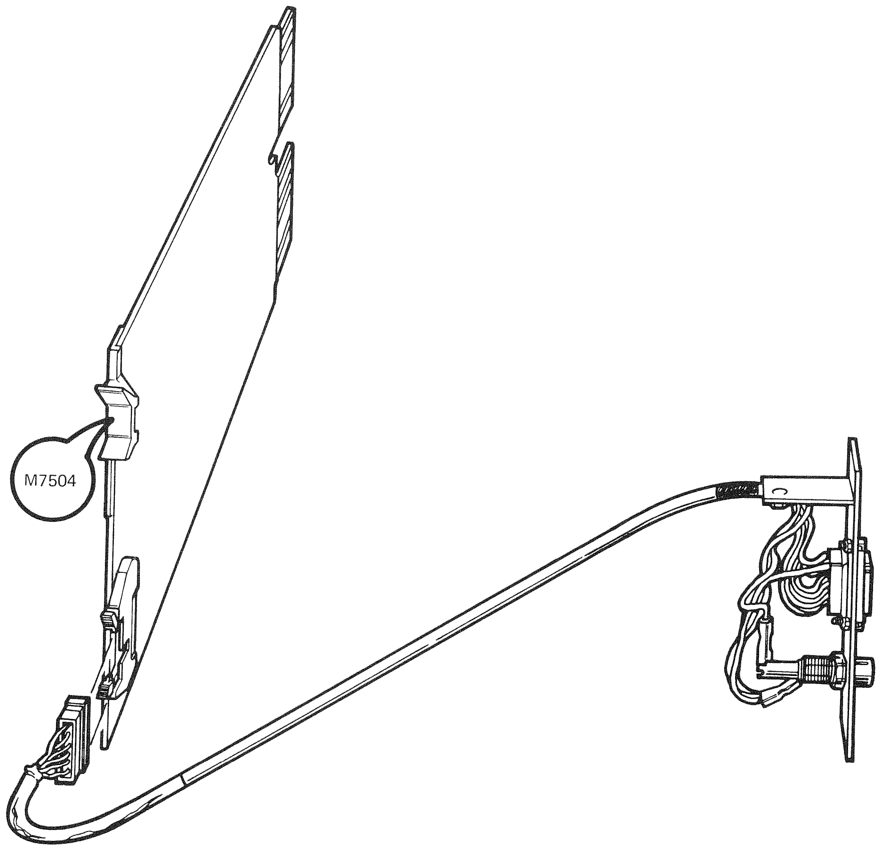

Figure 6-2 DEQNA Ethernet Internal Cabling

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

6.3 DHV11 ASYNCHRONOUS MULTIPLEXER

Factory installed:	DHV11-AP
Module number:	M3104 (one module LED)
Field upgrade:	DHV11-M Base module CK-DHV11-AA BA123-A Cabinet kit CK-DHV11-AB BA23-A Cabinet kit

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

The DHV11 (Figure 6-3) 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

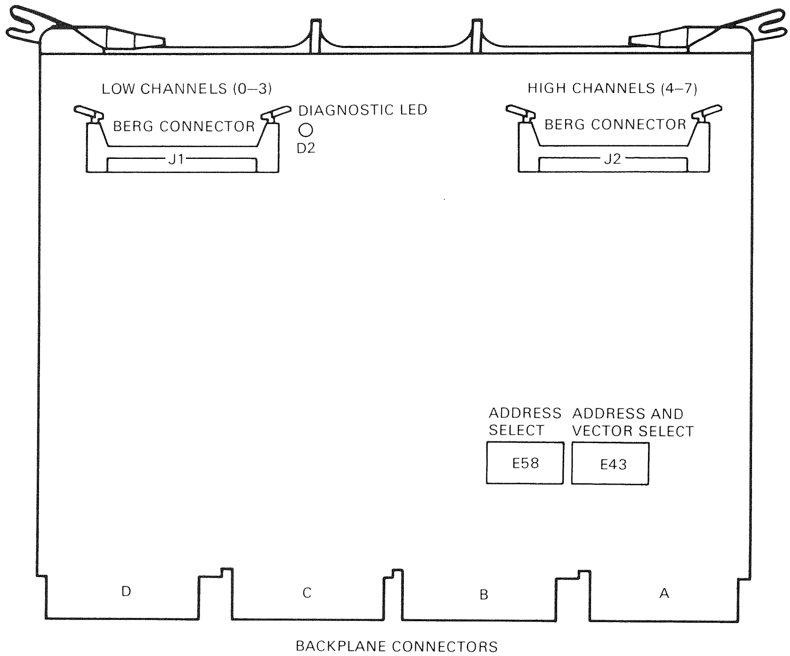

Figure 6-3 DHV11 Module (M3104) Layout

Set the CSR address and interrupt vector by using the two Dual In-line Package (DIP) switches, E58 and E43 (Figure 6-3). The CSR address and interrupt vector are floating. Tables 6-3 and 6-4 show the two settings.

Table 6-3 DHV11 CSR Address

CSR Address	A12 E58 1	A11 2	A10 3	A9 4	A8 5	A7 6	A6 7	A5 8	A4 E43 1	← Add. Bits ← 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 6-4 DHV11 Interrupt Vector

Vector Setting	V8 E43-3	V7 -4	V6 -5	V5 -6	V4 -7	V3 -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. Appendix A provides guidelines for setting the address and vector.

Figure 6-4 shows the DHV11 internal cabling setup.

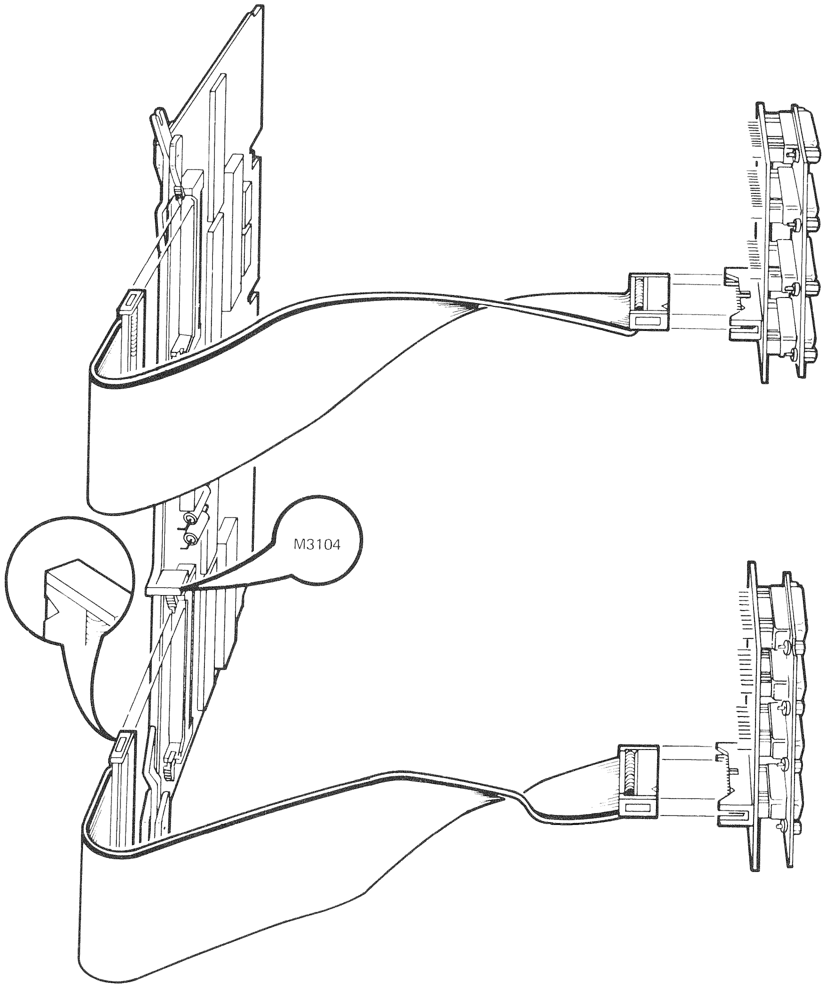

Figure 6-4 DHV11 Internal Cabling

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

6.4 DLVE1 ASYNCHRONOUS LINE INTERFACE

Factory installed:	DLVE1-DP
Module number:	M8017
Field upgrade:	DLVE1-M Base module CK-DLVE1-DB BA23-A 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 (where 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 6-5) 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.

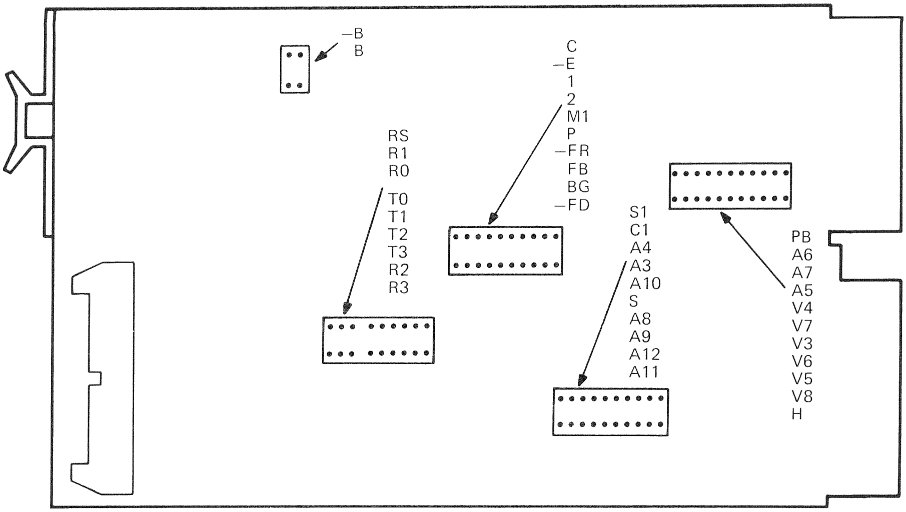

Figure 6-5 DLVE1 (M8017) Module Layout

Configure the module using the jumpers shown in Figure 6-5. The CSR addresses for two DLVE1 modules are fixed. Table 6-5 lists the settings. The interrupt vector is floating. Table 6-6 shows the factory setting of the interrupt vector.

Table 6-5 DLVE1 Fixed CSR Addresses

Module Number	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits (Jumpers)
1	17775610	1	1	0	1	1	1	0	0	0	1	(Factory*)
1	17776500	1	1	1	0	1	0	1	0	0	0	(1st option)
2	17776510	1	1	1	0	1	0	1	0	0	1	(2nd option)

1 = inserted
0 = removed

* The factory setting is for use with a modem.

Table 6-6 DLVE1 Interrupt Vector

Factory Setting	V8	V7	V6	V5	V4	V3	← Vector Bits (Jumpers)
300	0	1	1	0	0	0	

1 = inserted
0 = removed

> **NOTE**
> **The actual setting of the interrupt vector of the DLVE1 depends on the other modules in the system. Appendix A provides guidelines for determining the interrupt vector.**

Table 6-7 lists the factory setting of the other jumpers on the module.

Table 6-7 DLVE1 Jumper Factory Setting

Jumper Settings								
R0	I		BG	I		H	R
R1	R	(Note 1)	P	R		B	R
R2	I		E	R		-B	R
R3	I		1	R		FD	R
			2	R		RS	I
T0	I		PB	R	(Note 2)	FB	R
T1	R		C	I	(Note 4)	EF	R
T2	R	(Note 3)	C1	I	(Note 4)	MT	R
T3	R		S	R	(Note 5)	M	R
S1	R		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 6-8 for other settings.
2. Programmable baud rate is disabled.
3. Sets transmitter baud rate to 9,600 if split speed is used.
4. Common speed is enabled.
5. Split speed is disabled.

Table 6-8 lists the jumper settings required for other baud rates. Set transmit and receive jumpers separately when split speed is enabled.

Table 6-8 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	1,200
	R	I	I	I	1,800
	R	I	I	R	2,000
	R	I	R	I	2,400
	R	I	R	R	3,600
	R	R	I	I	4,800
	R	R	I	R	7,200
	R	R	R	I	9,600

Figure 6-6 shows the internal cabling.

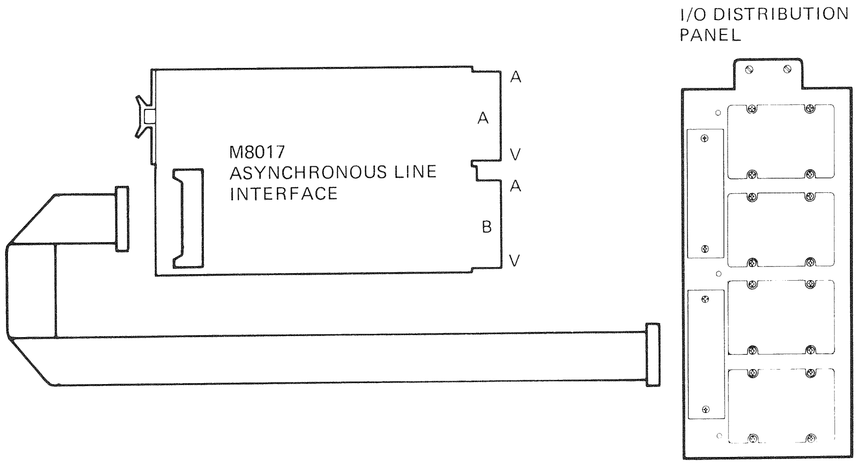

Figure 6-6 DLVE1 Internal Cabling

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

6.5 DLVJ1 ASYNCHRONOUS INTERFACE

Factory installed:	DLVJ1-LP
Module number:	M8043
Field upgrade:	DLVJ1-M Base module CK-DLV11-LA BA123-A Cabinet kit CK-DLV11-LB BA23-A 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. The factory configuration sets CH-3 as the console Serial Line Unit (SLU).

Configure the DLVJ1 module by using the wire-wrap pins shown in Figure 6-7. The CSR addresses for two DLVJ1 modules are fixed. Table 6-9 lists the factory setting for the CSR addresses of the fist channel (CH-0). The CSR address of the other channels is 10 (octal) greater. For example, if CH-0 is set at 17776500, the CH-1 CSR address is 17776510 and CH-2 is 17776520. However, when CH-3 is configured as the console device, its address is fixed at 17777560, regardless of the setting of the other channels.

Table 6-9 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

* C1 and C2 are wire-wrapped on pins 1 and x. This sets the CH-3 CSR address to 17777650. To configure CH-3 as a non-console device, wire-wrap C1 and C2 on pins 0 and x.

The interrupt vector is floating. The factory configuration is shown in Table 6-10.

Table 6-10 DLVJ1 Interrupt Vector

Settings	V8	V7	V6	V5	V4	V3	← Vector Bits
300	–	x-h	x-h	0-x	–	–	(factory*)
340	–	x-h	x-h	1-x	–	–	

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

NOTE
The actual interrupt vector depends on the other modules in the system. Appendix A provides guidelines for determining the interrupt vector.

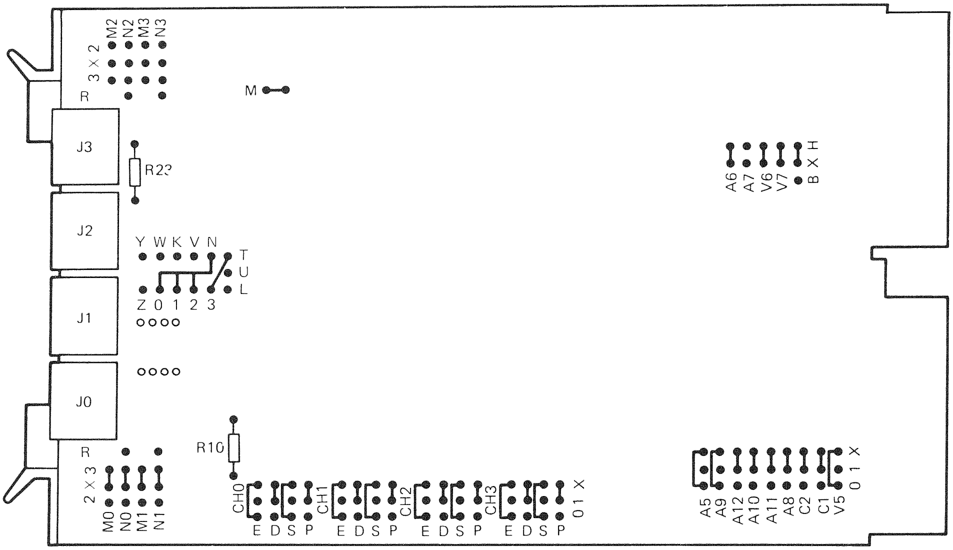

Figure 6-7 DLVJ1 Module (M8043) Layout

Figure 6-8 shows the internal cabling.

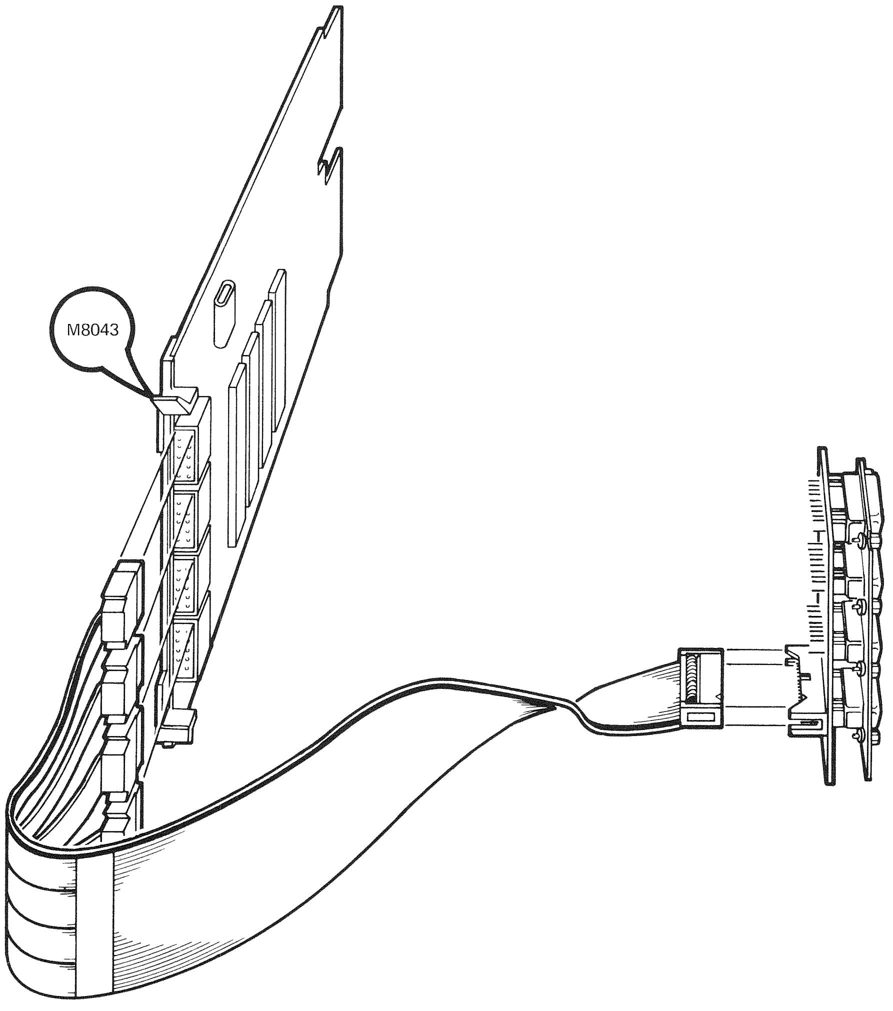

Figure 6-8 DLVJ1 Internal Cabling

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

6.6 DMV11 SYNCHRONOUS CONTROLLER

Factory installed:	DMV11-M
Module numbers:	M8053 and M8064
Field upgrade:	DMV11-M Base module CK-DMV11-XA BA123-A Cabinet kit. See Table 6-11 for possible designations of X. CK-DMV11-XB BA23-A Cabinet kit. See Table 6-11 for possible designations of X.

The DMV11 is a quad-height module (M8064 or M8053) 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 6-11 lists the four system options and their corresponding upgrade components. Table 6-12 lists the interface for each system option, and the appropriate external cable.

Table 6-11 DMV11 Versions

System Option	Model Number	Upgrade (Base Module + Cabinet Kit) BA123	BA23	Connector	I/O Panel Insert Type
DMV11-AP	M8053	DMV11-M + CK-DMV11-AB	-AB	J2 (of 2)	B
DMV11-BP	M8053	DMV11-M + CK-DMV11-BA	-BB	J1 (of 2)	A
DMV11-CP	M8064	DMV11-M + CK-DMV11-CA	-CB	J11 (of 2)	B
DMV11-FP	M8053	DMV11-M + CK-DMV11-FA	-FB	J1 (of 2)	B

Table 6-12 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, -BB cabinet kit.

Configure the CSR address and interrupt vector of the DMV11 by using the switches shown in Figure 6-9. The CSR address and interrupt vector are both floating. Tables 6-13 and 6-14 show the factory setting.

Table 6-13 DMV11 CSR Address

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

1 = on = closed
0 = off = open

Table 6-14 DMV11 Interrupt Vector

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

1 = on = closed
0 = off = open

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

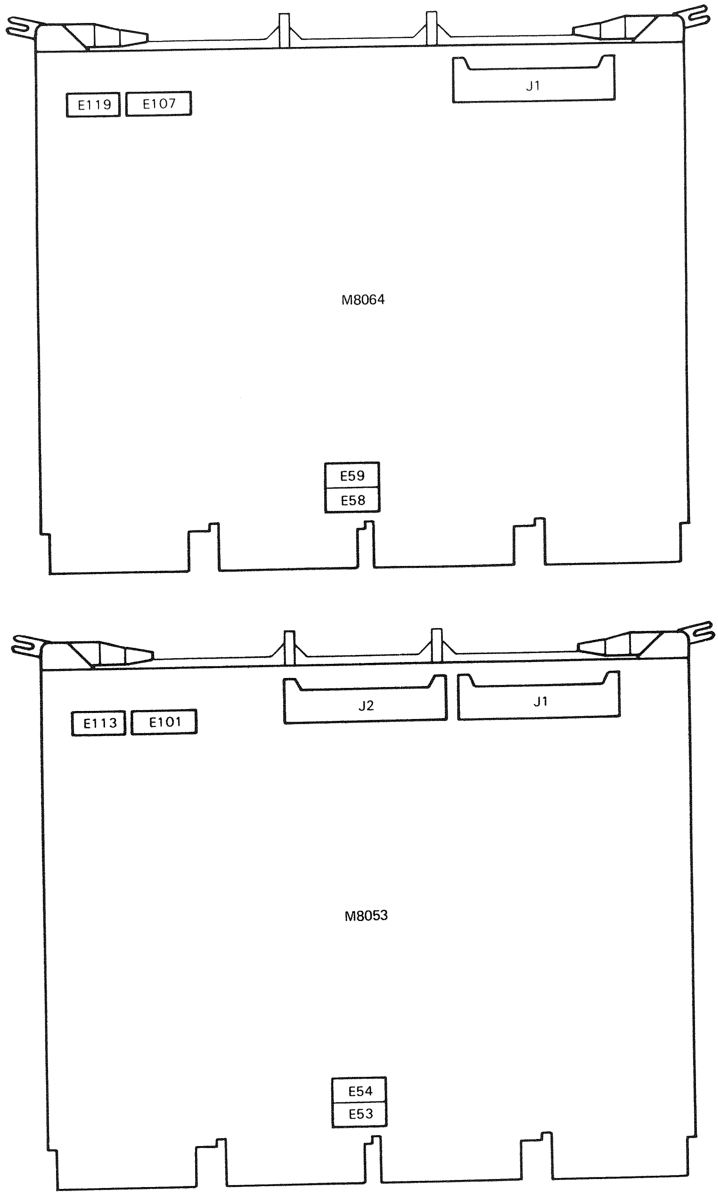

Figure 6-9 DMV11 Module (M8064 and M8053) Layouts

Another DIP switch on the DMV11 controls selectable features. Table 6-14A shows the function of this switch, and a common setting.

Table 6-14A DMV11 Switch Selectable Settings

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

On = zero = function disabled
* Unused on M8064.

Switch 10 should be off for EIA interface, on for V.35. Switch 9 must be off for integral modem (M8064) or when running above 19.2 K baud. Switches 8, 7, and 6 set the mode of operation when switch 1 is off. Switch 5 off enables remote load detect. Switch 4 off enables power on boot. Switch 3 off enables auto answer. Switch 2 determines unit number for booting (on for first DMV11, off for second DMV11). Switch 1 off enables switches 8, 7, and 6 to determine mode of operation. Switch 1 on means mode of operation determined by software.

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

Figure 6-10 shows the internal cabling set up 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).

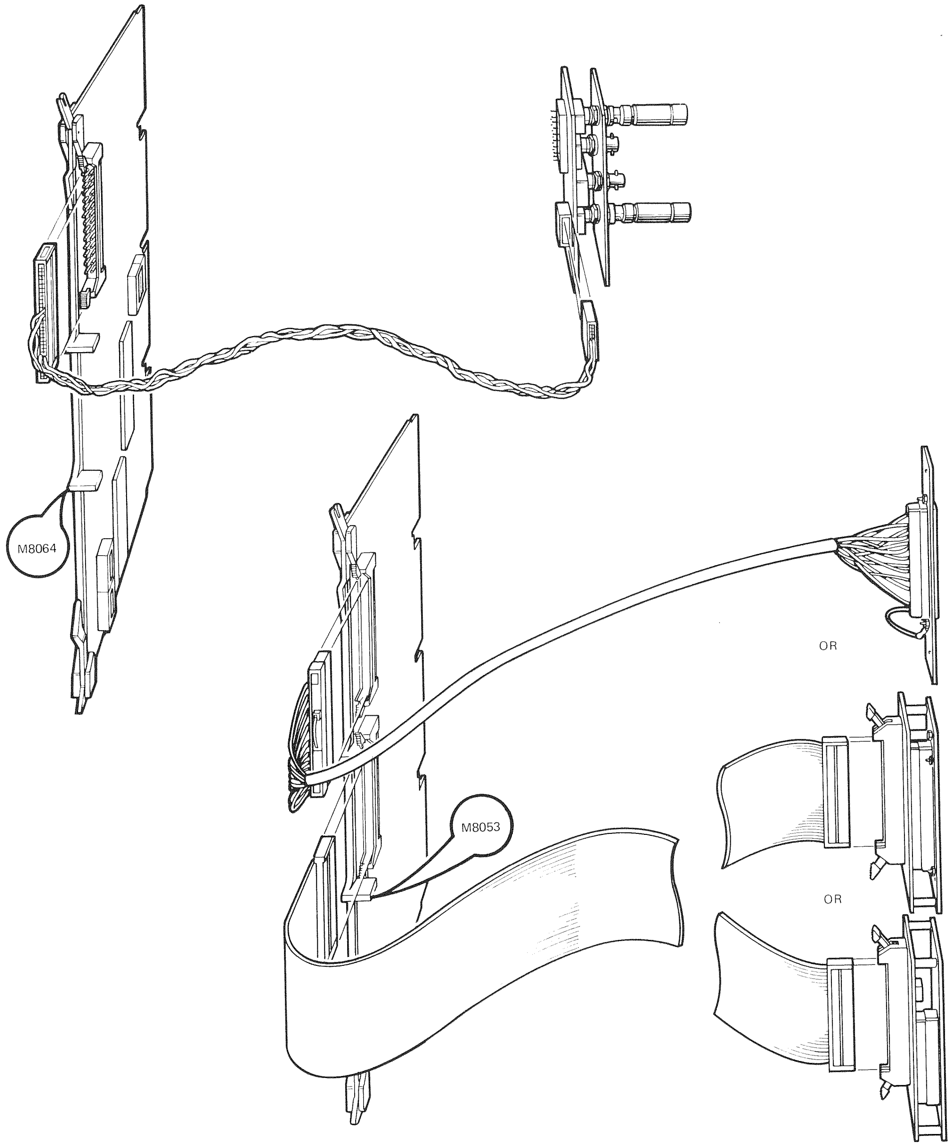

Figure 6-10 DMV11 Internal Cabling

6.7 DPV11 SYNCHRONOUS INTERFACE

Factory installed:	DPV11-AP
Module number:	M8020
Field upgrade:	DPV11-M Base module CK-DPV11-AA BA123-A Cabinet kit CK-DPV11-AB BA23-A Cabinet kit

The cabinet kit includes a type A filter connector and a cable that connects it to 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 DDCMP, or 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 6-11.

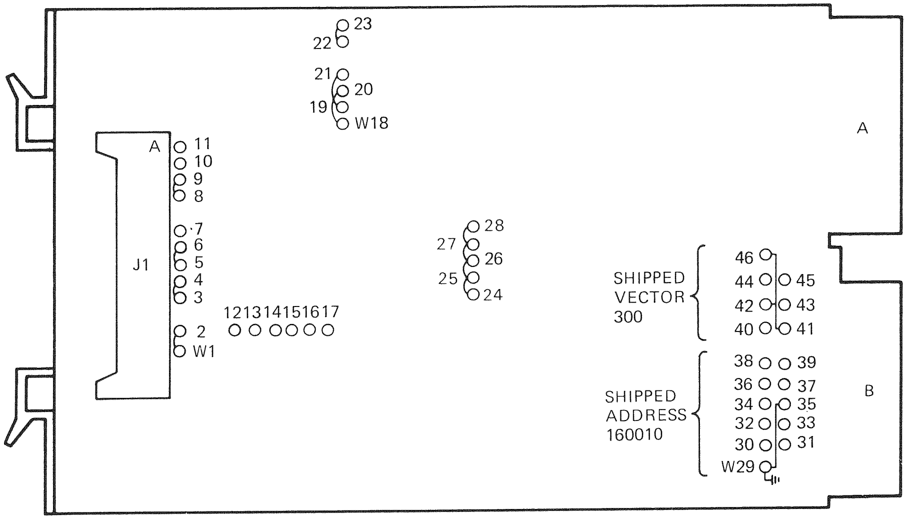

Figure 6-11 DPV11 Module (M8020) Layout

The CSR address and interrupt vector are both floating. Tables 6-15 and 6-16 show the factory setting.

Table 6-15 DPV11 CSR Address

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

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

Table 6-16 DPV11 Interrupt Vector

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

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

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

Figure 6-12 shows the internal cabling.

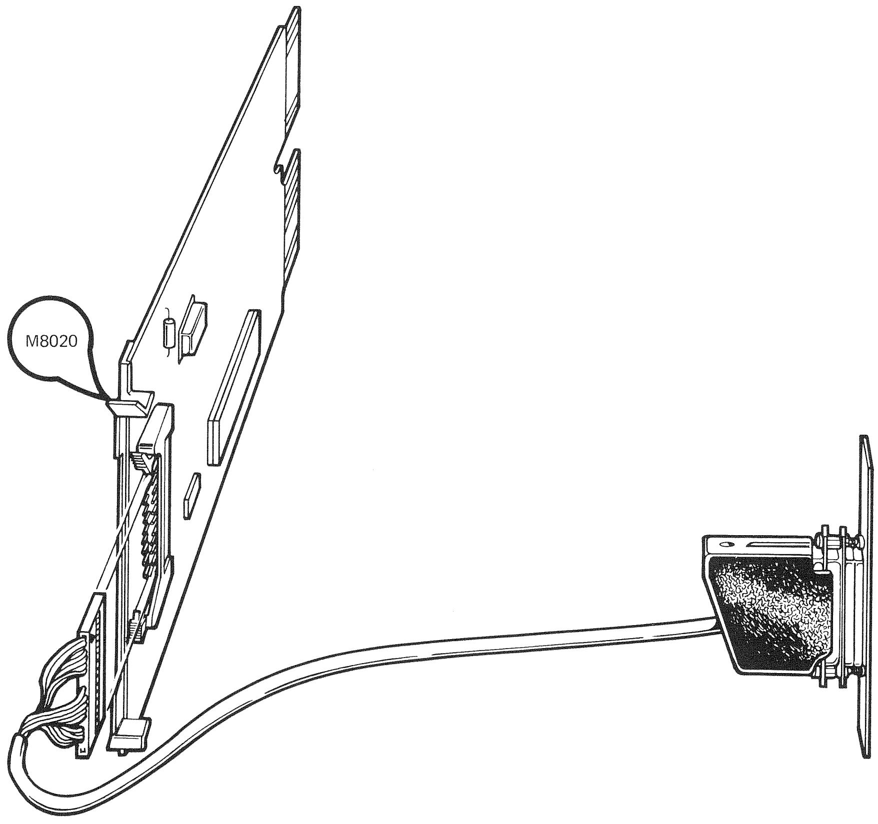

Figure 6-12 DPV11 Internal Cabling

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

6.8 DRV11 PARALLEL-LINE INTERFACE

Factory installed:	DRV11-LP
Module number:	M7941
Field upgrade:	DRV11 Base module CK-DRV1B-KB BA23-A Cabinet kit

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

The DRV11 (Figure 6-13) is a dual-height module that provides 16 I/O lines, corresponding to the 16 data lines of the Q22-Bus.

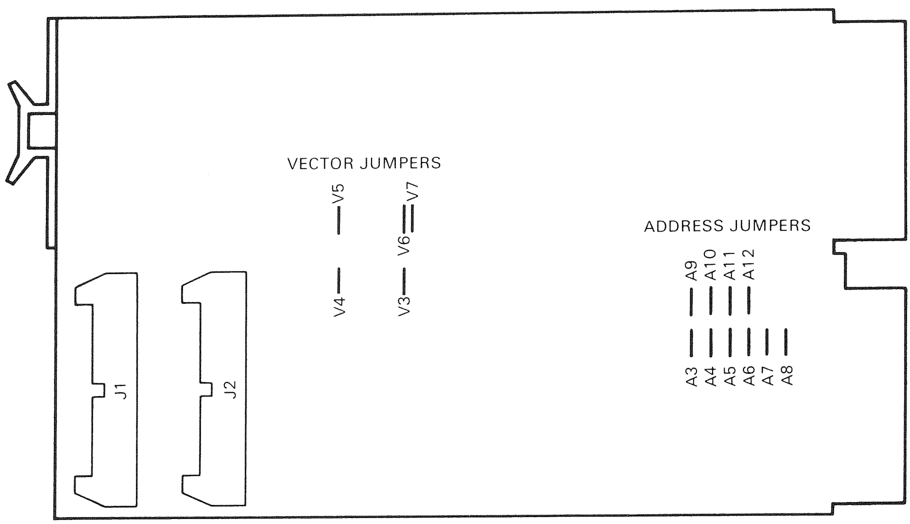

Figure 6-13 DRV11 Module (M7941) Layout

The CSR addresses of two DRV11 modules are fixed and are set using jumpers A12 to A3 (Figure 6-13). Table 6-17 lists the factory jumper configuration.

Table 6-17 DRV11 CSR Address

Module Number	Starting Address	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits (Jumpers)
1	17767770	0	1	1	1	1	1	1	1	1	1	← factory
2	17767760	0	1	1	1	1	1	1	1	1	0	

0 = inserted = 0
1 = removed = 1

The interrupt vector is floating. Table 6-18 shows the factory configuration.

Table 6-18 DRV11 Interrupt Vector

Factory Setting	V8	V7	V6	V5	V4	V3	← Vector Bits (Jumpers)
300	0	1	1	0	0	0	

0 = inserted = 0
1 = removed = 1

> **NOTE**
> **The actual setting depends on the other modules in the system. Appendix A provides guidelines for setting the interrupt vector.**

Figure 6-14 shows the internal cabling layout.

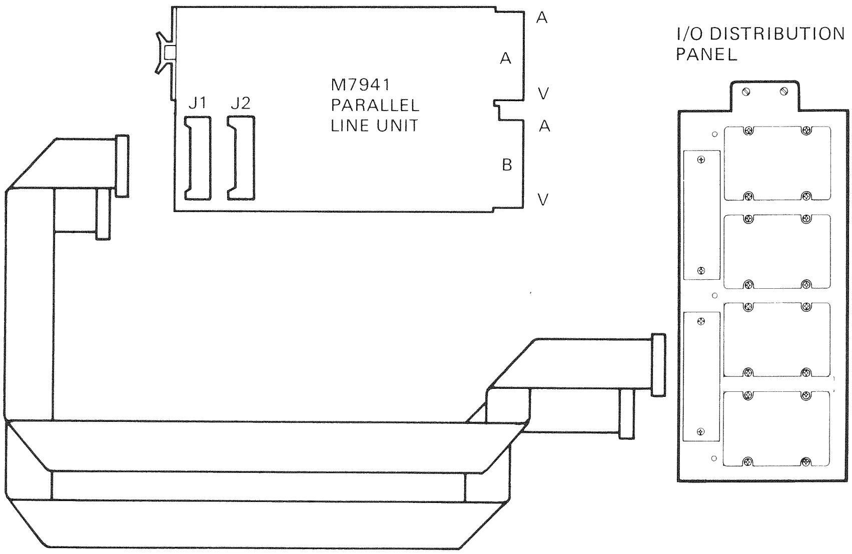

Figure 6-14 DRV11 Internal Cabling

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

6.9 DRV11-B DMA INTERFACE

Factory installed:	DRV11-BP
Module number:	M7950
Field upgrade:	DRV11-B Base module CK-DRV1B-KB BA23-A 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.

The DRV11-B is not supported on MicroPDP-11/73 or MicroPDP-11/83 systems.

Configure the DRV11-B CRS address and interrupt vector using the DIP switches S2 and S1, respectively (Figure 6-15).

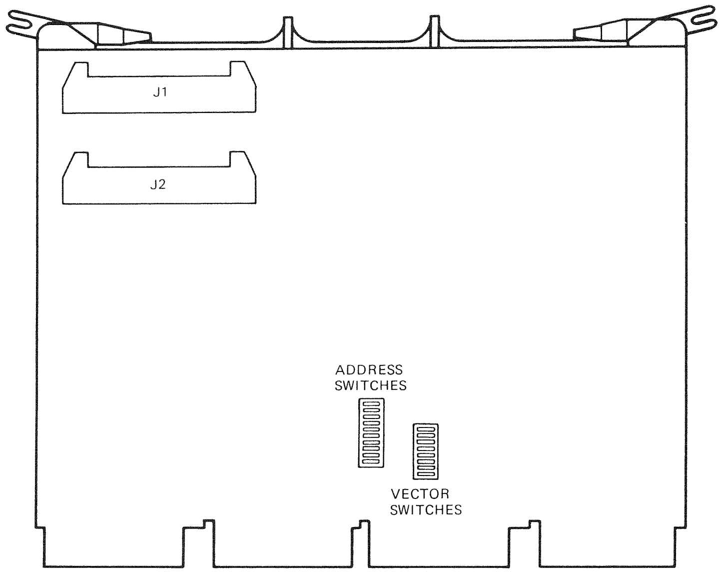

Figure 6-15 DRV11-B Module (M7950) Layout

The CSR addresses of two DRV11-B modules are fixed. Table 6-19 lists the settings.

Table 6-19 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. Appendix A provides guidelines for setting the floating vector. Table 6-20 lists the interrupt vector settings.

Table 6-20 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

S11–must be open.

Figure 6-16 shows the internal cabling.

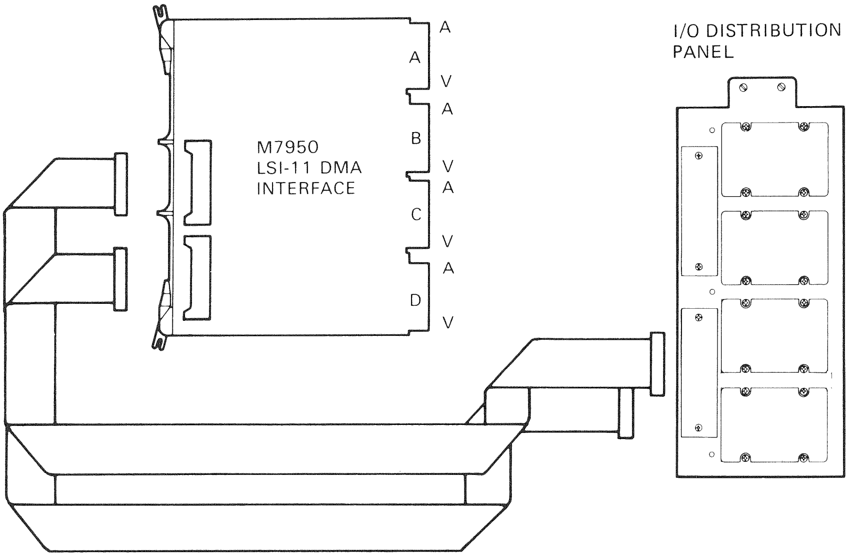

Figure 6-16 DRV11-B Internal Cabling

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

6.10 DRV11-J HIGH-DENSITY, PARALLEL INTERFACE

Factory installed:	DRV11-JP
Module number:	M8049 (one module LED)
Field upgrade:	DRV11-J Base module CK-DRV1J-KA BA123-A Cabinet kit CK-DRV1J-KB BA23-A Cabinet kit

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

The DRV11-J (Figure 6-17) 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.

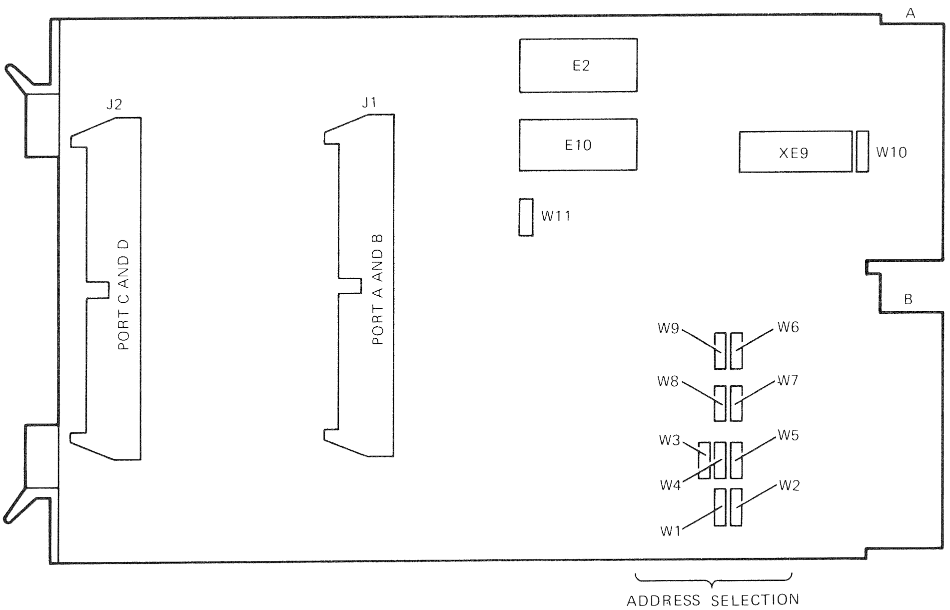

Figure 6-17 DRV11-J Module (M8049) Layout

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 6-21 lists the factory configuration for the CSR address.

Table 6-21 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	0	1	0	0	0	0	1	1	1	
2	17764140	0	1	0	0	0	0	1	1	0	

1 = installed
0 = removed

Figure 6-18 shows the internal cabling layout for this module.

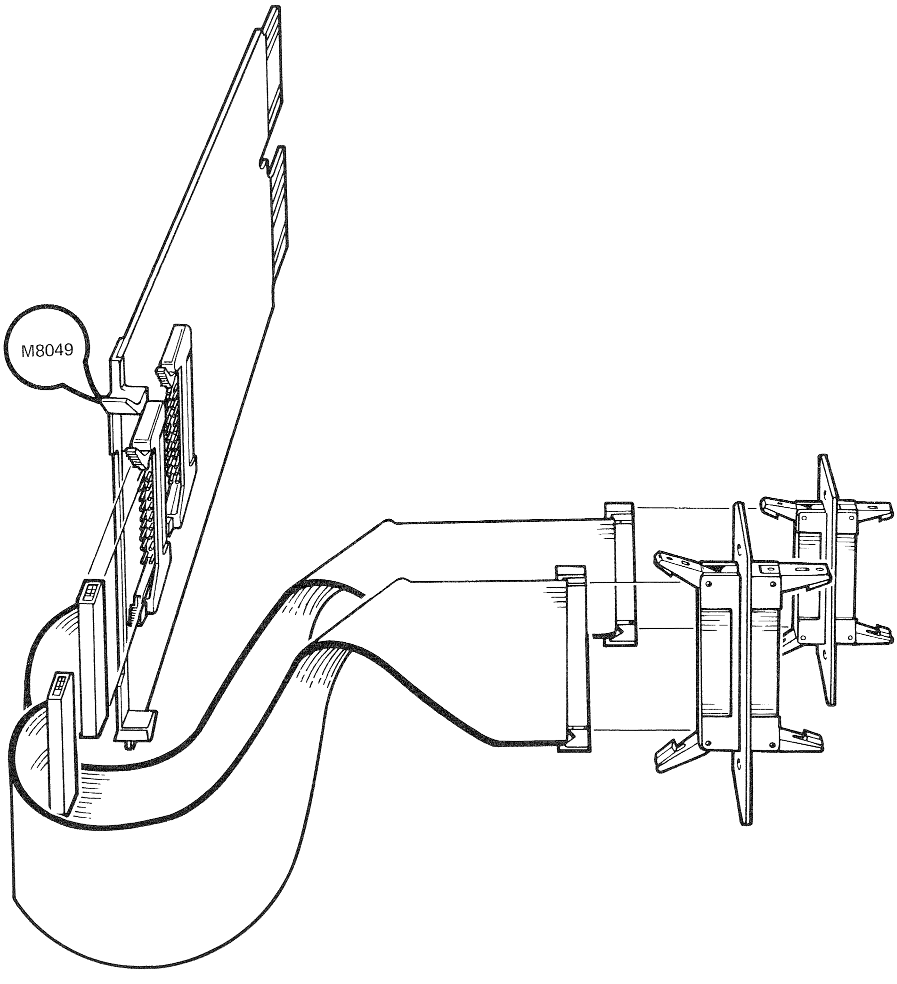

Figure 6-18 DRV11-J Internal Cabling

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

6.11 DUV11 SYNCHRONOUS SERIAL-LINE INTERFACE

Factory installed:	DUV11-AP
Module number:	M7951
Field upgrade:	DUV11-M Base module CK-DUV11-AB BA23-A Cabinet kit

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

The DUV11 (Figure 6-19) is a quad-height module used to connect any Q-Bus CPU to a Bell 201 synchronous modem or equivalent.

It has the following features:

- Designed for applications using character-oriented protocols.
- Controls a modem for half- or full-duplex operation.
- Transmits data at rates up to 9,600 baud per second.
- Interfaces synchronous and asynchronous communications data.

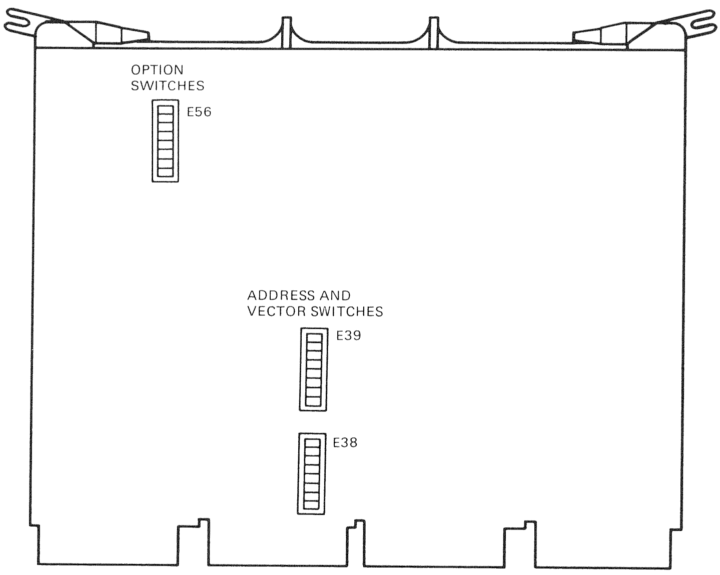

Figure 6-19 DUV11 Module (M7951) Layout

The CSR address and interrupt vector of the DUV11 are both floating, and are configured using DIP switches E38 and E39 (Figure 6-19). Tables 6-22 and 6-23 list the factory settings.

Table 6-22 DUV11 CSR Address

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

1 = switch on
0 = switch off

Table 6-23 DUV11 Interrupt Vector

Factory Setting	V8 E39 3	V7 4	V6 5	V5 6	V4 7	V3 8	← Vector Bits / ← Switches
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. Appendix A provides guidelines for setting the CSR address and interrupt vector.

Figure 6-20 shows the internal cabling layout for the module.

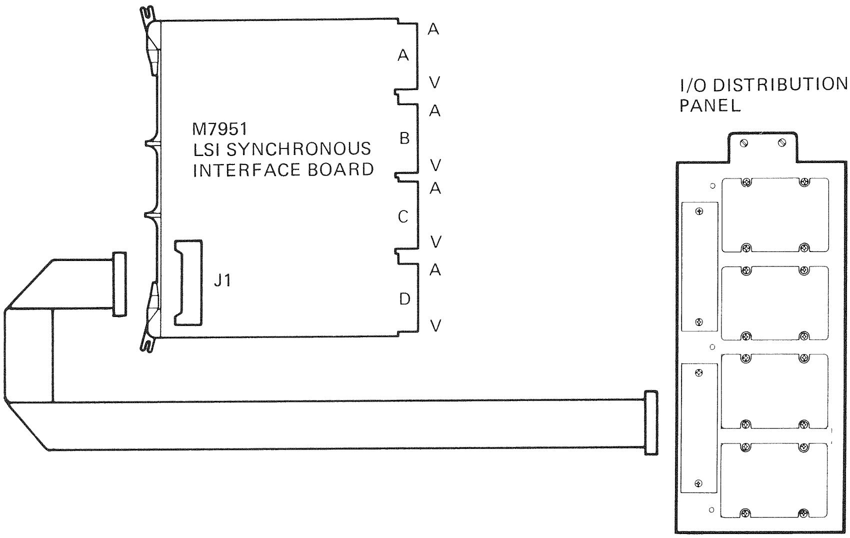

Figure 6-20 DUV11 Internal Cabling

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

6.12 DZQ11 ASYNCHRONOUS MULTIPLEXER – (FOUR LINES)

Factory installed:	DZQ11-M
Model number:	M3106
Upgrade:	DZQ11-M Base module CK-DZQ11-DA BA123-A Cabinet kit CK-DZQ11-DB BA23-A Cabinet kit

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

The DZQ11 (Figure 6-21) 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 RS-423-A interface standards.
- Permits dial-up (auto-answer) operation with modems using full-duplex operations such as Bell models 103, 113, 212 or the equivalent.

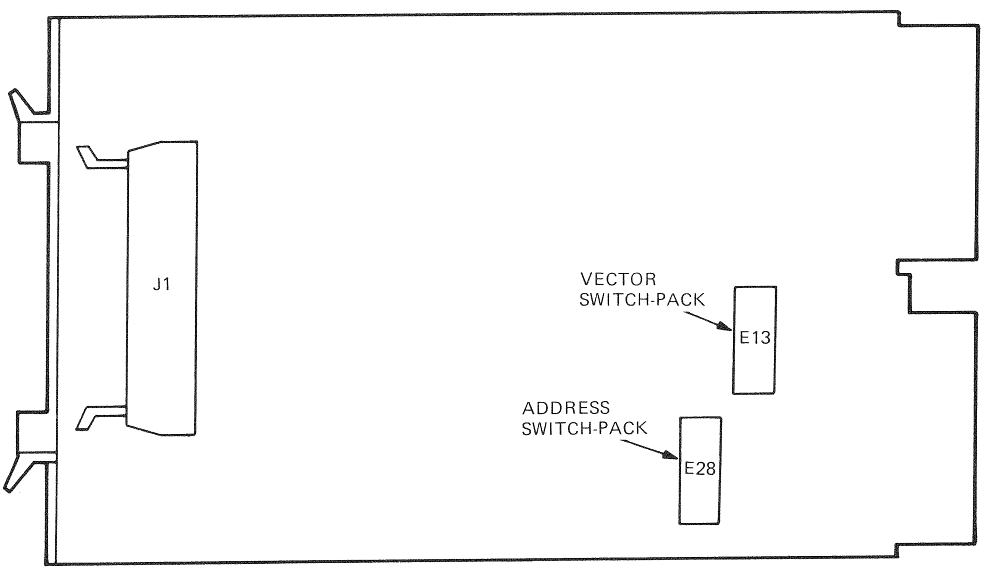

Figure 6-21 DZQ11 (M3106) Module Layout

Configure the DZQ11 using the two DIP switches E28 and E13. The CSR address and interrupt vector of the DZQ11 are both floating. Tables 6-24 and 6-25 show the factory and common settings.

Table 6-24 DZQ11 CSR Address

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

0 = switch on
1 = switch off

Table 6-25 DZQ11 Interrupt Vector

	V8	V7	V6	V5	V4	V3	← Vector Bits
Vector Setting	**E13 1**	**2**	**3**	**4**	**5**	**6**	**← Switches**
300	0	1	1	0	0	0	(factory)
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 switches 9 and 10 must be off for normal operation.

Figure 6-22 shows the internal cabling for the DZQ11.

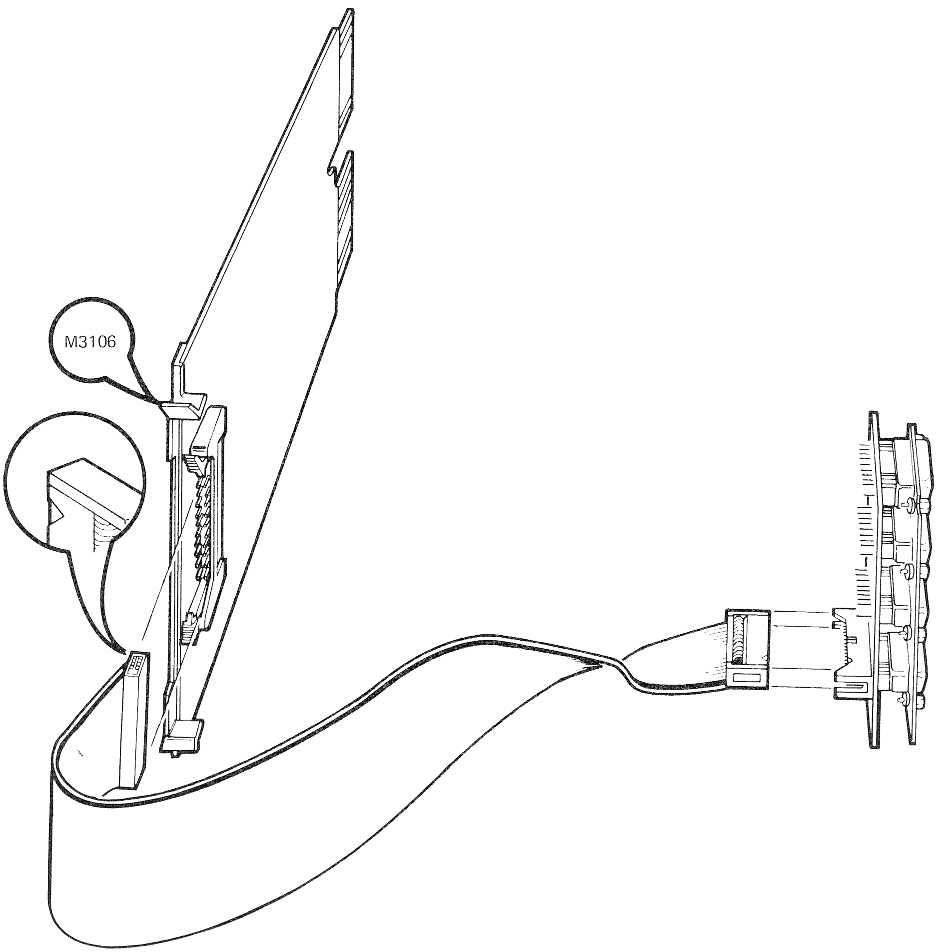

Figure 6-22 DZQ11 (M3106) Internal Cabling

6.13 DZV11 ASYNCHRONOUS MULTIPLEXER

Factory installed:	DZV11-DP
Model number:	M7957
Upgrade:	DZV11-M Base module CK-DZV11-DA BA123-A Cabinet kit CK-DZV11-DB BA23-A Cabinet kit

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

The DZV11 (Figure 6-23) 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.

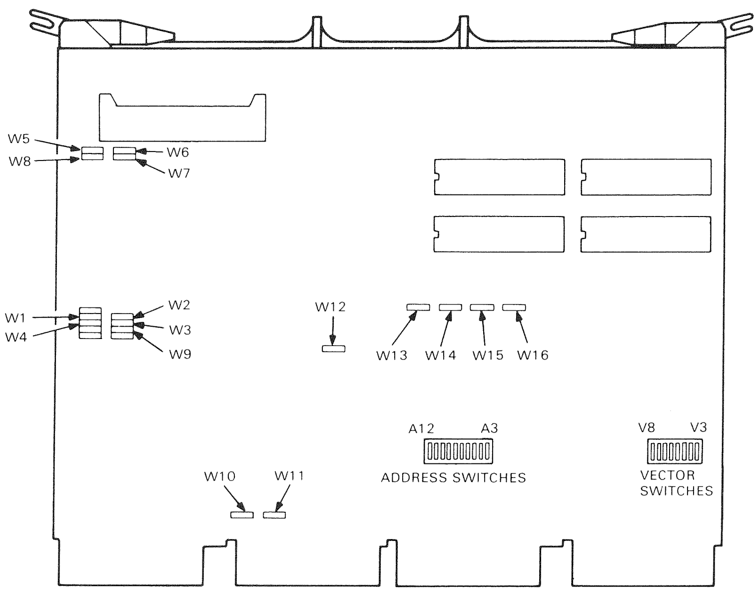

Figure 6-23 DZV11 Module (M7957) Layout

Configure the DZV11 using 16 jumpers and 2 DIP switches. The CSR address and interrupt vector of the DZV11 are both floating. Tables 6-26 and 6-27 list the factory settings.

Table 6-26 DZV11 CSR Address

	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	← Add. Bits
CSR	E30										
Address	1	2	3	4	5	6	7	8	9	10	← 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 6-27 DZV11 Interrupt Vector

	V8	V7	V6	V5	V4	V3	← Vector Bits
Vector	E2						
Setting	1	2	3	4	5	6	← 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. Appendix A provides guidelines for setting floating CSR addresses and interrupt vectors.

Figure 6-24 shows the internal cabling layout for the module.

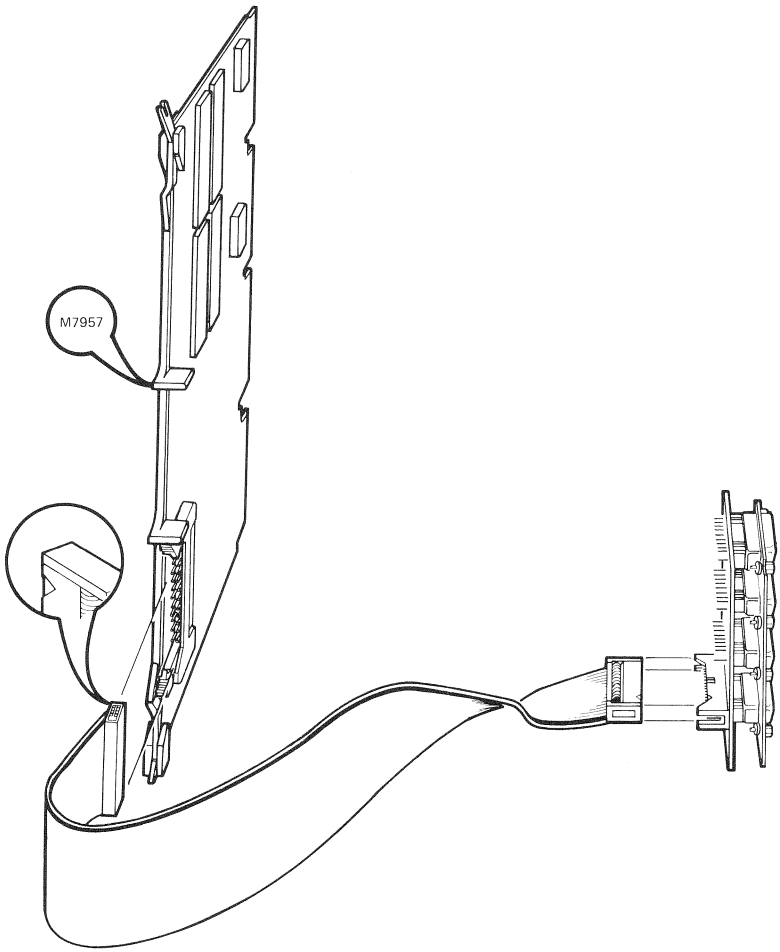

Figure 6-24 DZV11 Internal Cabling

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

6.14 LPV11 INTERFACE MODULE

Factory installed:	LPV11-AP (includes LP25 line printer) LPV11-BP LPV11-EP (includes LP26 line printer) 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 BA23-A cabinet kit, includes a type A filter connector and internal cable.
	CK-LPV1A-KB BA123-A cabinet kit, includes a type A filter connector and internal cable.

The LPV11 is a dual-height module that controls the flow of data between the Q22-Bus and a line printer. It is configured using jumpers (Figure 6-25).

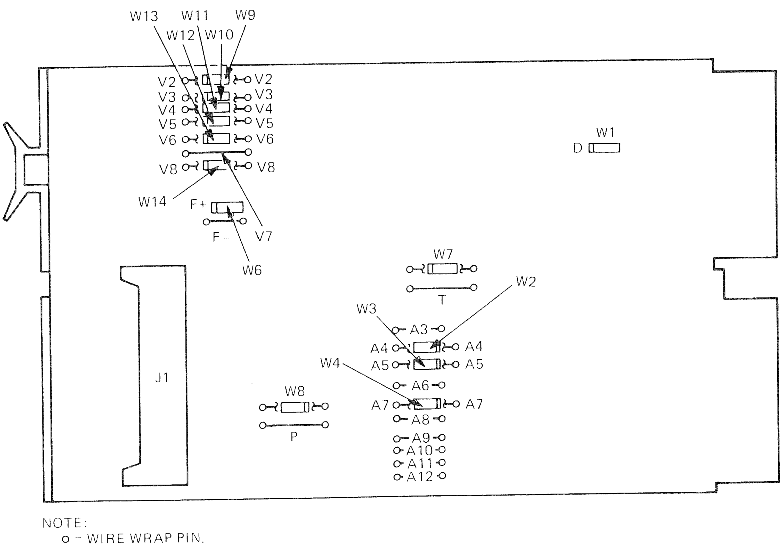

Figure 6-25 LPV11 Module (M8027) Layout

The CSR address and interrupt are both fixed. Tables 6-28 and 6-29 list the factory configuration. Figure 6-26 shows the internal cabling set-up.

Table 6-28 LPV11 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	← (Jumpers)
17777514	1	1	1	1	1	0	1	0	0	1	

0 = installed
1 = removed

Table 6-29 LPV11 Interrupt Vector

Factory	V8	V7	V6	V5	V4	V3	V2	← Vector Bits
Setting	W14	V7	W13	W12	W11	W10	W9	← Jumper
200	I	R	I	I	I	I	I	

I = installed = 0
R = removed = 1

Table 6-30 lists the factory setting of the other jumpers on the module.

Table 6-30 LPV11 Jumper Configuration

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

R = removed
I = installed

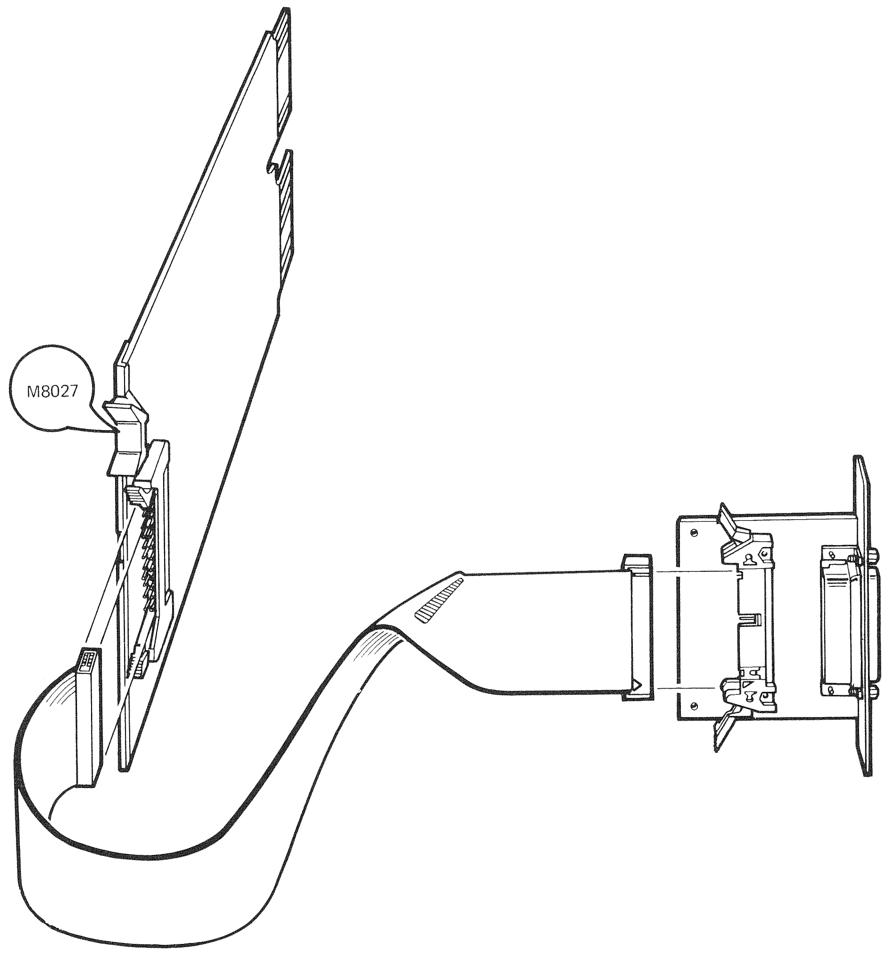

Figure 6-26 LPV11 Internal Cabling

7.1 INTRODUCTION

The BA23-A enclosure (Figure 7-1) supports 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, KDJ11-B Systems, discusses the contents of typical MicroPDP-11/73 and MicroPDP-11/83 systems. Chapter 3, KDF11-B Systems, discusses the contents of a typical MicroPDP-11/23 systems.

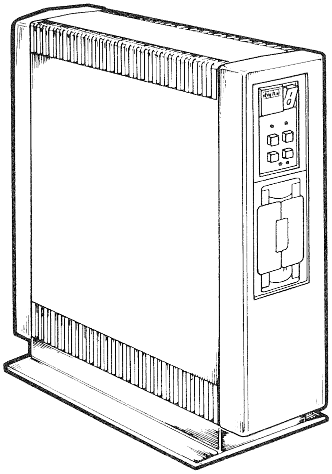

Figure 7-1 A Floor-standing BA23-A Enclosure

7.2 BA23-A FRAME

The BA23-A frame houses the power supply and the backplane assembly. It also provides space for two 13.3-cm (5.25-inch) mass storage devices (Figure 7-2).

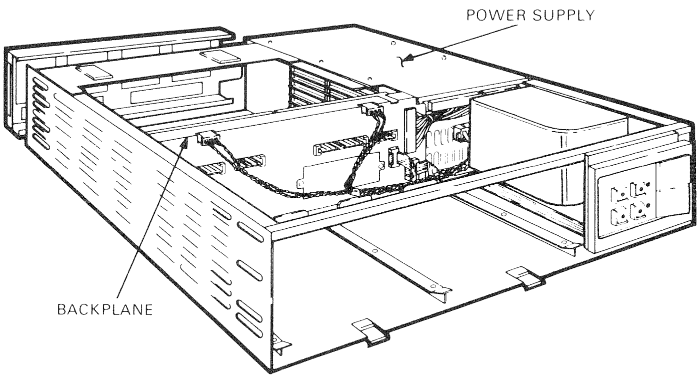

Figure 7-2 BA23-A Frame

The BA23-A frame mounts in a rack or in a floor-stand. The floor-stand model can convert to desktop use. Table 7-1 shows the dimension and weight of the various configurations.

Table 7-1 BA23 Enclosure Specifications

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

7.2.1 BA23-A Bezels

A removable bezel covers the front of the BA23-A frame. The floor-stand and desktop models also have a removable rear bezel (Figure 7-3).

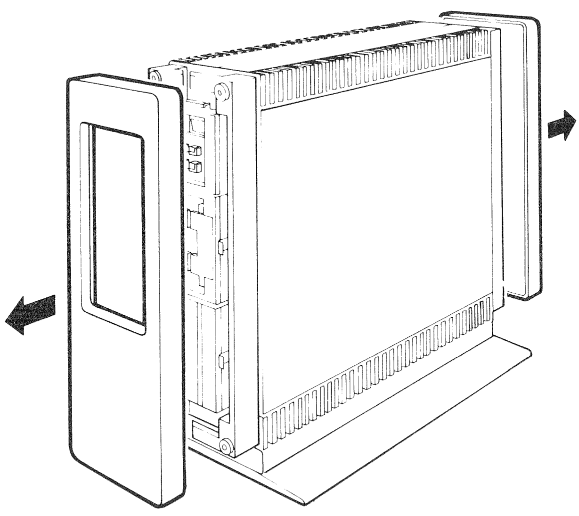

Figure 7-3 BA23-A Removable Bezels

7.2.2 Air Circulation

The BA23-A frame contains two fans:

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

These draw air from the bottom of the enclosure (Figure 7-4).

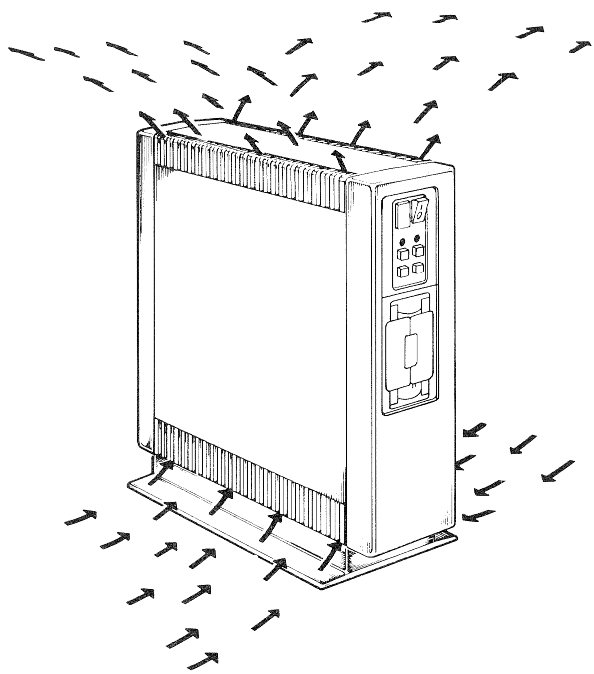

Figure 7-4 Air Flow

7.3 FRONT CONTROL PANEL

The front control panel of the enclosure contains the system controls and indicators (Figure 7-5). Table 7-2 describes their functions.

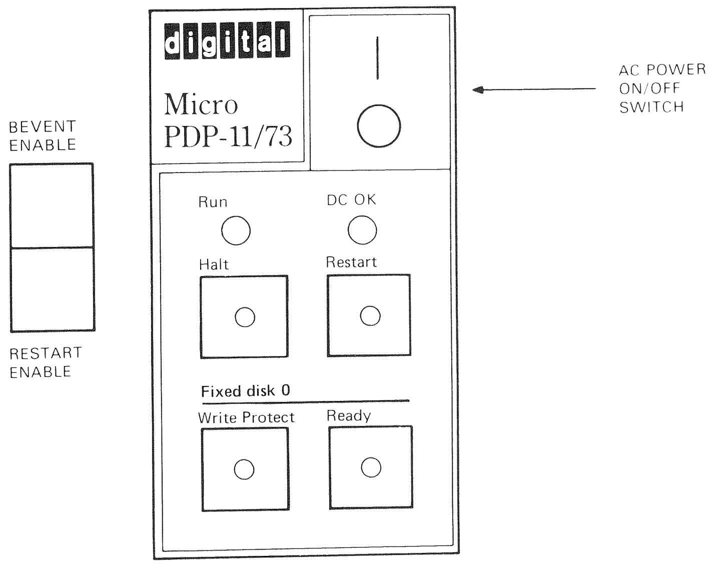

Figure 7-5 BA23-A Front Control Panel

Table 7-2 Front Control Panel Controls and Indicators

Control/ Indicator	Position/ Condition	Description
I/O	1/Lit	Rocker switch with integral red indicator. Lights red when system ac power is on.
	0/Unlit	System ac power is off.
DC OK	Lit	Green LED. Lights when all dc voltages are present and within tolerance.
	Unlit	The Q22-Bus BDCOK (dc bus power is OK) signal is negated.

Table 7-2 Front Control Panel Controls and Indicators (Cont.)

Control/ Indicator	Position/ Condition	Description
Run	Lit	Green LED. Lights when the CPU is executing in run mode.
	Unlit	The CPU is in console mode.
Halt	Out/Unlit	Push-on/push-off button with integral red LED. Normal position for running user software.
	In/Lit	Red LED. Stops normal software operation. Puts the CPU in console mode and the system accepts only console commands (see Chapter 2, KDJ11-B 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* restarting 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. Normal operation. Enables disk reads and writes.
	In/Lit	Prevents fixed-disk read and write operations.

7.3.1 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.

7.3.2 LTC DIP Switch Unit

The LTC Dual In-line Package (DIP) switch unit has two switches labeled 1 and 2 (Figure 7-6). 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.

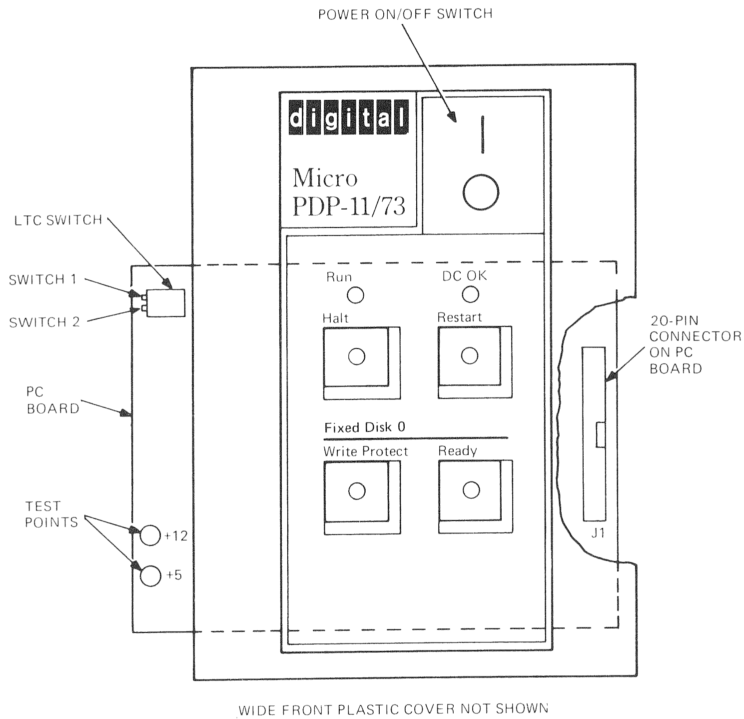

Figure 7-6 Control Panel with PC Board

Setting switch 2 (Restart/Enable) to on allows the front control panel Restart switch to function as described in Table 7-2. Setting the Restart/Enable switch to off disables the front control panel Restart switch.

7.4 MASS STORAGE

The front bezel covers two slots used for mounting standard 13.3-cm (5.25-inch) 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.**

7.5 BACKPLANE ASSEMBLY

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

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

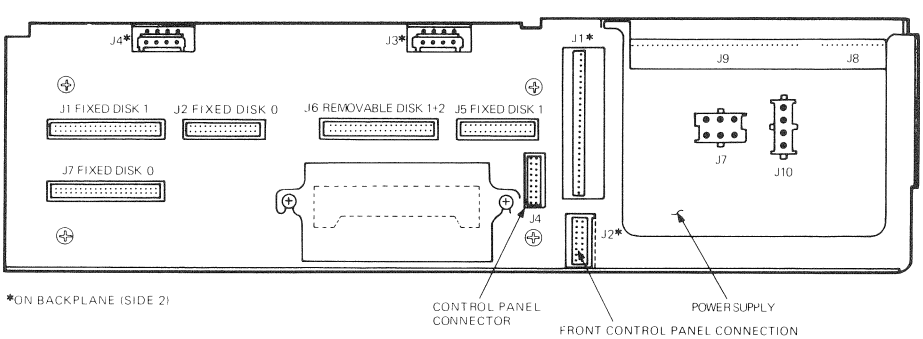

Figure 7-7 Signal Distribution Panel

7.5.1 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 7-8 shows the internal cabling setup for the BA23-A 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 and 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 also the first fixed-disk drive to be booted. The ROM code usually labels this fixed-disk drive 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 fixed-disk drive would be the second fixed-disk drive to boot. The ROM code usually labels this disk drive as Disk Unit 1 (DU1).

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

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

A TK50 tape drive, installed in the BA23-A 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.

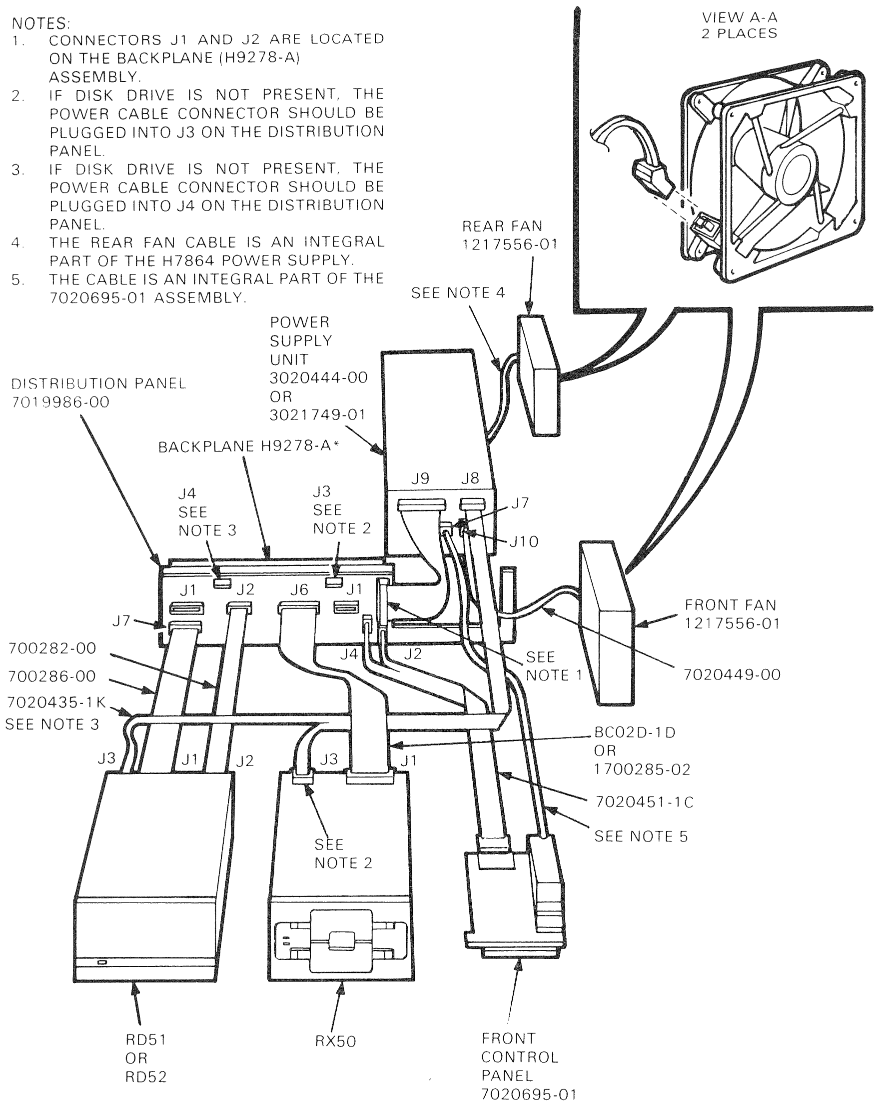

Figure 7-8 Internal Cabling in a BA23-A Enclosure

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* The four slot (MicroPDP/SV system) backplane has a DIGITAL P.N. of H9278-B.

7.5.2 Q22-Bus Backplane

The backplane implements the extended LSI-11 Bus, which uses 22-bit addressing to support up to four 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 7-7 and 7-8) provide the following functions:

- J1 – provides the connection for the power supply backplane cable that carries the dc power and signals from the power supply.
- J2 – provides the signals to the control panel PC 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 PC 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

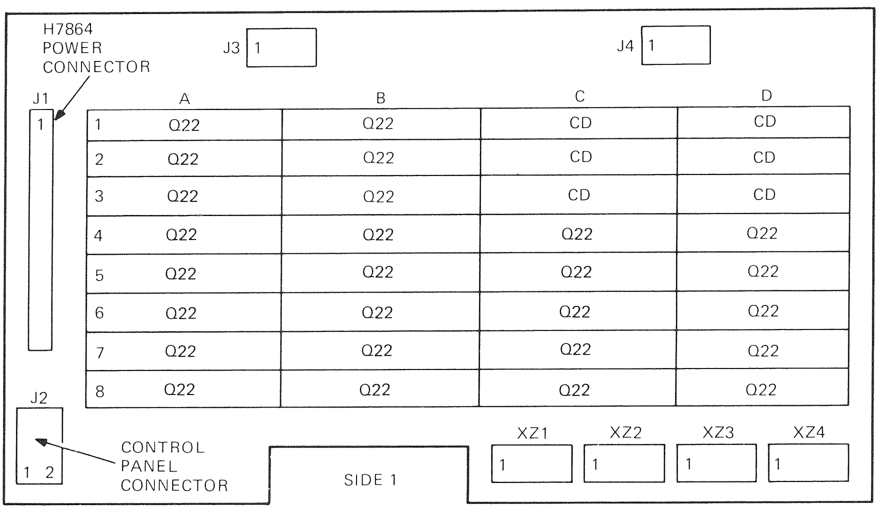
7 Signal

8 Signal

NOTE
Section A.1 discusses the configuration rules for the backplane.

The backplane contains four rows of connectors (A–D). Each row contains eight slots for inserting modules. Figure 7-9 shows the connectors that supply the Q22-Bus signal to the modules.

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.



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 7-9 Backplane

The backplane accommodates dual- or quad-height Q22-Bus-compatible modules. Figure 7-10 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.

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.

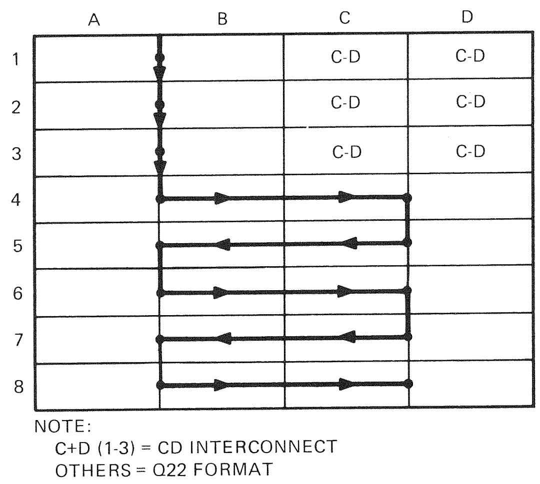


Figure 7-10 Backplane Grant Continuity

7.6 POWER SUPPLY AND FANS

The power supply (Figure 7-11) features protection against excess voltages, excess currents, and temporary fluctuations in the ac supply.

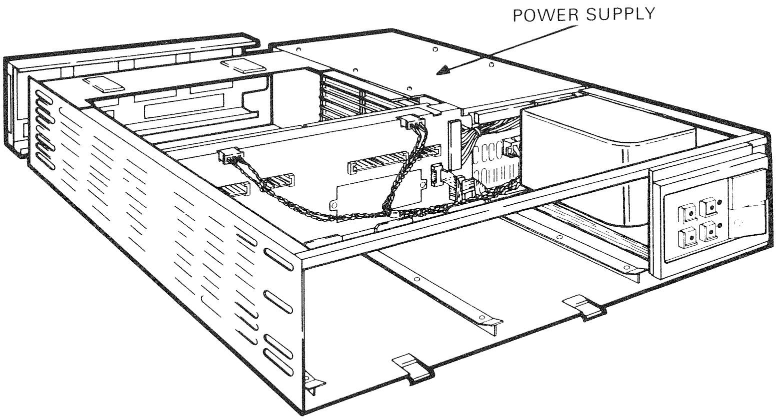


Figure 7-11 Location of Power Supply

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 following:

- Backplane
- Fixed-disk drive
- Diskette drive

The power supply 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-A 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 Appendix A, Configuration). If you replace a power supply, replace it with an identical model. (See Chapter 6, FRU Removal and Replacement Procedures).

See Table 7-3 for the specifications for the H7864-A (Rev. 20, 30-21749-00) power supply. See Table 7-4 for the specifications for the H7684 (Rev. 12, 30-20444-00) power supply.

Table 7-3 H7864-A Power Supply Specifications (Rev. 20)

+5 Vdc Output	
Voltage	+5.1 Vdc ± 2.5%
Current	36.0 Adc max. 4.5 Adc min.
Excess current (must trip)	37 A min. (averaged over 1 ms min.) 42 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. 12.5 A for 1 s min.
Ripple and Noise	75 MV peak-to-peak max.

Table 7-4 H7864 Power Supply Specifications (Rev. 12)

+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. 12.5 A for 1 s min.
Ripple and noise	75 MV peak-to-peak max.

The rear of the power supply contains a connector for remote power control (Figure 7-12). An ac input connector provides compatibility with international line cords and a circuit breaker protects the input power line. The voltage select (VOLT SEL) switch selects two ranges as follows:

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

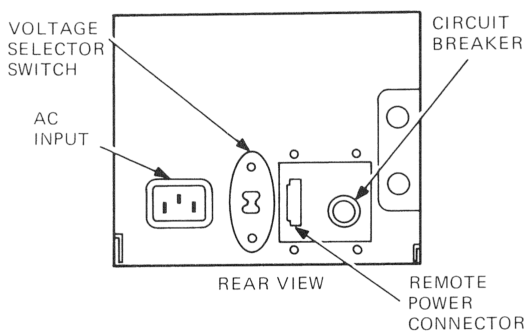


Figure 7-12 Power Supply Rear View

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 an RD5n 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.

7.7 REAR I/O DISTRIBUTION PANEL

External devices connect to the system through the rear I/O distribution panel of the BA23-A 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. Chapters 5 and 6 provide cabinet kit information for mass storage, backup, I/O, and communications options.

The filter connectors mount in the insert panels which are installed in cutouts in the rear I/O distribution panel. The BA23-A 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 7-13 shows the rear I/O distribution panel with a typical insert panel installed. It also shows the serial line unit display panel of the KDJ11-B CPU module, which is typically installed in the top (or left) cutout.

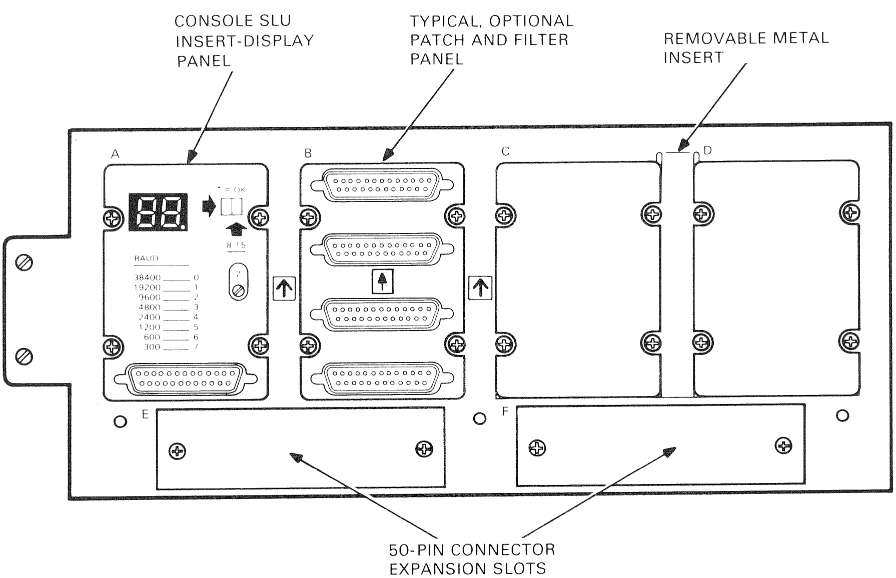


Figure 7-13 Rear I/O Distribution Panel (KDJ11-B SLU Display Panel Shown)

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

- Two of type A: 2.6 × 8.1 cm (.6 × 3.2 inch)
- Four of type B: 6.2 × 8.1 cm (2.5 × 3.2 inch)

Insert panels corresponding to these I/O distribution panel cutouts follows:

- Type A: 2.5 × 10.1 cm (1 × 4 inch)
- Type B: 6.6 × 8.2 cm (2.6 × 3.2 inch)

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 7-14 shows typical type A and type B insert panels and the adapter plate.

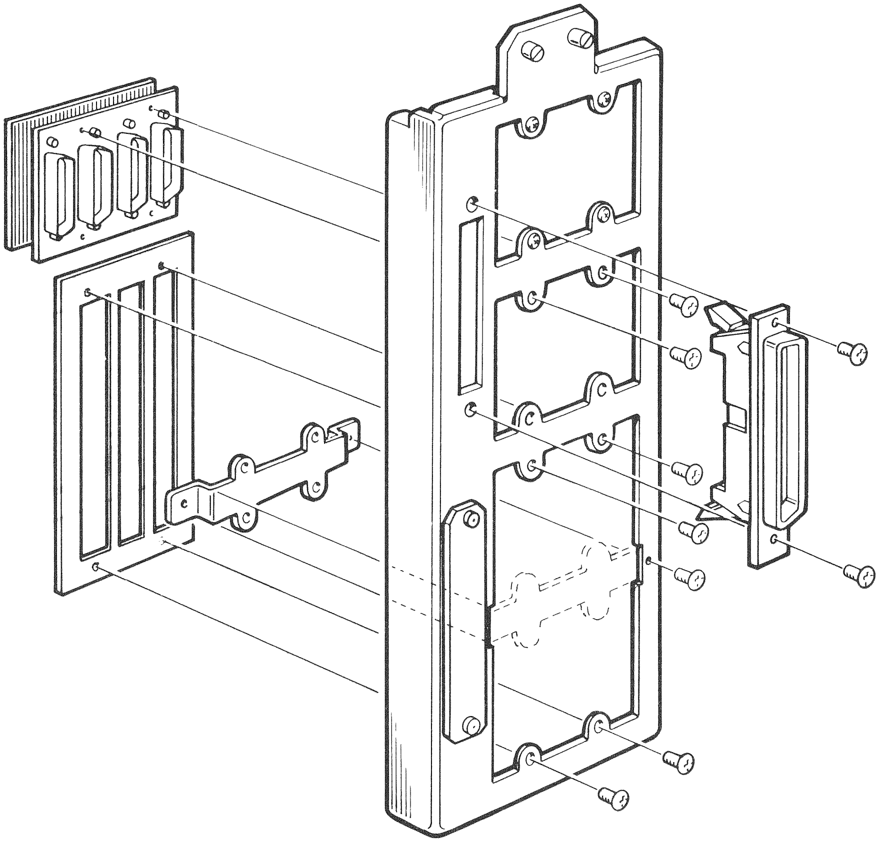


Figure 7-14 I/O Insert Panels and Adapter Plate

BA23-A FRU Removal and Replacement Procedures 8

8.1 INTRODUCTION

This chapter describes the removal and replacement procedures for the Field Replaceable Units (FRUs) in the BA23-A enclosure. Figure 8-1 shows the major FRUs as seen from the front of the enclosure. Table 8-1 lists the FRUs and their part numbers.

CAUTION
Static electricity can damage modules installed in the BA23-A 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 a microcomputer system.

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

Table 8-1 Field Replaceable Units

Component	DIGITAL P.N.
H7864 power supply	30-20444-00*
H7864-A	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 (8-slot)	H9278-A
Q22-Bus backplane (4-slot)	H9278-B
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	70-20695-01
Control panel cable	70-20451-1C
KDF11 SLU panel	54-15422
KDJ11 SLU panel	70-21150-02
SLU cable 10-pin	17-00624-01
LED cable 20-pin	17-00712-02

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

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

Table 8-1 Field Replaceable Units (Cont.)

Component	DIGITAL P.N.
Adapter plate	74-28684-01
I/O distribution panel	70-19979-0
Front bezel (rackmount)	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
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
RQDX1-E	M7512
RQDX1-E cabinet kit	CK-RQDX
Grant card	M9047
Grant card	G7272

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.**

Notes to Figure 8-1:

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.

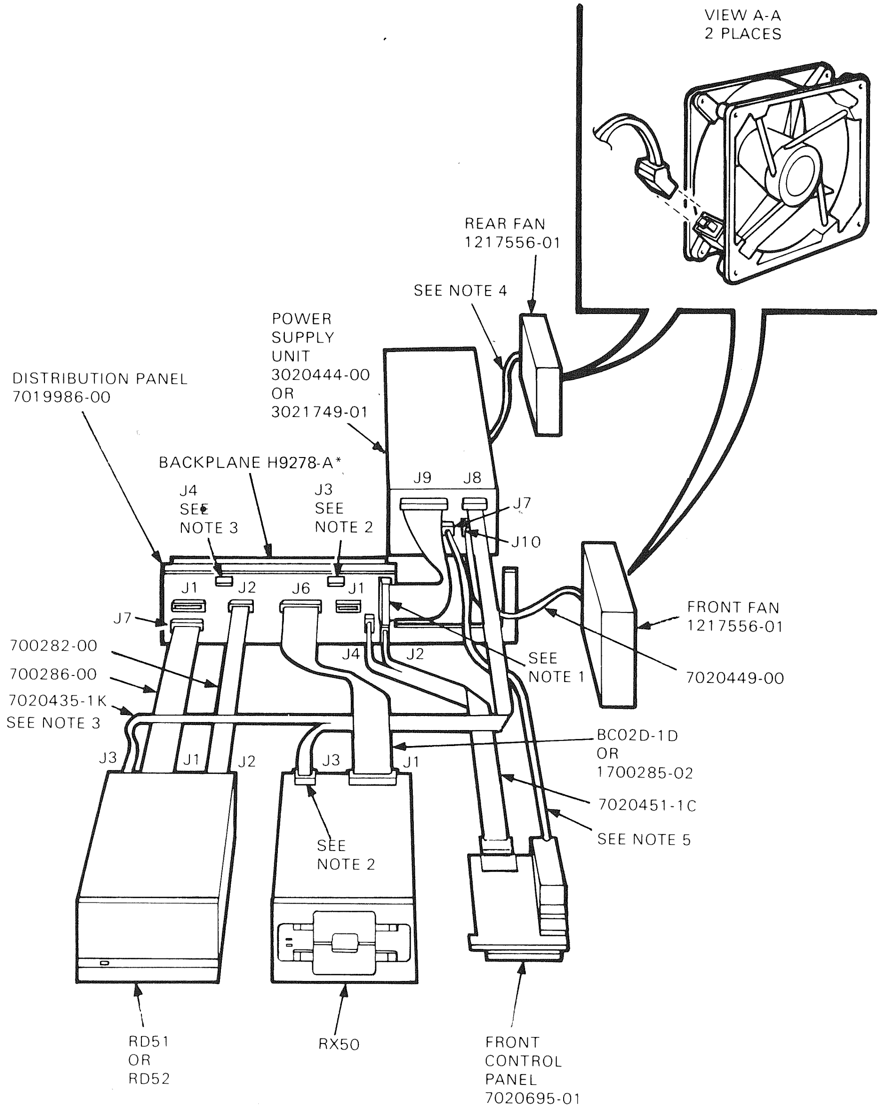


Figure 8-1 BA23-A Enclosure FRUs

* For four-slot MicroPDP-11/SV systems, the backplane part number is H9278-B.

BA23-A FRU Removal and Replacement Procedures

8.2 CONTROL PANEL REMOVAL

Use the following procedure to remove the control panel (Figure 8-2).

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.

Use the following procedure to install a replacement control panel.

1. Reverse steps 1 through 8.
2. Make sure that the Line Time Clock (LTC) switch and the Restart/Enable switch on the control panel printed circuit board are set correctly (see Section 7.3.2).

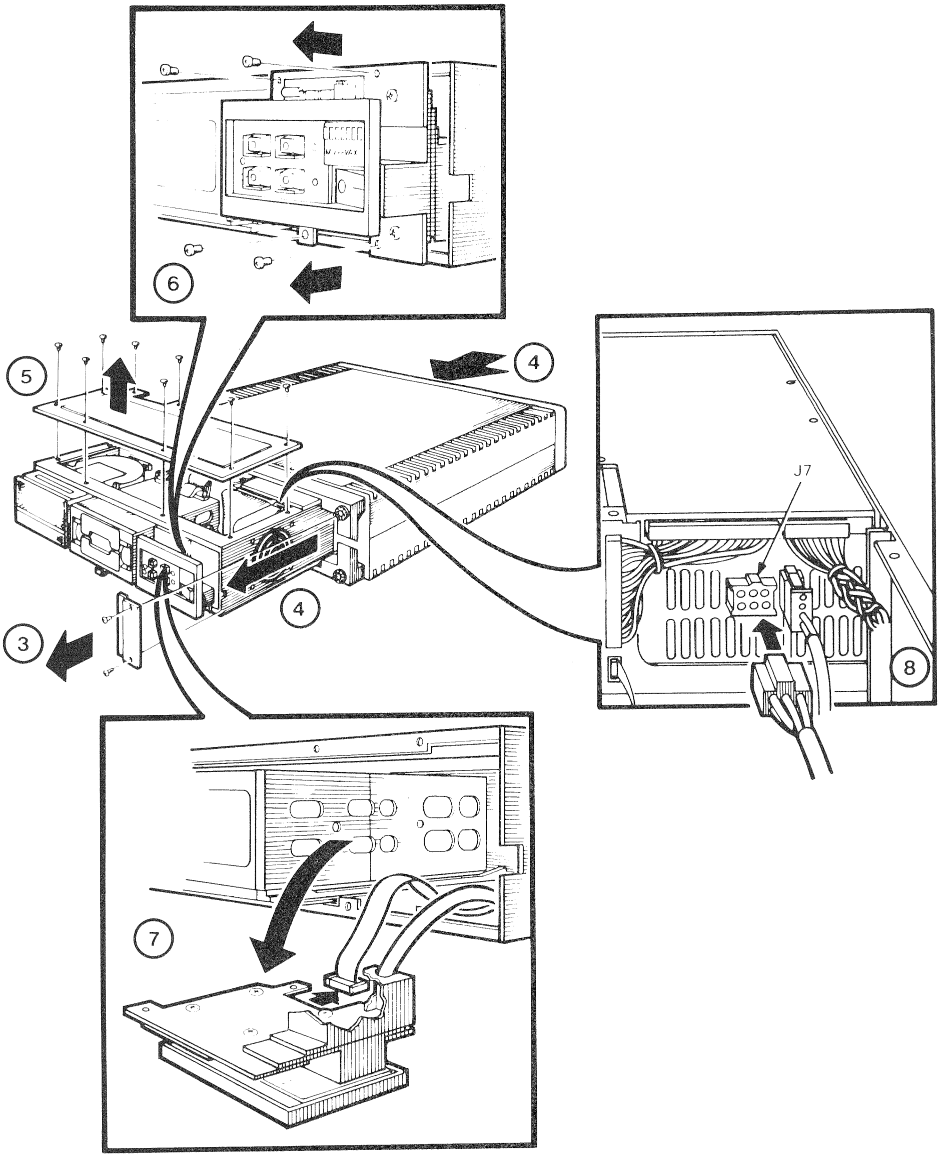


Figure 8-2 Control Panel Removal

8.3 RX50 DISKETTE DRIVE AND TK50 TAPE DRIVE REMOVAL

Use the following procedures to remove the RX50 diskette drive or the TK50 tape drive (Figure 8-3, RX50 shown).

> **NOTE**
> **The RX50 diskette drive and TK50 tape drives are single FRUs. Do not disassemble the diskette or tape drives or remove any of the printed circuit boards. All adjustments must be made in a special test configuration.**
>
> **Only use formatted RX50K diskette and TK50 compact tapes 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.**

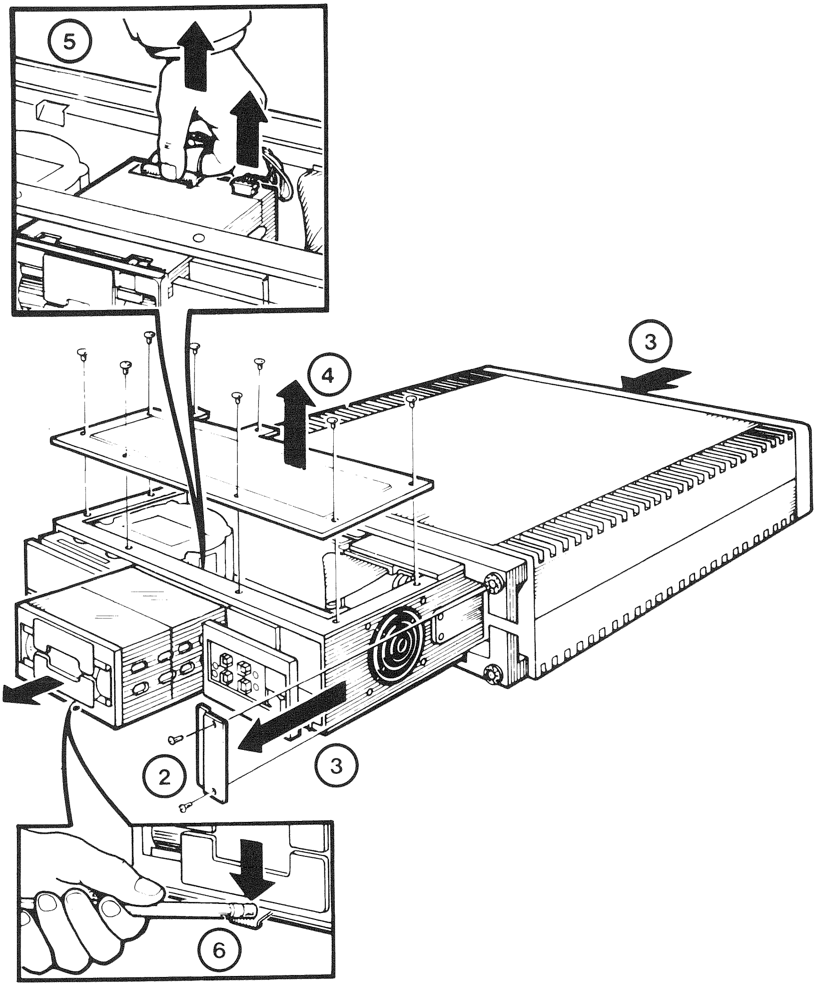


Figure 8-3 RX50 Diskette Drive Removal

8.3.1 TK50/TQK50 INTERCONNECT CABLE REMOVAL

The TK50 tape drive connects to its TQK50 controller module through an interconnect cable. This cable runs through the access cover on the signal distribution panel, and underneath the modules installed in the backplane.

Use the following procedure to remove the TK50/TQK50 interconnect cable (Figure 8-4).

1. Remove the front and rear covers and all cables. Label the cables for reinstallation later.
2. Remove the rear retaining bracket and slide the subsystem completely out through the back.
3. Remove the subsystem storage cover, the Q22-Bus module cover, and all mass storage devices.
4. Release the interconnect cable from the wire tie holding it to the access cover on the signal distribution panel.
5. Remove the two screws retaining the access cover and remove the cover.

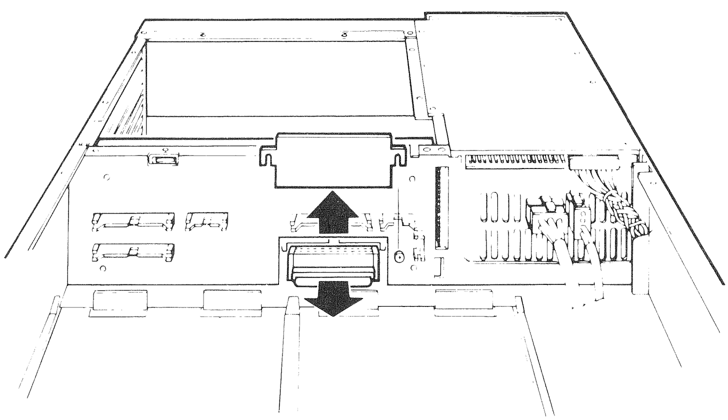


Figure 8-4 Access Cover Removal

7. Disconnect the RQDX controller cable from side two of the backplane and move it to the side to provide working room.
8. Remove the module in slot 8 (bottom slot) of the backplane (Section 8.9).
9. Pull the TK50/TQK50 interconnect cable (from the back) through the signal distribution panel, backplane, and card cage.

To install a replacement TK50/TQK50 interconnect cable, reverse steps 1 through 9 with the following exceptions:

- Push the replacement cable through the backplane assembly from the front to the rear of the enclosure.
- Be sure to observe the "THIS SIDE UP" marking on the cable. As a check, the striped side of the cable should be nearest the front fan of the enclosure.
- If you are installing a TK50 tape drive in a BA23-A enclosure which did not previously contain a tape drive, be sure to install the *new* access cover shipped with the TK50. Do not try to use the access cover originally shipped with the system.

8.4 RD5n FIXED-DISK DRIVE REMOVAL

Use the following procedure to remove an RD5n fixed-disk drive (Figure 8-5):

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

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).

NOTE
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.

An RD52 or RD53 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.

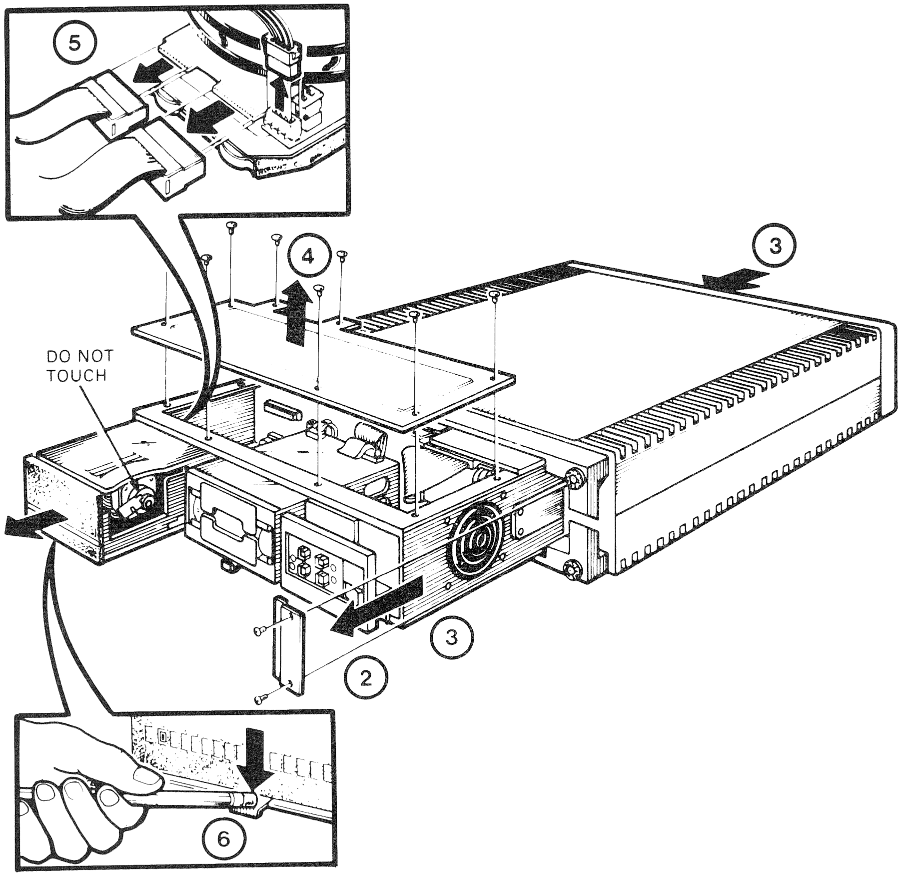


Figure 8-5 RD5n Fixed-Disk Drive Removal (RD51 Disk Drive Shown)

7. To configure an RD52 drive as DU0 (installed in port 0), make sure the jumper clip is set at DS3 (Figure 8-6). To configure an internal RD52 drive as DU1 (installed in port 1), place the jumper clip on DS4. Refer to Sections 5.3 and 5.5 for further information.

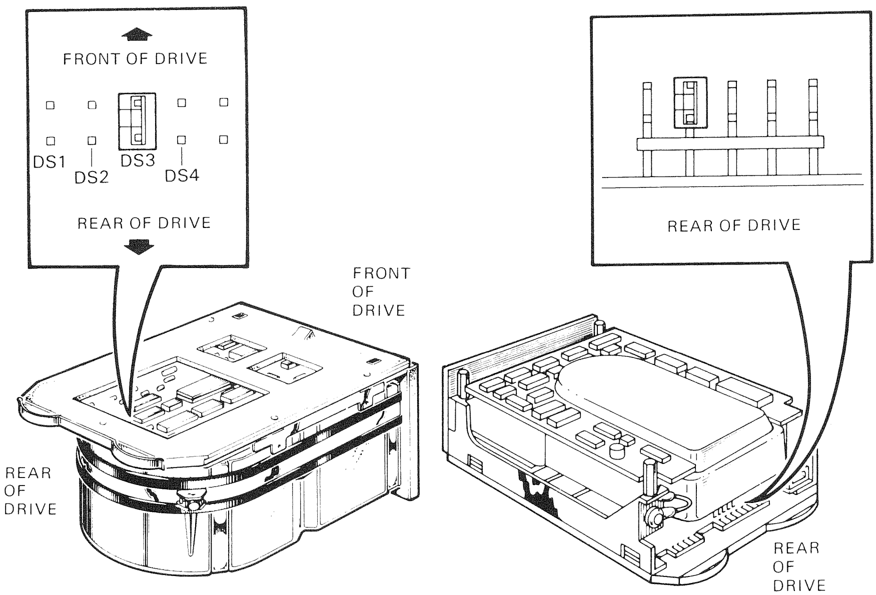


Figure 8-6 RD52 Jumper Clip Setting

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

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

8.4.1 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 8-7).

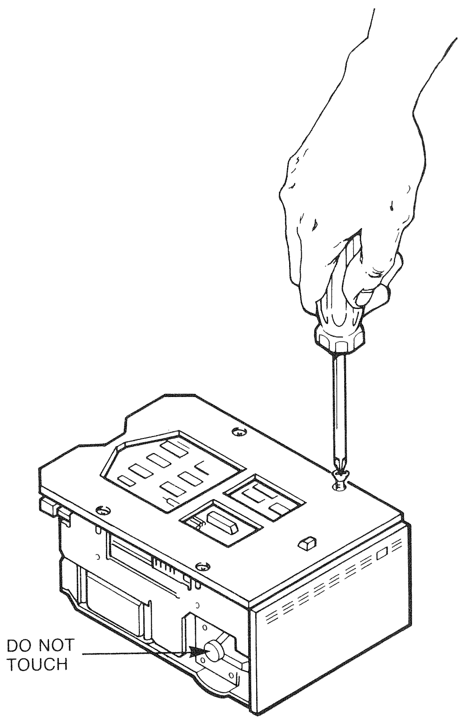


Figure 8-7 RD51 Disk Drive Skid Plate Removal

2. Using a 3/32-inch Allen wrench, remove the four screws that hold the read/write printed circuit board to the fixed-disk drive (Figure 8-8).
3. Disconnect connector P5 from the side of the board.

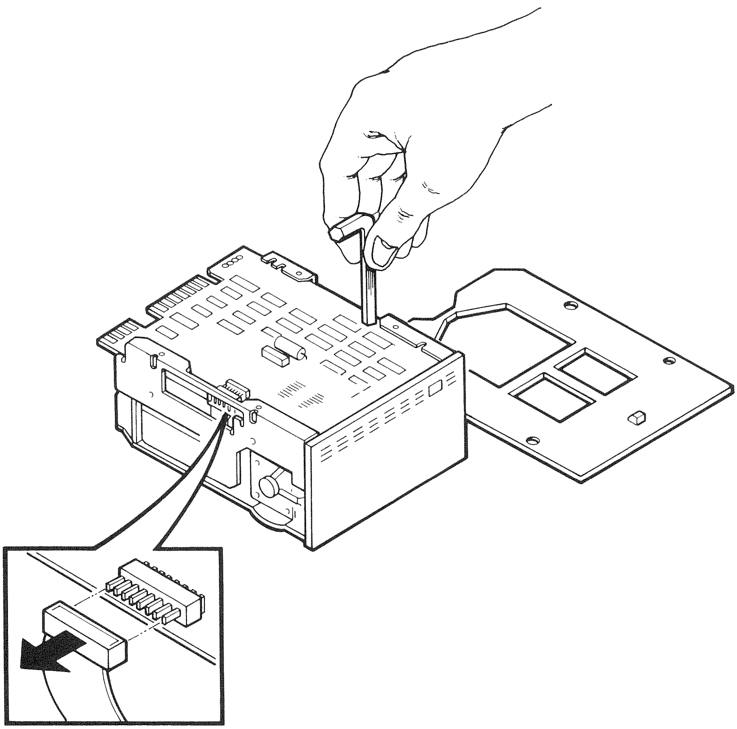


Figure 8-8 RD51 Disk Drive Allen Screws and Connector P5 Removal

4. Disconnect connectors P6, P7, and P8 from the front of the read/write printed circuit board (Figure 8-9).
5. Disconnect connector P4, a two-wire connector found on the rear of the read/write printed circuit board next to the dc power connector.
6. Remove the fixed-disk drive read/write board.

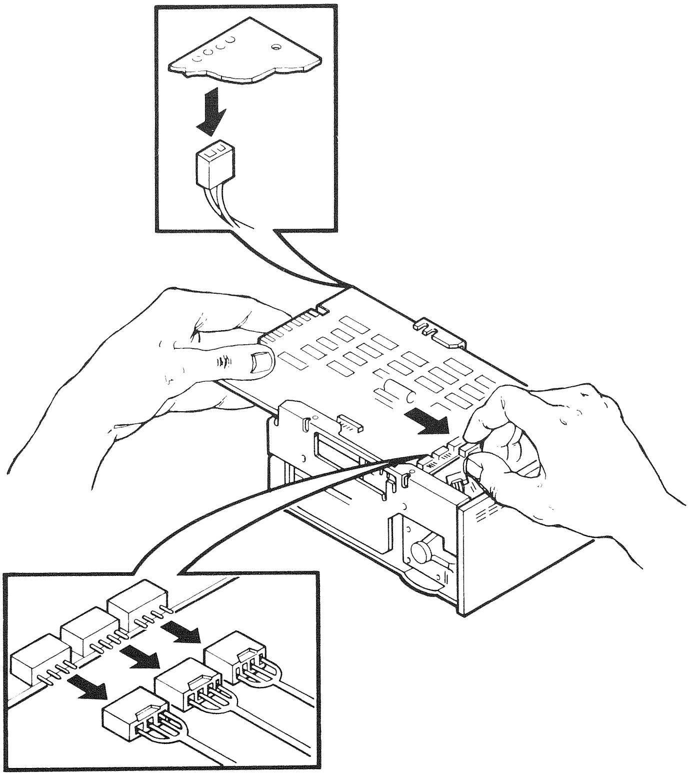


Figure 8-9 RD51 Disk Drive Connectors P6, P7, P8, and P4

7. Make sure the jumper configuration of the 14-pin Dual In-line Package (DIP) shunt pack matches the listing in Table 8-2.

Table 8-2 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 8-10).

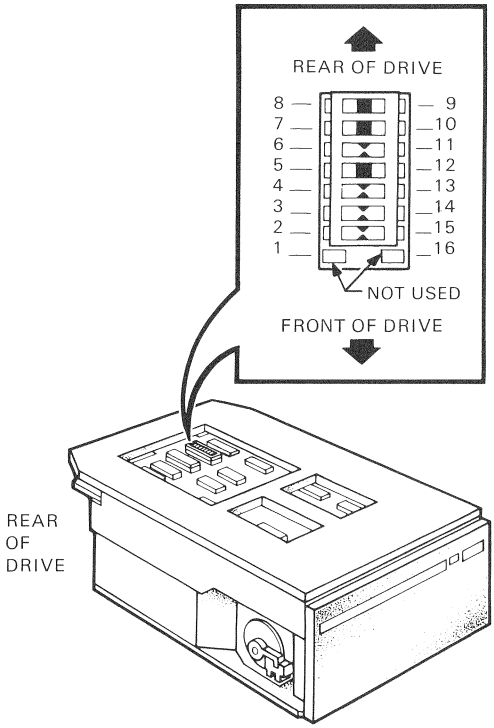


Figure 8-10 DIP Shunt Pack Setting

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

8.4.2 RD52 Main Printed Circuit Board Removal

NOTE
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 8-11).

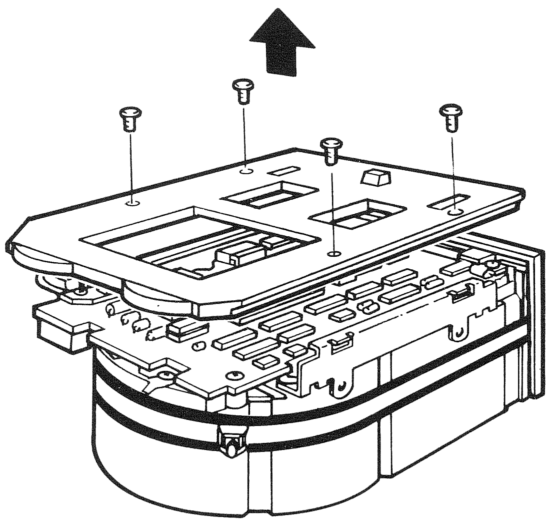


Figure 8-11 Slide Plate Removal

2. Unplug the two-pin connector (Figure 8-12).
3. Remove the two Phillips screws that attach the front bezel to the drive.

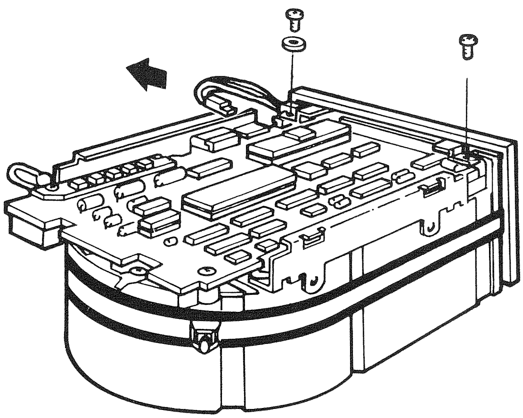


Figure 8-12 Two-Pin Connector and Screw Removal

4. Remove the front bezel by pulling it away from the drive. The bezel is held in place with pop fasteners (Figure 8-13).

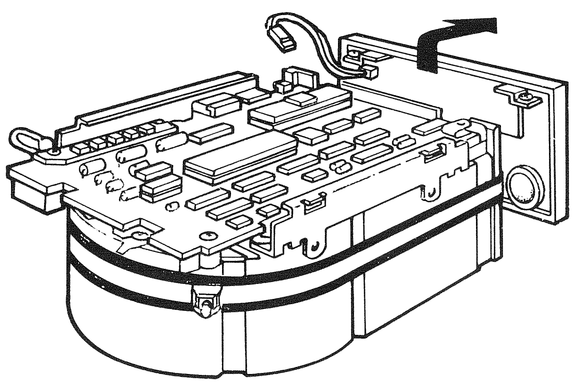


Figure 8-13 Front Bezel Removal

5. Remove the three Phillips screws from the heatsink, the grounding strip, and the corner opposite the heatsink (Figure 8-14).

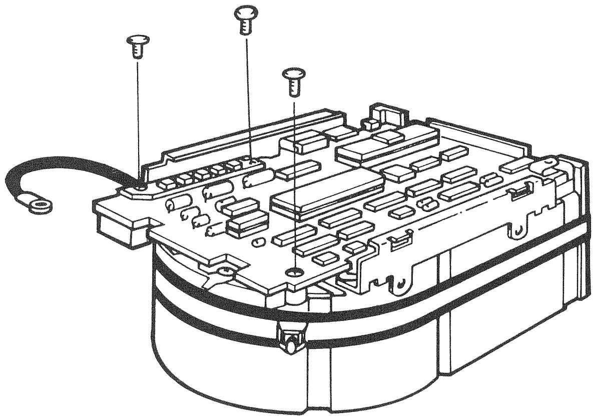


Figure 8-14 Removal of Phillips Screws from Heatsink

6. Lift the MPCB straight up until it clears the chassis. This disconnects P4, a 12-pin fixed plug (Figure 8-15).
7. Disconnect P5, a 10-pin connector.

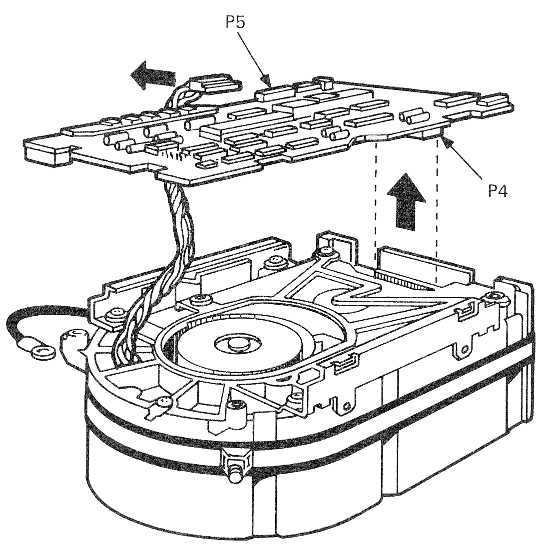


Figure 8-15 MPCB Removal

8.4.3 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 8-16).
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 these with care.
5. Lift the read/write board out of the hinge slots.

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

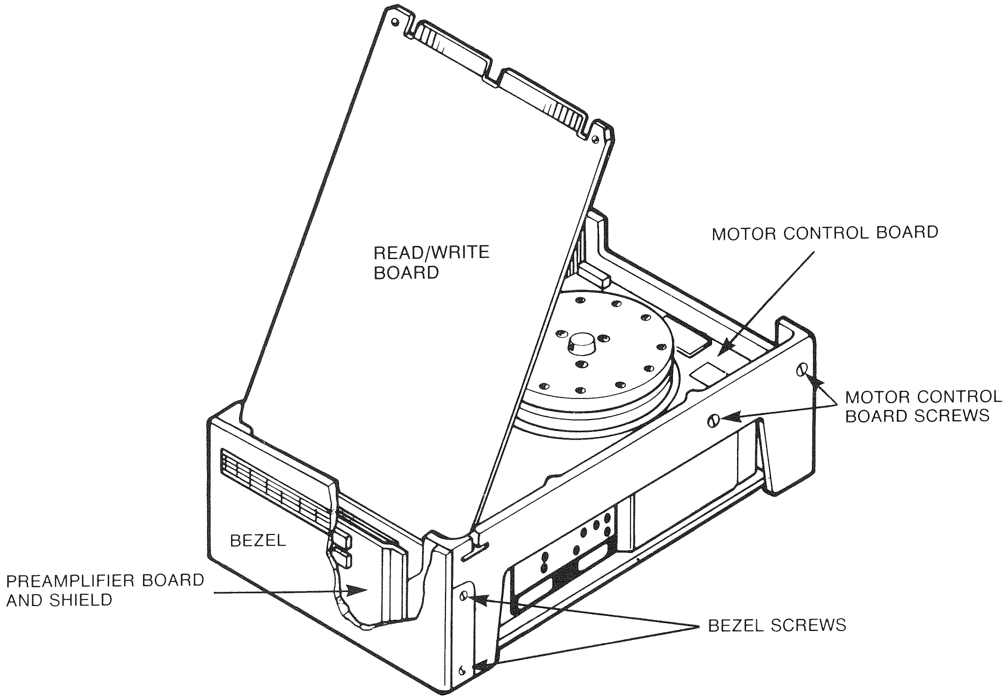


Figure 8-16 RD53 Read/Write Board Removal

8.4.4 RQDX Interconnect Cable Removal

RD5n and RX50 disk drives connect to the signal distribution panel, which in turn connects to the RQDX controller module through an interconnect cable. This cable runs from the signal distribution panel underneath the modules to the back of the RQDX controller module.

Use the following procedure to remove the RQDX interconnect cable.

1. Remove the front and rear covers and all cables. Label the cables for reinstallation later.
2. Remove the rear retaining bracket and slide the subsystem completely out through the back.
3. Remove the subsystem storage cover, the Q22-Bus module cover, and all mass storage devices.
4. Release the TK50 interconnect cable (if present) from the wire tie holding it to the access cover on the signal distribution panel.

5. Remove the two screws retaining the access cover and remove the cover (Figure 8-17).

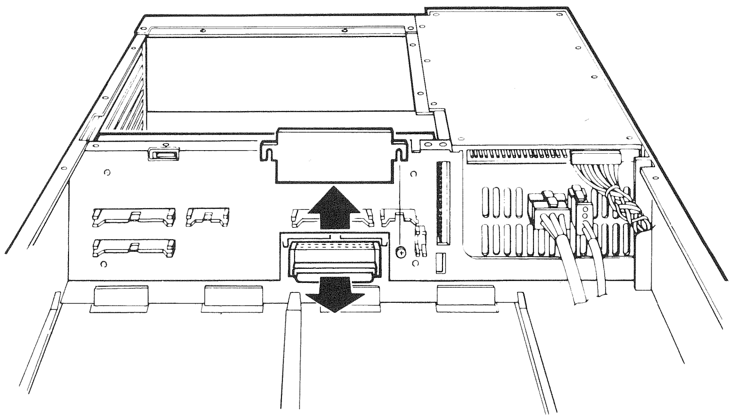


Figure 8-17 Access Cover Removal

7. Move the TQK50 cable (if present) to the side to provide working room.
8. Disconnect the RQDX cable, which was exposed when you removed the access cover, from side two of the backplane.
9. Remove the module in slot 8 (bottom slot) of the backplane (Section 8.9).
10. Pull the RQDX interconnect cable (from the back) through the signal distribution panel, backplane, and card cage. you may also have to remove the TQK50 interconnect cable (if present) to remove the RQDX interconnect cable (Section 8.3.1)

To install a replacement RQDX interconnect cable, reverse steps 1 through 10. Note, however, that it is easier to push the replacement cable through the backplane assembly from the front to the rear of the enclosure.

8.5 BACKPLANE ASSEMBLY REMOVAL

Use the following procedure to remove the backplane assembly.

1. Remove the front and rear covers and all cables. Label the cables 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 8-18).

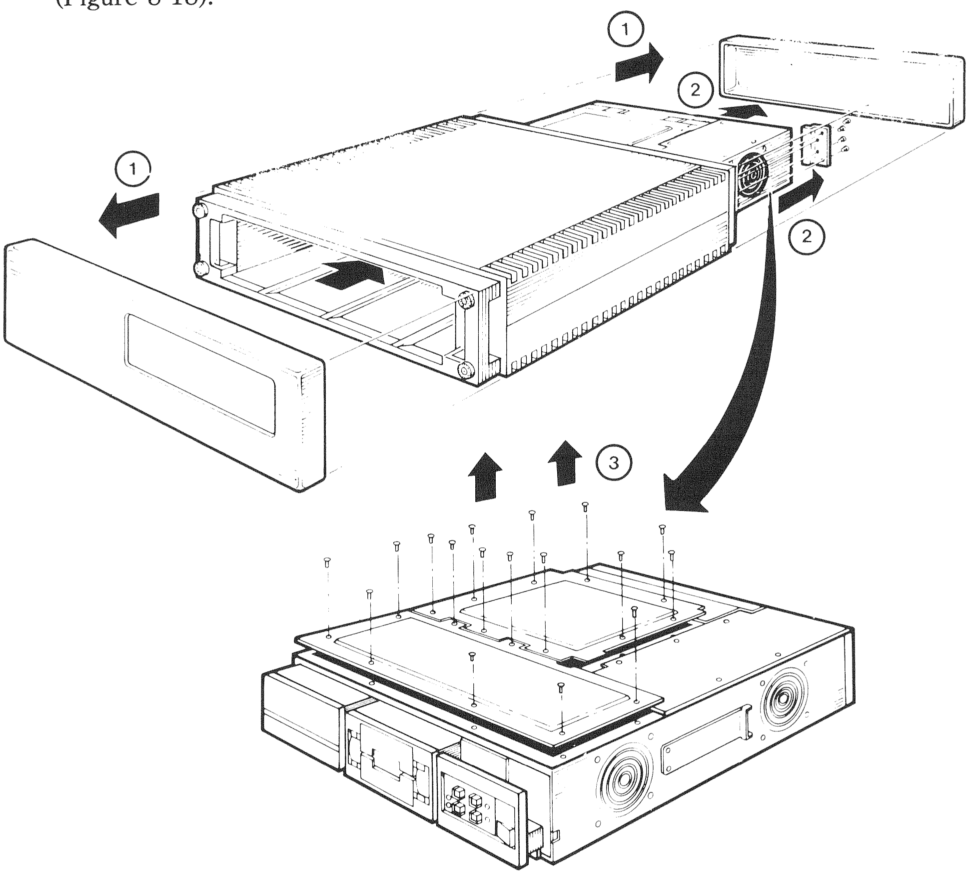


Figure 8-18 Backplane Access

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 8-19). Refer to Section 8.9 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 8.3 and 8.4).
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.

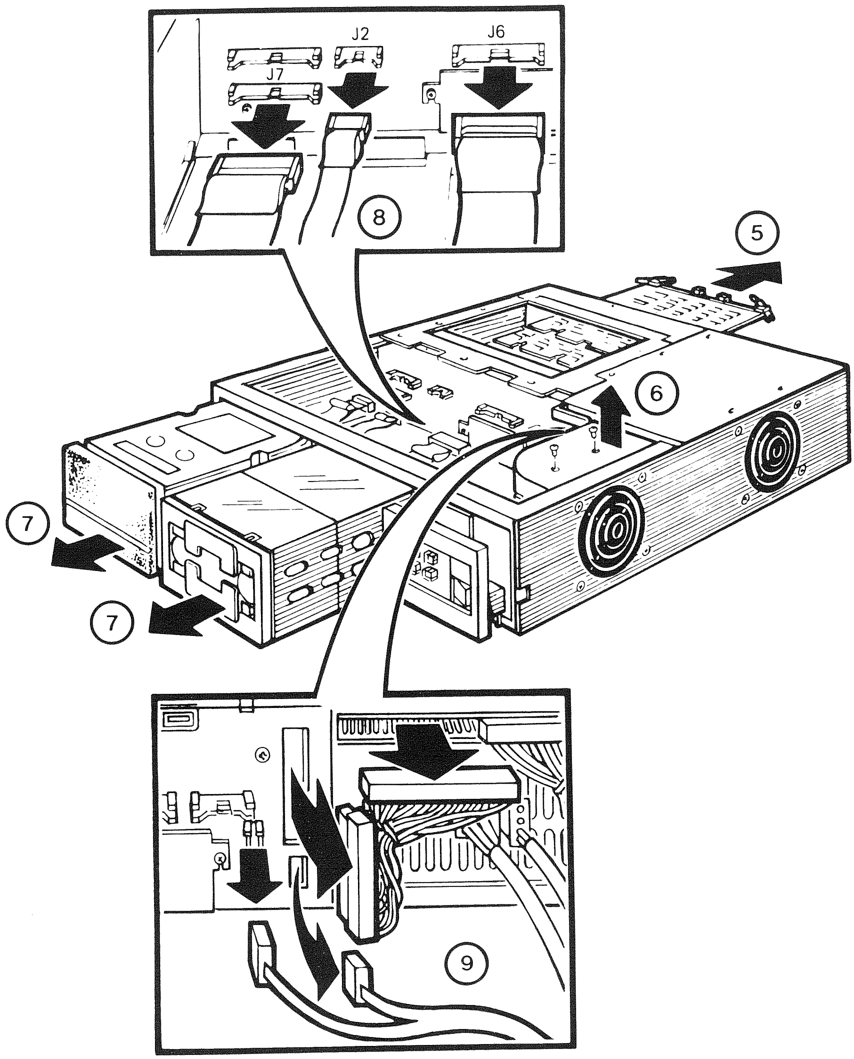


Figure 8-19 Cables and Module Removal

10. Loosen the two screws retaining the small access cover. Remove the cover and disconnect the cable from side two of the backplane (Figure 8-20).
11. Remove the four screws holding the backplane assembly to the chassis.

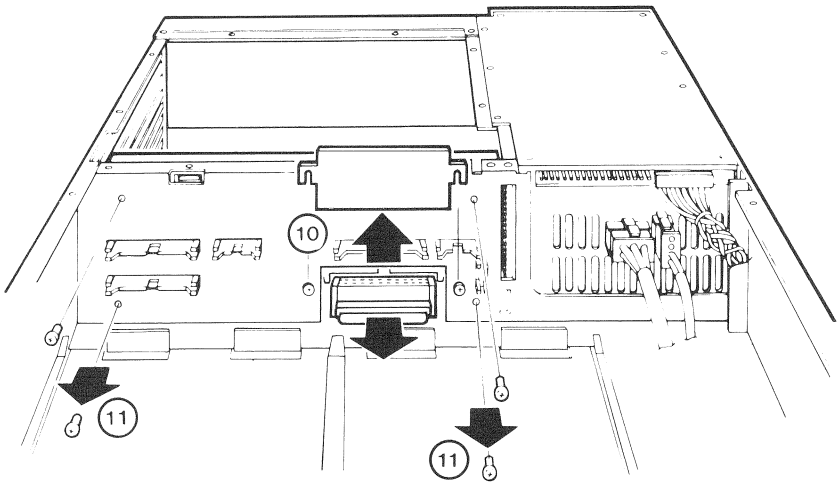


Figure 8-20 Access Cover and Screw Removal

12. Pivot the CD side of the backplane assembly 45 degrees toward the rear and lift it straight up (Figure 8-21).

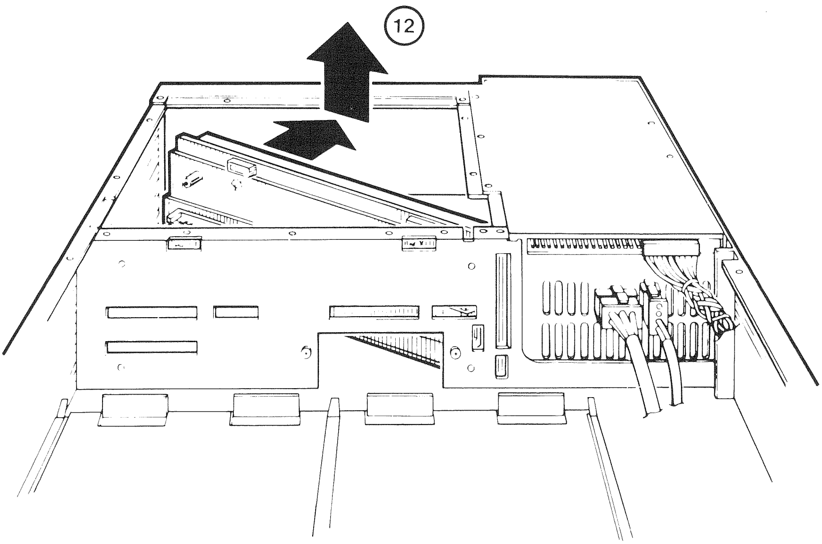


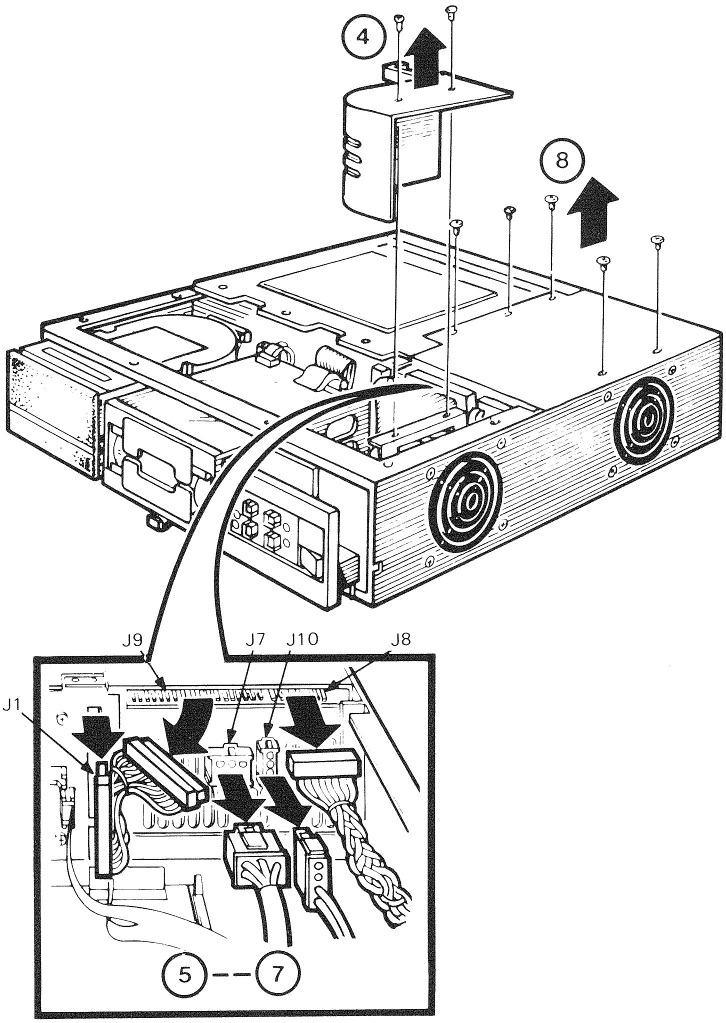
Figure 8-21 Backplane Removal

8.6 POWER SUPPLY (H7864-A/H7864) REMOVAL

Use the following procedure to remove the power supply (Figure 8-22).

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 (±.13 V) for the +5 Vdc regulator, and +12.1 Vdc (±.13 V) 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.



NOTE:
REPLACE A POWER SUPPLY WITH ONE THAT HAS AN IDENTICAL PART NUMBER.

Figure 8-22 Power Supply Removal

9. Lift the power supply assembly out of the chassis and rest it on top of the Q22-Bus module cover (Figure 8-23).
10. Disconnect the power connector from the rear cooling fan.

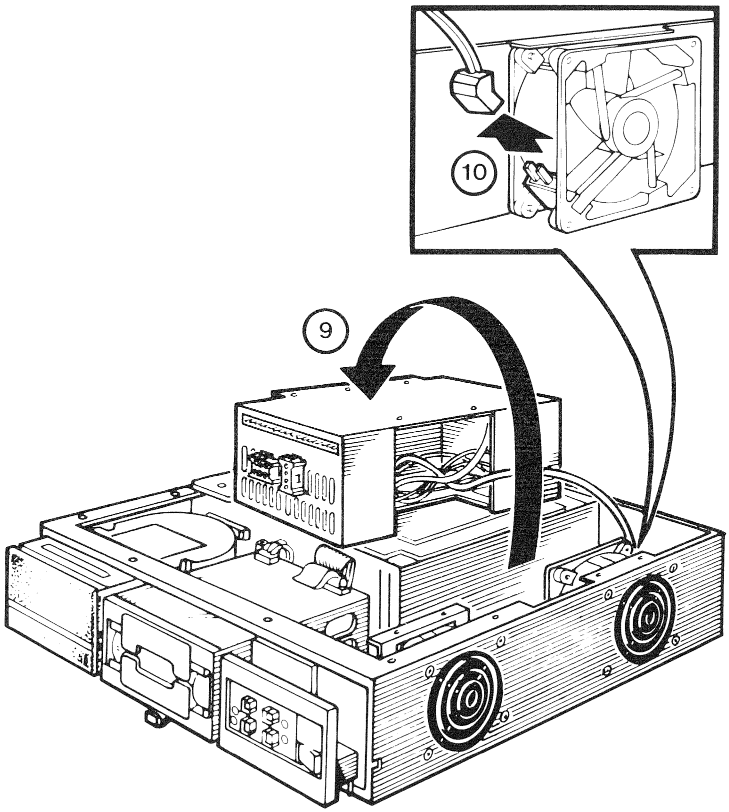


Figure 8-23 Power Supply and Fan Connector Removal

Use the following procedure to install a replacement power supply.

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

   CAUTION
   The rear fan power cable is not keyed. Observe the polarity of the connector. The curve of the connector must match the curve of the fan housing (Figure 8-24).

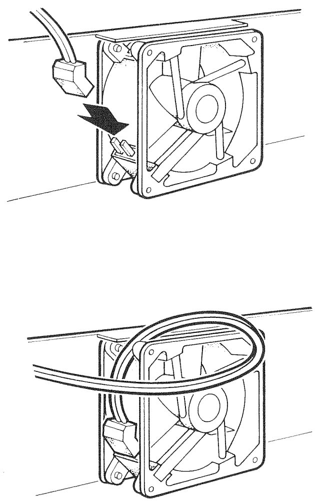


Figure 8-24 Rear Fan Power Cable Installation and Routing

2. Place the power supply in position. Make sure you route the rear fan cable over the top of the rear fan (Figure 8-24).
3. Reverse steps 1 through 8 of the removal procedure to finish installing the power supply.

8.7 REAR COOLING FAN REMOVAL

Use the following procedure to remove the rear cooling fan (Figure 8-25).

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 8.6).
4. Remove the four screws and spacers that hold the fan to the chassis and remove the fan.

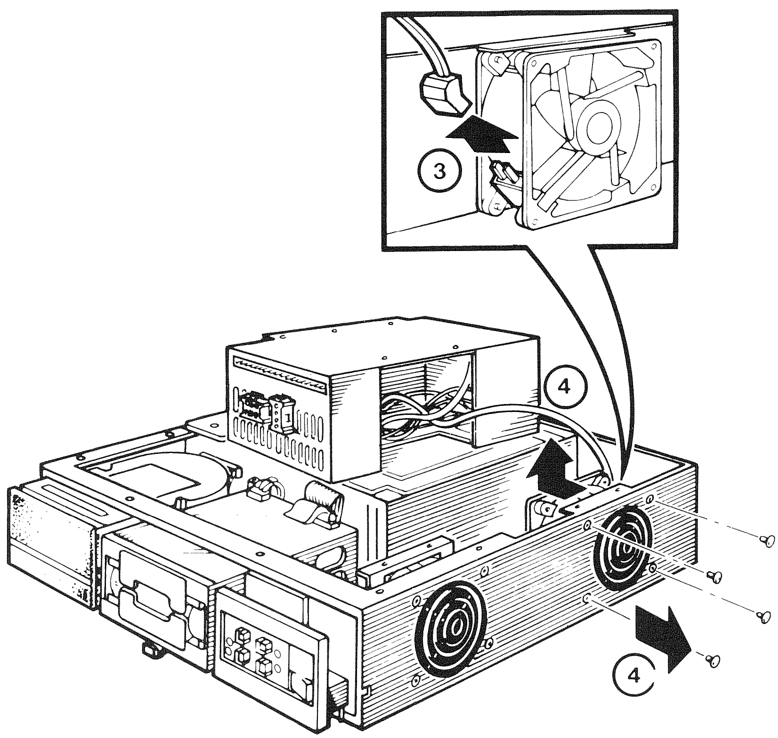


Figure 8-25 Removal of Fan from Chassis

Use the following procedure to install a rear replacement fan.

1. Relocate the four screws and place the fan guard on the screws. Make sure the cross members of the fan guard face the inside of the unit (Figure 8-26).
2. Place the spacers on the screws and secure the fan. Make sure the fan is oriented as shown in Figure 8-26. 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 8-24.

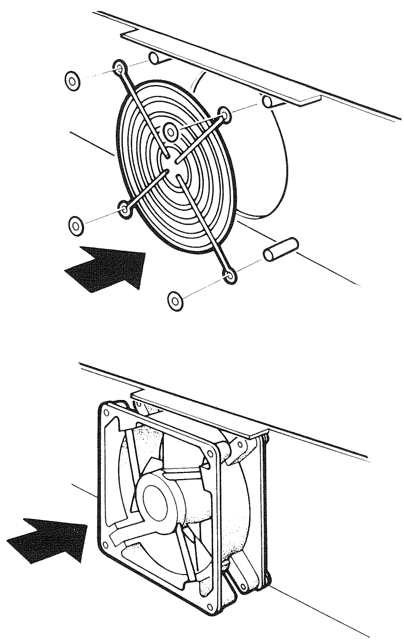


Figure 8-26 Rear Fan Installation

8.8 FRONT FAN REMOVAL

Use the following procedure to remove the front fan (Figure 8-27).

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.
6. Remove the four screws and spacers that hold the fan and fan guard to the chassis and remove the fan (Figure 8-28).

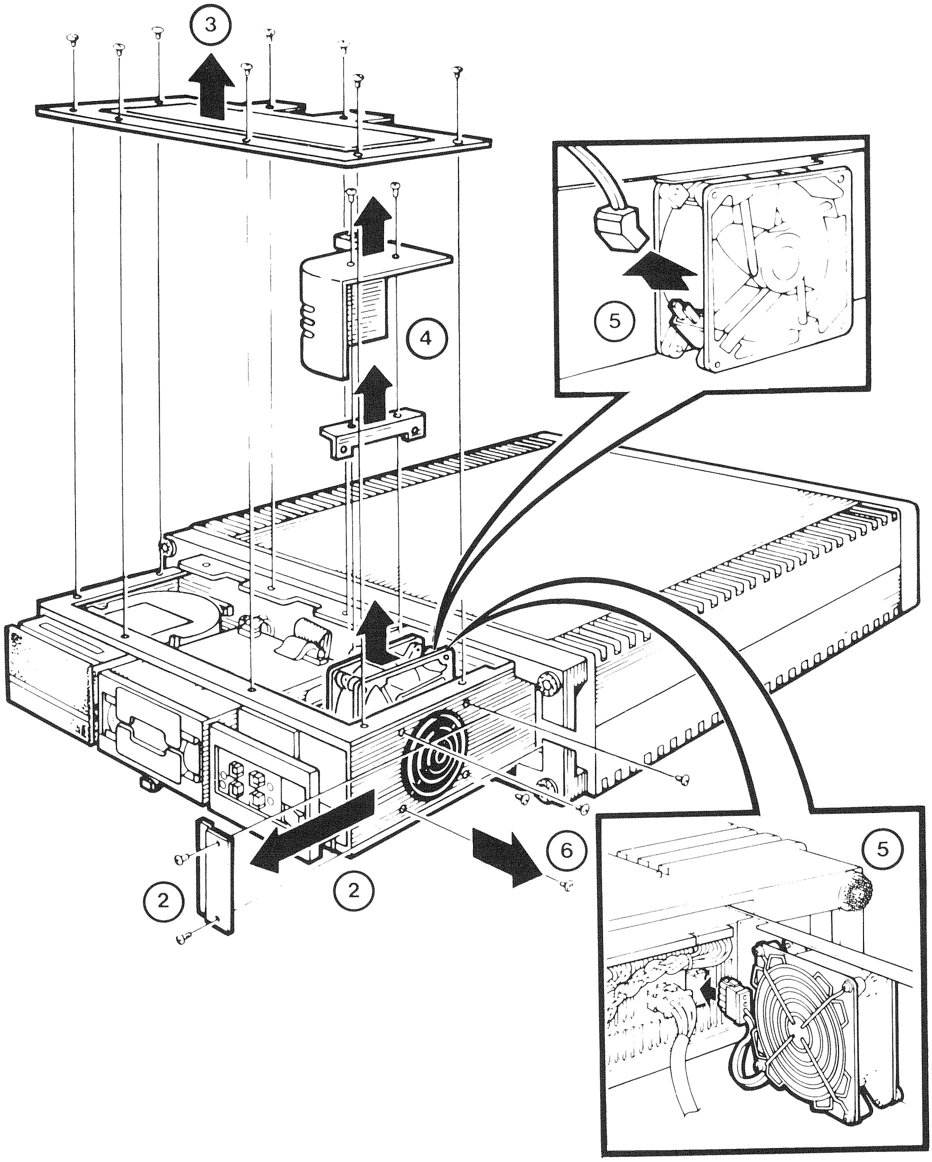


Figure 8-27 Front Cooling Fan Disconnection

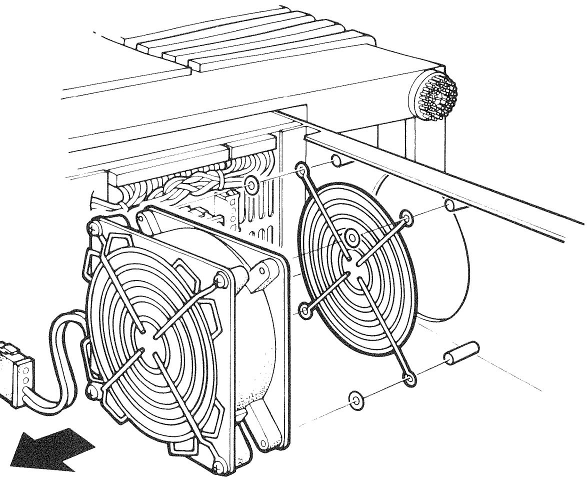


Figure 8-28 Front Cooling Fan Removal

Use the following procedure to install a replacement front fan.

1. Remove the power cable and fan guard (if present) from the intake side of the old fan and fit them to the replacement fan (Figure 8-29).

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 8-29.

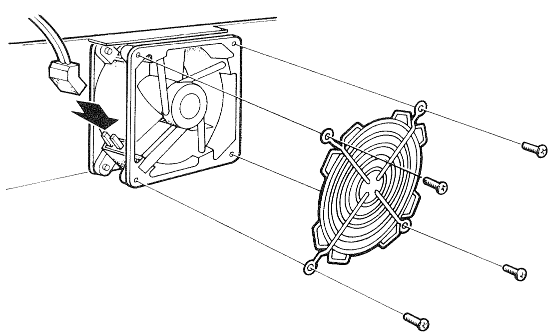


Figure 8-29 Front Fan Power Cable and Fan Guard Connection

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 8-30).
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.

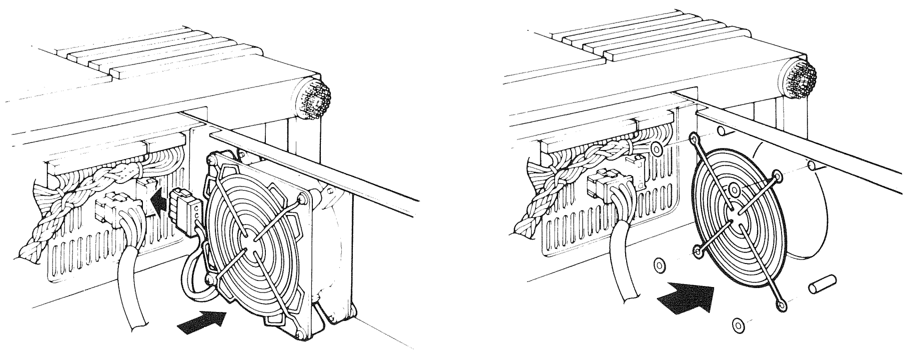


Figure 8-30 Replacement Fan Installation

8.9 MODULE REMOVAL

Use the following procedure to remove modules from the BA23-A enclosure (Figure 8-31).

> **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 damaging the module components, damaging 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.

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.

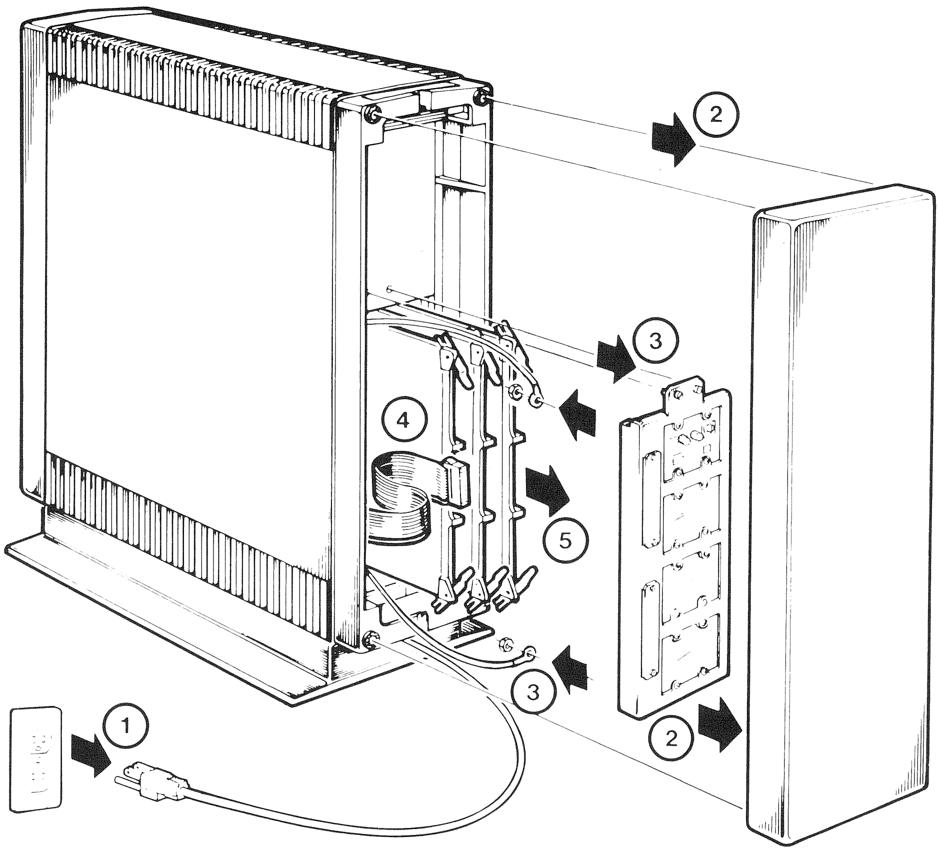


Figure 8-31 Module Removal

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 8-32 shows the operation of these ejector levers.

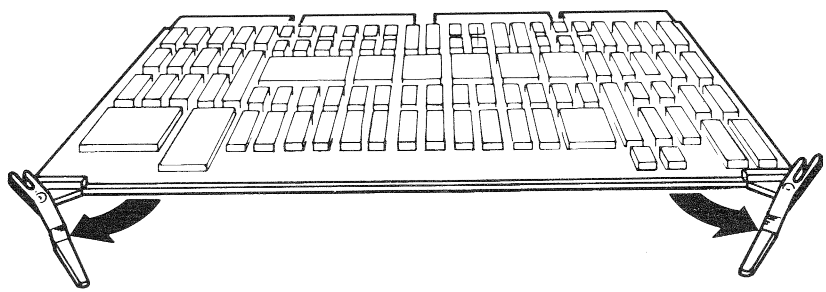


Figure 8-32 Quad-Height Module Ejector Levers

Use the following procedure to install modules.

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 guide or installation guide supplied with the new module.
2. Reverse steps 1 through 6 of the removal procedure.
3. Retest the system to confirm that it is working correctly. Refer to Chapter 3, Troubleshooting of your *Systems Owner's Manual* for instructions.

8.10 REAR I/O INSERT PANEL REMOVAL

Use the following procedure to remove a rear I/O insert panel (Figure 8-33).

1. Remove the ac power cord from 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 panel insert to the rear I/O panel assembly and remove the insert.

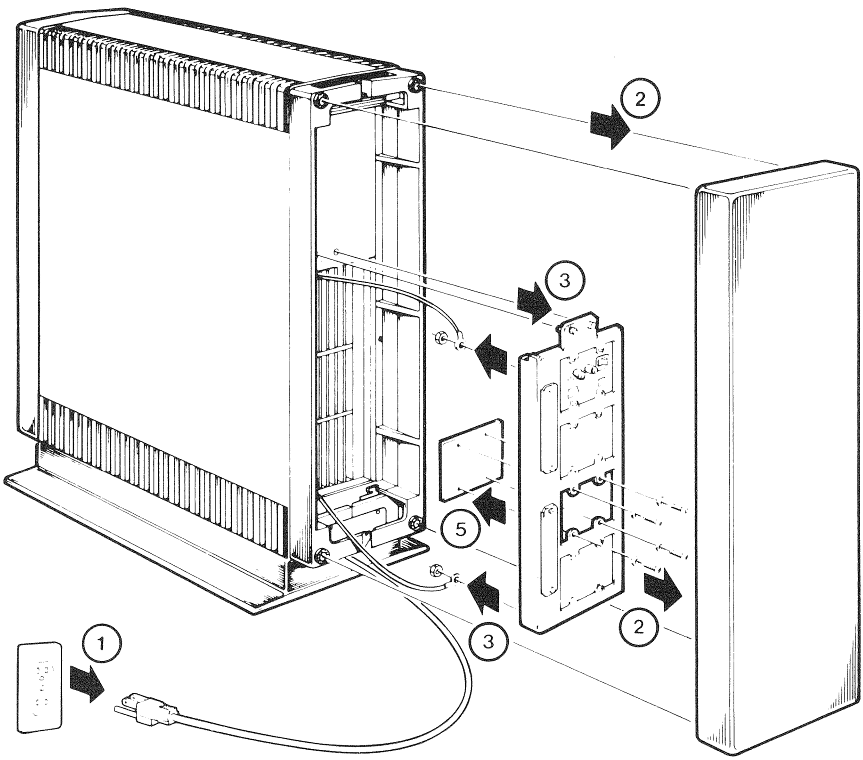


Figure 8-33 Rear I/O Insert Panel Removal

9.1 INTRODUCTION

The BA123-A enclosure (Figure 9-1), a floor-standing unit, supports microcomputer systems and a wide variety of hardware options. The fan-cooled enclosure operates in an open office environment. It includes the following major components:

- BA123-A frame
- Front control panel
- Mass storage area
- Backplane assembly
- Power supply
- Rear I/O distribution panel

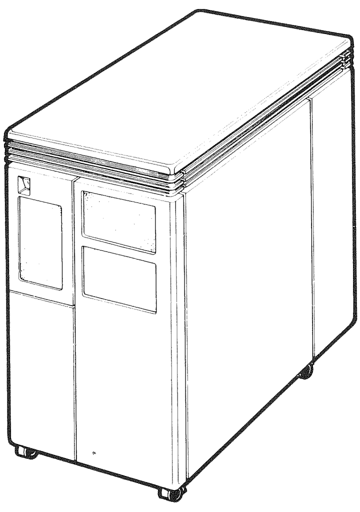


Figure 9-1 BA123-A Enclosure

9.2 ENCLOSURE FRAME

The BA123-A enclosure frame houses the power supply and the backplane assembly. It also provides mounting space for five 13.3-cm (5.25-inch) mass storage devices. It is mounted on four shock isolating castors. The dimensions of the enclosure frame are as follows:

- Height: 62.2 cm (24.5 inches)
- Width: 33.0 cm (13.0 inches)
- Depth: 70.0 cm (27.5 inches)

Removable panels (Figure 9-2) cover the front, right, and left sides of the enclosure.

The BA123-A enclosure contains three doors:

- Control panel door on the front
- I/O panel door at the rear
- Card-cage door inside the right-side panel

> **NOTE**
> **For panel removal procedures, see Section 10.2.**

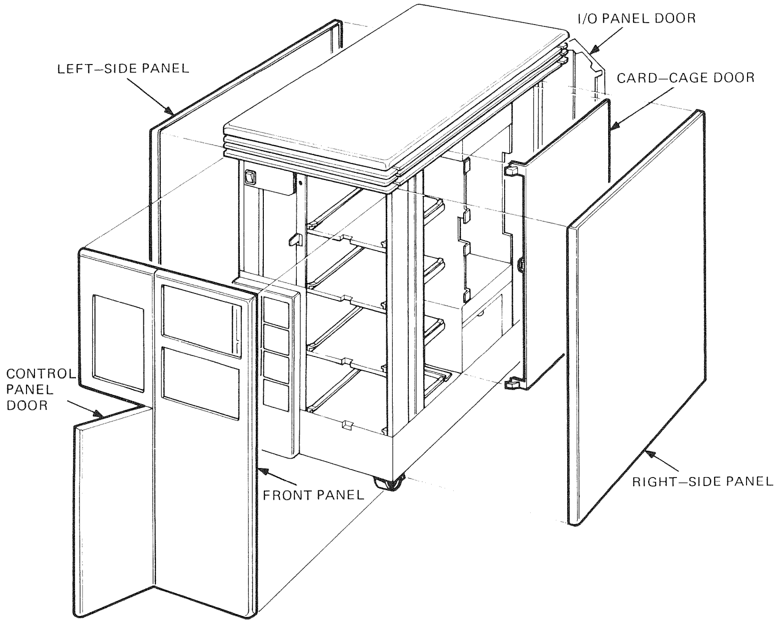


Figure 9-2 BA123-A Removable Panels and Doors

9.2.1 Air Circulation

The BA123-A enclosure contains three fans:

- One below the module card cage
- One behind the control panel
- One inside the power supply

These fans draw air in from the top of the enclosure (Figure 9-3).

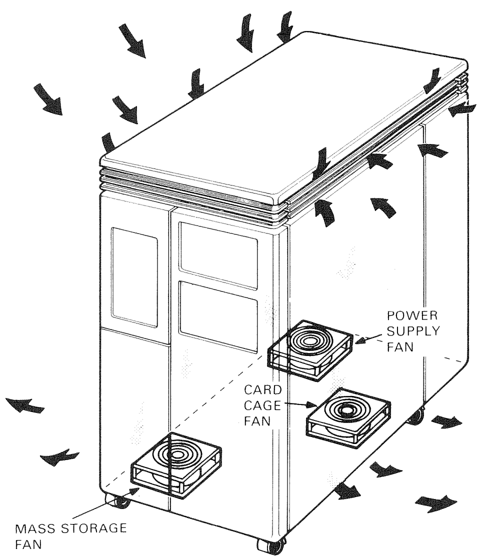


Figure 9-3 Air Flow

9.2.2 Temperature Sensors

A Printed Circuit (PC) board above the card cage contains two temperature sensors (Figure 9-4):

- One sensor regulates the speed of the card-cage fan at the minimum level required to maintain a constant temperature within the card cage.
- One sensor shuts down the system at high temperatures.

The card-cage door encloses the area surrounding the modules. Removal of this door triggers a switch, which increases the speed of the card-cage fan to maximum.

If the proper temperature within the card cage cannot be maintained, even at maximum fan speed, the over-temperature sensor causes the system to shut down. The system also shuts down if the card-cage fan fails.

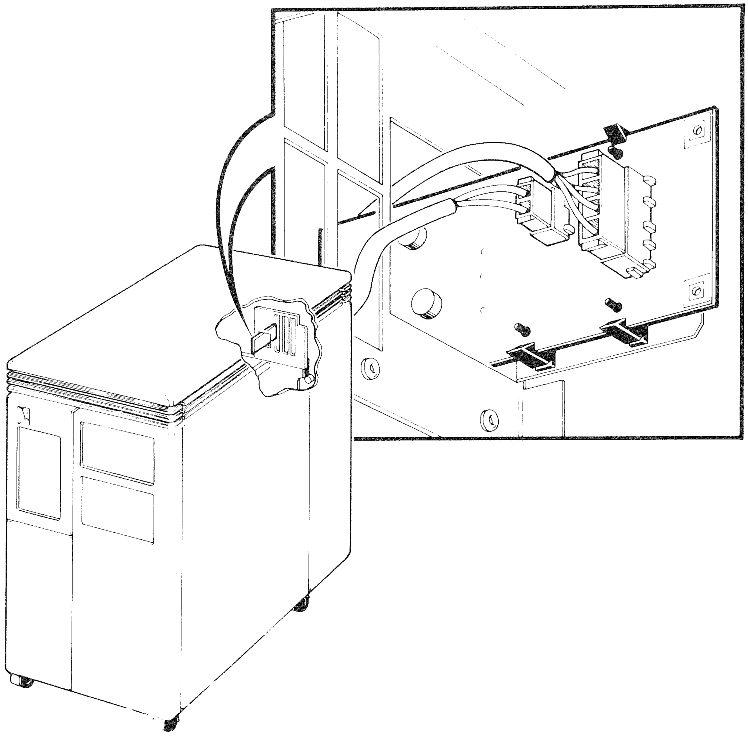


Figure 9-4 Temperature Sensor PC Board

9.3 CONTROL PANEL

The control panel contains six cutouts to provide space for control circuits:

- One for a CPU console board (Section 9.3.1)
- Five for mass storage console boards (Section 9.4.2)

Removable plates cover any unused cutouts. Figure 9-5 shows the relation between the cutouts and the mass storage shelves.

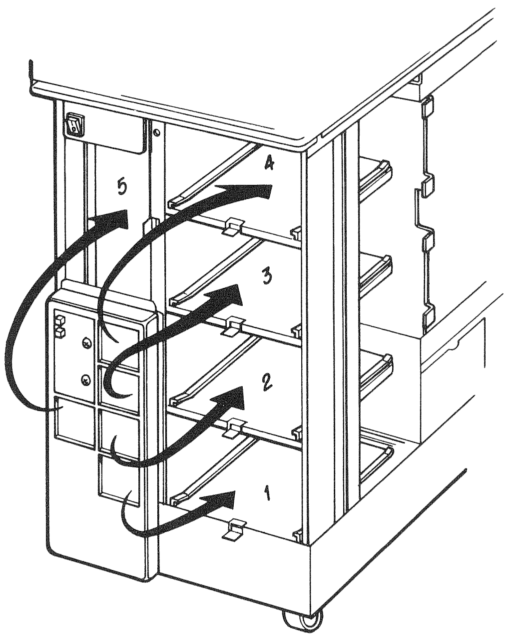


Figure 9-5 Mass Storage Shelves

9.3.1 CPU Console Board

The CPU console board (Figure 9-6) attaches to the back of the control panel. A ribbon cable connects the CPU console board to the backplane and provides the connection between the CPU and the CPU console board.

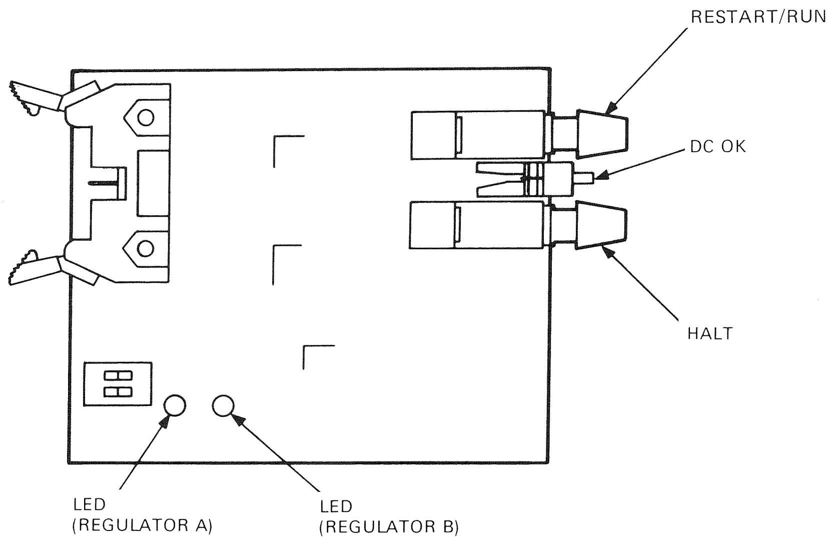


Figure 9-6 CPU Console Board

The front of the CPU console board contains a DC OK indicator light and two buttons that allow the user to halt or restart the system. These buttons and indicator are visible on the control panel. Table 9-1 describes their function.

Table 9-1 CPU Console Board Controls and Indicators

Control/ Indicator	Position/ Condition	Description
Halt	Out/Unlit	Push-on/push-off button with integral red LED. Normal position for running software.
	In/Lit	Red LED. Stops normal software operation. Puts the CPU in console emulator mode and the system accepts only ODT commands (see Section 4.5).
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 restarting the system.
DC OK	Lit	Green LED. Lights when all dc voltages are present and within tolerance.

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

- Regulator A: left LED
- Regulator B: right LED
- LED is on: +5 Vdc to the backplane is OK
- LED is off: regulator or connection to regulator has failed

> **NOTE**
> **There should be at least one module in both an odd- and even-numbered backplane slot to draw enough current to start each regulator (Section 9.5).**

9.3.2 LTC DIP Switch Unit

The LTC DIP unit, located to the left of the LEDs, contains two switches labeled 1 and 2. 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 9-1. Setting the Restart/Enable switch to off disables the front control panel Restart switch.

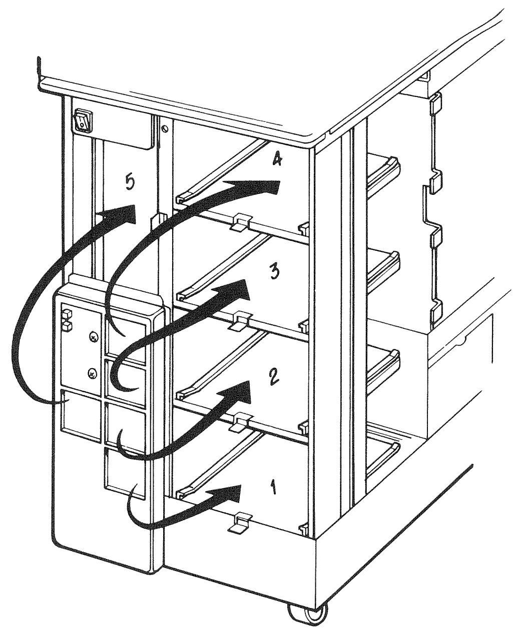
9.4 MASS STORAGE SHELVES

The front panel covers five shelves used for mounting 13.3-cm (5.25-inch) mass storage and backup devices (Figure 9-5). Install mass storage and backup devices in the following sequence:

- Two in shelves 1 and 2
- Two in shelves 3 and 4
- One (usually an RX50 diskette drive) in shelf 5

NOTE
Only four mass storage devices can be in operation at any one time.

Removable plates in front of shelves 1, 2, and 3 allow access to removable-media devices. Devices normally occupy the shelves as shown in Figure 9-7.



LEGEND:

1. DISK DRIVE 1
2. DISK DRIVE 2
3. DISK DRIVE 3
4. TAPE DRIVE
5. DISKETTE DRIVE

Figure 9-7 Typical Arrangement of Devices

9.4.1 Signal Distribution Board

The signal distribution board (M9058, Figure 9-8) is mounted in the bottom two (C and D) rows of backplane slot 13.

Four fixed-disk drives, or an RX50 diskette drive and two fixed-disk drives, can be connected to the signal distribution board (Figure 9-9).

The signal distribution board connects to an RQDX2 controller module (M8639-YB) in the card cage with a 50-pin connector ribbon cable. Another ribbon cable connects the signal distribution board and the RD console boards behind the control panel.

9.4.2 RD Console Board

The RD console board attaches to the back of the control panel. A ribbon cable (Figure 9-9) connects the RD console board to the signal distribution board.

The front edge of the RD console board contains two buttons that control the status of the fixed-disk drive. Table 9-2 describes their function.

Table 9-2 RD Console Board Controls and Indicators

Control/ Indicator	Position/ Condition	Description
Write-Protect	Out/Unlit	Push-on/push-off button with integral yellow LED. Normal operation. Enables disk read and write operations.
	In/Lit	LED lights yellow. Data cannot be to the disk (data can be read from the disk).
Ready	Out/Lit	Push-on/push-off button with integral green LED. Normal operation. Lights green. Enables disk reads and writes.
	In/Unlit	Prevents disk read and write operations.

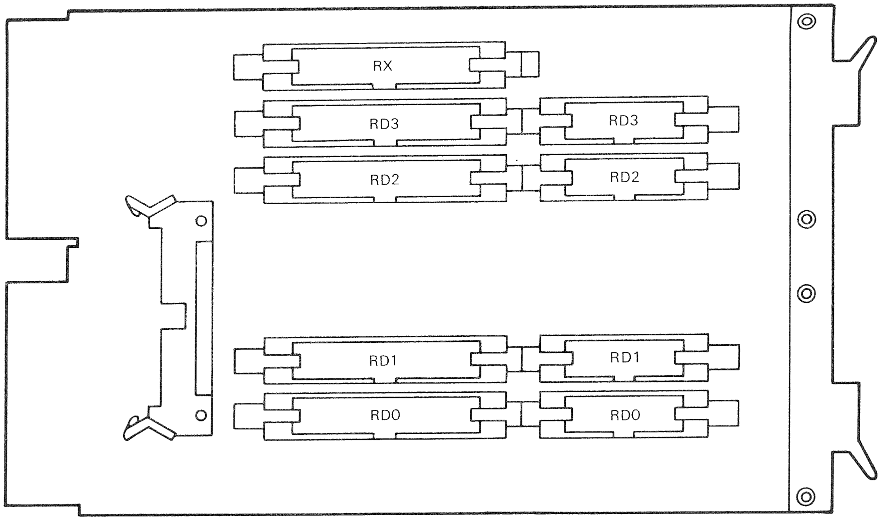


Figure 9-8 Signal Distribution Board

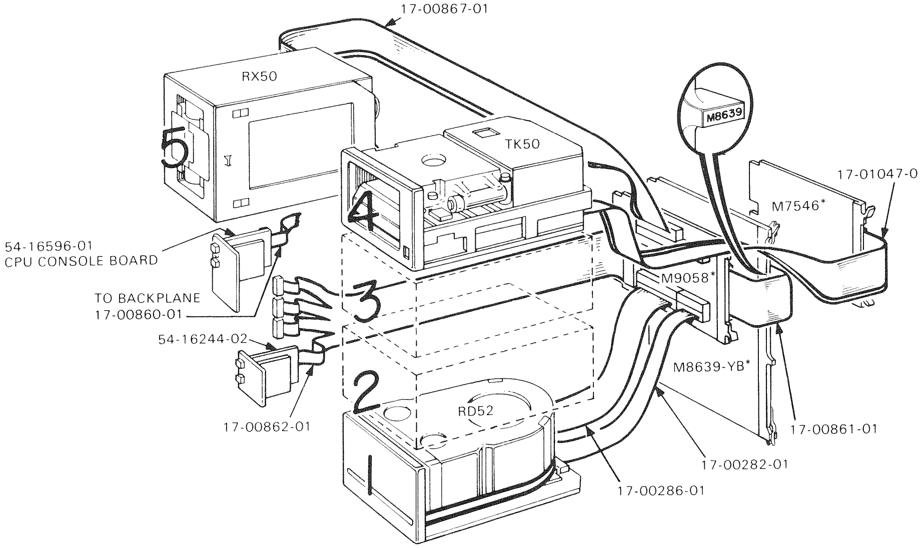


Figure 9-9 Signal Distribution Board Cabling

9.5 BACKPLANE

The BA123 has a four-row by 13-slot backplane that measures 27.9 × 19.9 cm (11 × 7.85 inches). The backplane implements the extended LSI-11 bus, which uses 22-bit addressing. This bus is usually referred to as the Q22-Bus.

Figure 9-10 shows the grant lines for the Q22-Bus interrupt and for Direct Memory Access (DMA). The C and D rows of slots 1–4 implement a separate CD interconnect.

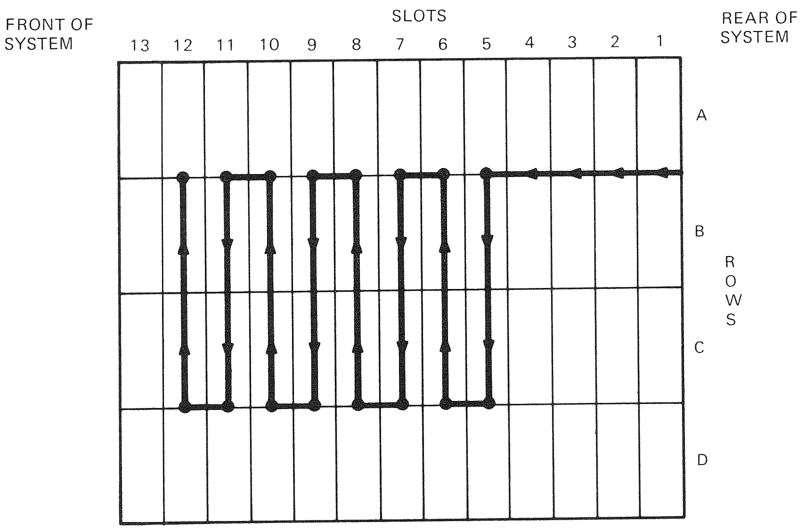


Figure 9-10 Backplane Grant Continuity

The first 12 slots of the backplane accommodate dual- or quad-height Q22-Bus-compatible modules.

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

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

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

Four 120-ohm resistor packs between backplane slots 12 and 13 terminate the Q22-Bus.

Slot 13 of the backplane provides space for two dual-height modules (rows A and B and rows C and D). The Q22-Bus is not implemented in this slot. Slot 13 provides +5 Vdc, +12 Vdc, ground, and a signal (DC OK) that indicates that the dc voltage from the power supply is stable.

The signal distribution board is installed in rows C and D. Rows A and B are available for future use.

NOTE
This backplane is a bounded system. An additional backplane cannot be connected to a BA123-A enclosure.

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

The backplane balances the load on each of the power supply's two regulators.

Three connectors on the backplane (Figure 9-11) provide the following functions:

- J1 – An 18-pin connector, receives the dc power and signals from regulator A in the power supply, and supplies the odd-numbered backplane slots and the resistor packs.
- J2 – An 18-pin connector, receives the dc power and signals from regulator B in the power supply, and supplies the even-numbered backplane slots.
- J3 – A 10-pin connector, provides the connection for the CPU console board cable.

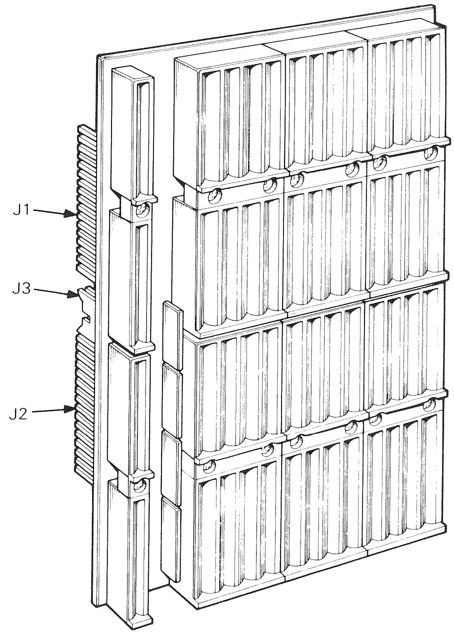


Figure 9-11 Backplane Connectors

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

1 Signal

2 Signal

3 +5 Vdc from regulator A

4 Ground

5 Ground

6 +5 Vdc from regulator B

7 Signal

8 Signal

Appendix A discusses the configuration rules for the backplane.

9.6 POWER SUPPLY

The power supply (Figure 9-12) is a 460-watt unit consisting of two regulators. Each regulator supplies power to one-half of the slots in the backplane (Section 9.5), and to mass storage devices inside the system.

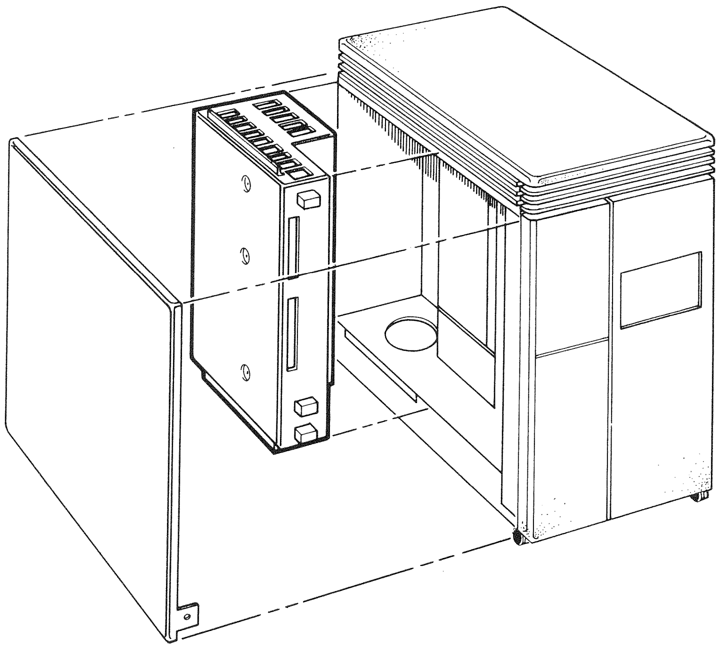


Figure 9-12 Power Supply

The power supply provides protection against excess voltage and current, and protection against temporary fluctuations in the ac supply. Table 9-3 lists the minimum and maximum currents supplied by each regulator.

Table 9-3 Regulators A and B Current and Power

Regulator	Power	Current at +5 Vdc	Current at +12 Vdc
A	230 W max.	4.5 A min. 36.0 A max.	0.0 A min. 7.0 A max.
B	230 W max.	4.5 A min. 36.0 A max.	0.0 A min. 7.0 A min.

NOTE
Total power used from each regulator must not exceed 230 watts. This means that maximum current at +5 Vdc and +12 Vdc cannot be drawn at the same time. Refer to Figure A-2 for further information.

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

The rear of the power supply contains a connector for remote power control (Figure 9-13). An ac input connector provides compatibility with international line cords and a circuit breaker protects the input power line. The voltage select (VOLT SEL) switch selects two ranges as follows:

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

NOTE

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

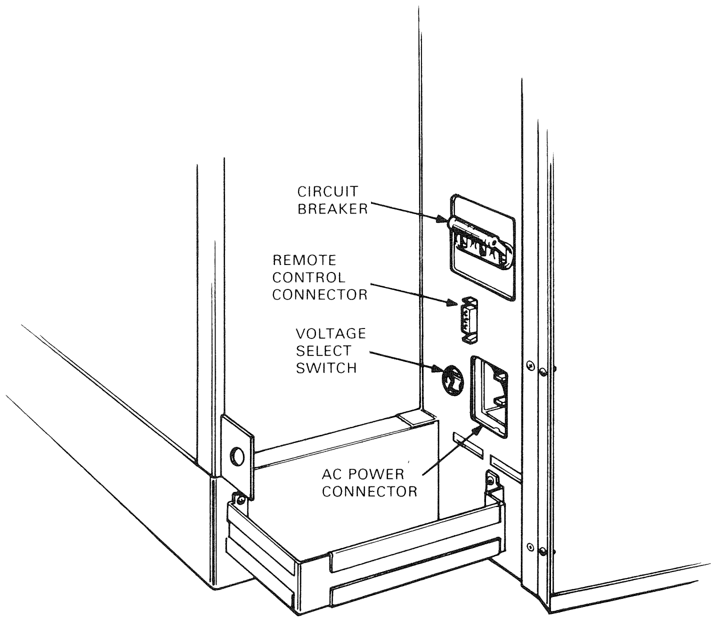
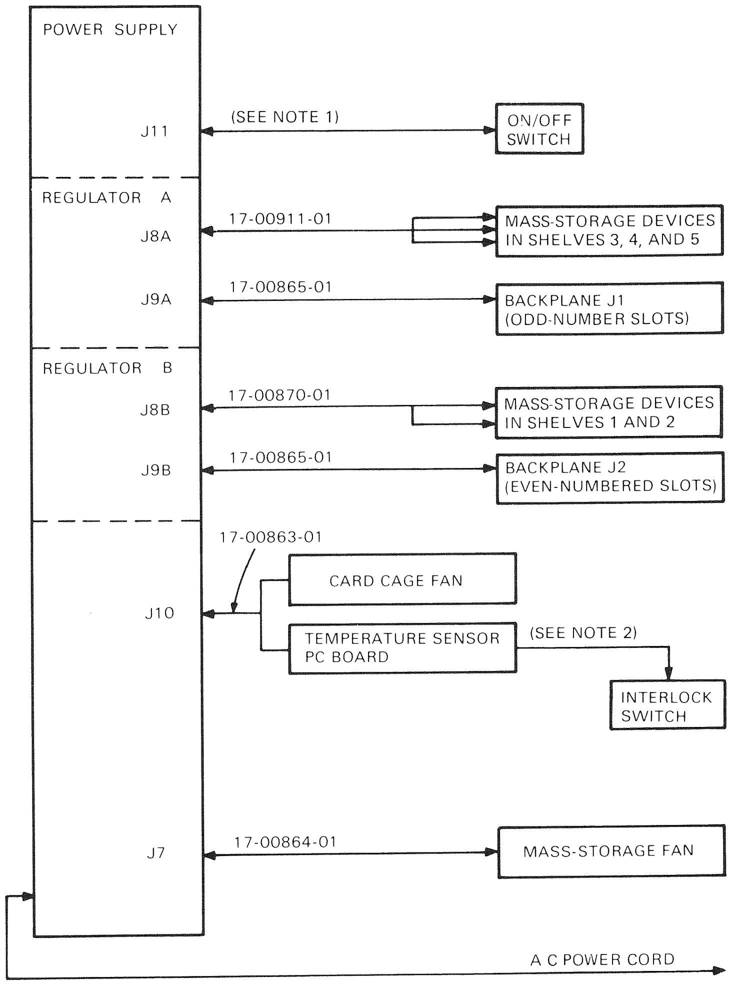


Figure 9-13 Circuit Breaker, Voltage Select Switch, Connectors (Rear View)

9.7 ELECTRICAL DISTRIBUTION

Figure 9-14 shows the electrical power distribution of the enclosure and the part numbers of the power cables.



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

Figure 9-14 Electrical Distribution

9.8 I/O DISTRIBUTION PANEL

External devices connect to the system through the rear I/O distribution panel of the BA123-A enclosure. The rear door provides access to the I/O distribution panel (Figure 9-15).

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. Chapters 5 and 6 provide cabinet kit information for modules that support external devices.

Filter connectors mount in the insert panels and the insert panels are installed in cutouts in the I/O distribution panel (Figure 9-15). The CPU Serial Line Unit (SLU) distribution panel insert is typically mounted in cutout A. Removable plates cover unused cutouts. The BA123-A rear I/O distribution panel provides a place to install up to ten insert panels, four of which can contain 50-pin connector insert panels.

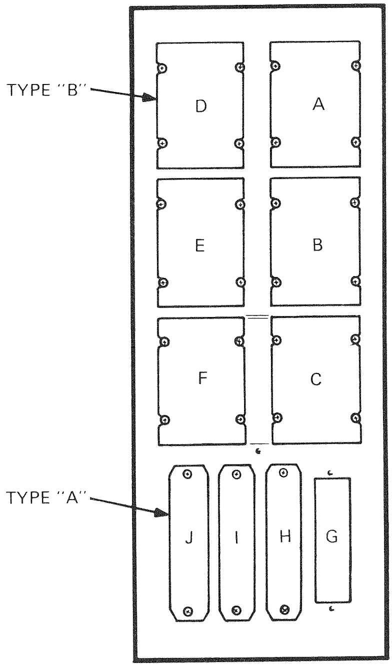


Figure 9-15 Rear I/O Panel

The rear I/O panel has ten cutouts as follows:

- Four type A cutouts: 5 × 8.1 cm (.6 × 3.2 inches)
- Six type B cutouts: 5.7 × 8.1 cm (2.25 × 3.2 inches)

Insert panels correspond to the I/O panel cutouts as follows:

- Type A: 2.5 × 10.2 cm (1 × 4 inches)
- Type B: 6.3 × 8.1 cm (2.5 × 3.3 inches)

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

Figure 9-16 shows typical type A and type B connectors, and the adapter plate.

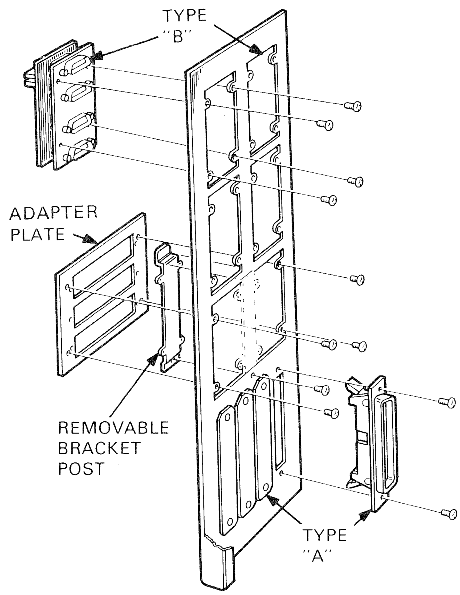


Figure 9-16 Filter Connectors and Adapter Plate

BA123-A FRU Removal and Replacement Procedures 10

10.1 INTRODUCTION

This chapter describes the removal and replacement procedures for the Field Replaceable Units (FRUs) in the BA123-A enclosure (Table 10-1, Figure 10-1).

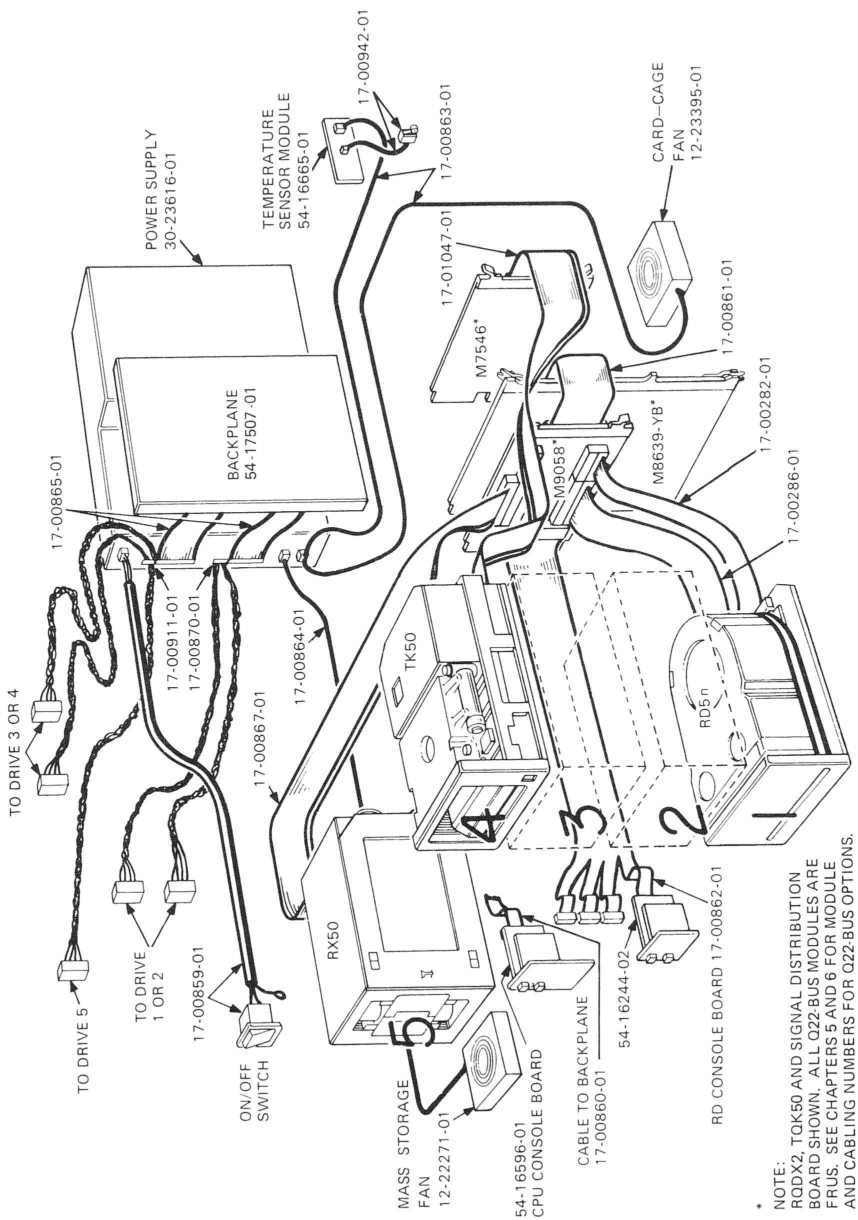
Table 10-1 BA123-A FRUs

Part Number	Description
17-00859-01	Switch, ac power to power supply, and cable from switch to power supply
17-00860-01	Cable, backplane to CPU console board
54-16596-01	CPU console board
17-00862-01	Cable, signal distribution board to 4 RD consoles
17-00282-01	Cable, 20 conductor, RD drive
17-00286-01	Cable, 40 conductor RD drive
54-16244-02	RD52 console
17-00861-01	Cable, 50 conductor, RQDX to signal distribution board
17-00867-01	Cable, signal distribution board to RX50
70-22300-01	Cable, TK50-A/TQK50 interconnect
54-16674-01	Signal distribution board (M9058)
12-23395-01	Fan, 12.7-cm, 5-inch (card-cage)
12-22271-01	Fan, 11.4-cm, 4.5-inch (mass storage)
17-00942-01	Switch, door interlock, and cable from switch to temperature sensor board
54-16665-01	Temperature sensor board
17-00863-01	Cable, power supply to card-cage fan and temperature sensor

Table 10-1 BA123-A FRUs (Cont.)

Part Number	Description
17-00864-01	Cable, power supply to mass storage fan
17-00865-01	Cable, regulator "A" to backplane
17-00865-01	Cable, regulator "B" to backplane
17-00870-01	Cable, regulator "A" to 2 drives via 2 plugs
17-00911-01	Cable, regulator "B" to 3 drives via 3 plugs
30-23616-01	Power supply
70-22019-00	Q22-Bus backplane, 13 slot, quad-height

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



* NOTE:
RQDX2, TQK50 AND SIGNAL DISTRIBUTION BOARD SHOWN. ALL Q22-BUS MODULES ARE FRUS. SEE CHAPTERS 5 AND 6 FOR MODULE AND CABLING NUMBERS FOR Q22-BUS OPTIONS.

Figure 10-1 BA123-A FRUs

10.2 REMOVAL OF THE EXTERIOR PANELS

The exterior panels must be taken off before beginning most removal and replacement procedures. The following two sections describe the removal of these panels. These sequences are referenced in the procedures that follow.

10.2.1 Removal of the Right-Side Panel

1. Turn the system off and unplug the ac power cord from the wall socket.
2. Open the rear door.
3. Loosen the captive screw that connects the right-side panel to the rear of the enclosure frame (Figure 10-2).
4. Pull the bottom of the panel out. This releases it from two snap fasteners.
5. Lift the panel slightly to release it from the lip at the top of the frame and remove the panel (Figure 10-3).

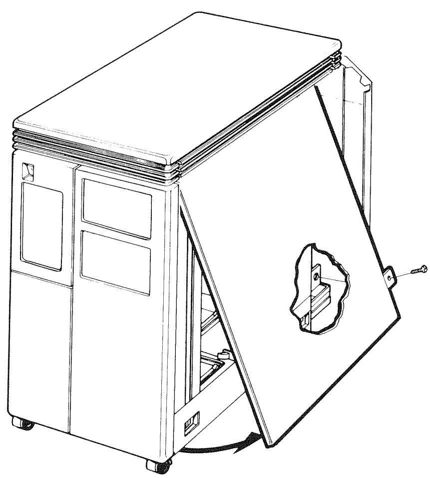


Figure 10-2 Right-Side Panel Unhooking

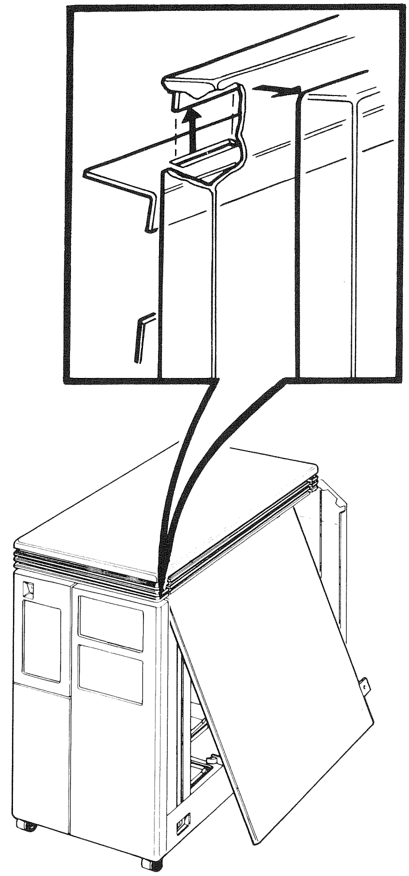


Figure 10-3 Right-Side Panel Removal

10.2.2 Removal of the Left-Side Panel

1. Turn the system off and unplug the ac power cord from the wall socket.
2. Open the control panel door.
3. Loosen the screw that connects the left-side panel to the front of the enclosure frame (Figure 10-4).
4. Pull the bottom of the panel out. This releases it from two snap fasteners.
5. Lift the panel slightly to release it from the lip at the top of the frame and remove the panel (Figure 10-5).

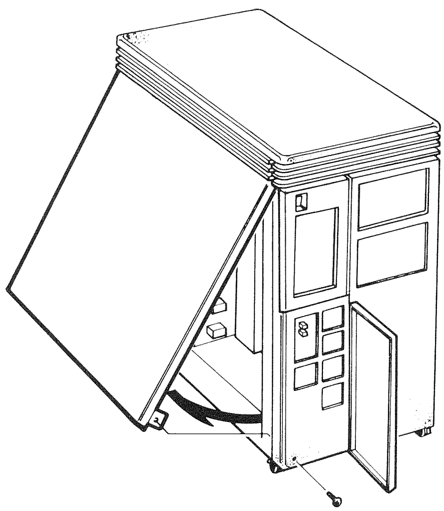


Figure 10-4 Left-Side Panel Unhooking

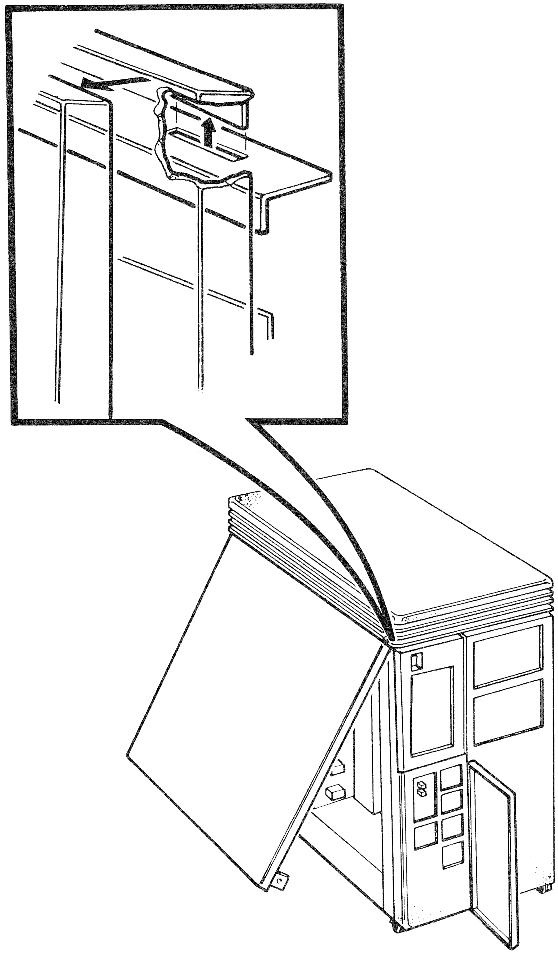


Figure 10-5 Left-Side Panel Removal

10.3 ON/OFF SWITCH REMOVAL

1. Remove the left-side panel as described in Section 10.2.2.
2. Unplug the on/off switch cable from the power supply.
3. Remove the nut that holds the cable's ground lead to the enclosure frame. Disconnect the ground lead.
4. Press the top and bottom of the on/off switch and push the switch and its cable out from the inside of the front panel (Figure 10-6).

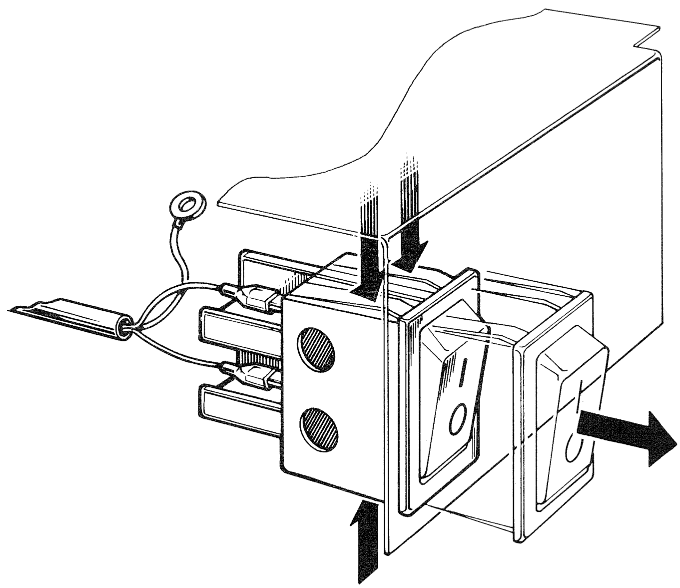


Figure 10-6 On/Off Switch Removal

10.4 CPU CONSOLE BOARD REMOVAL

1. Remove the left-side panel as described in Section 10.2.2.
2. Disconnect the ribbon cable from the CPU console board (Figure 10-7).
3. Remove the two screws that hold the CPU console board assembly to the control panel.
4. Remove the board from the plastic brackets.

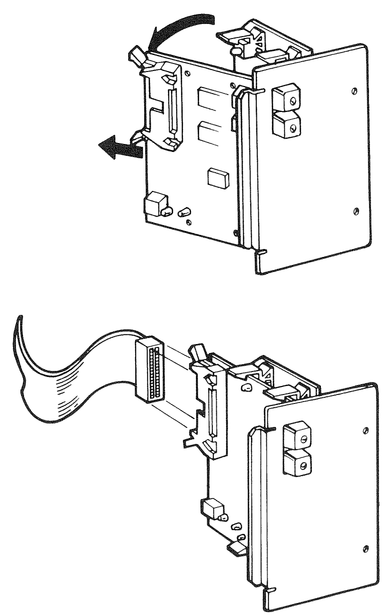


Figure 10-7 CPU Console Board Removal

10.5 MASS STORAGE DEVICE REMOVAL

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

CAUTION
Handle any RX50 diskette drive, RD5n fixed-disk drive, and TK50 tape drive with care. Dropping or bumping a drive can damage it.

Package any disk or tape drive to be returned in the replacement drive's shipping carton. If the fixed-disk drive shipping carton is not available, one may be ordered (DIGITAL P.N. 99-90045-01). Make sure you insert the cardboard shipping card in any diskette drive before transporting the drive.

NOTE
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 side panels as described in Sections 10.2.1 and 10.2.2.
2. Pull the front panel straight out. This releases it from four snap fasteners attached to the enclosure.
3. Disconnect all signal cables and dc power cables from the device.
4. Press the release tab below the front of the device and slide the device out of the shelf.

Use the following procedure to install an RD52 or RD53 fixed-disk drive

1. Make sure the jumper clip on a replacement RD52 fixed-disk drive is set to match the one you removed (Figure 10-8). Do not install a jumper clip on DS0; this setting is reserved for RX50 diskette drives.
2. Make sure you set the drive select switch on the rear of the read/write board of a replacement RD53 disk drive to match the one that you removed.
3. Reverse the removal procedure.

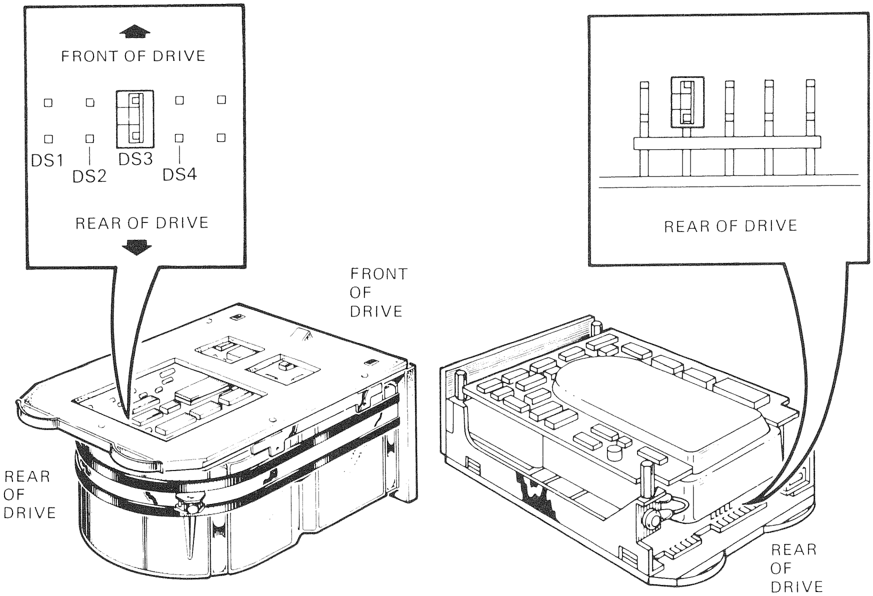


Figure 10-8 RD52 Jumper Clip Setting

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

Before you format a newly installed fixed-disk drive, write-protect any other RD5n disk drives that may be present. Remember to write-enable these additional RD5n disk drives when the formatting procedure is complete.

10.5.1 RD52 Main Printed Circuit Board (MPCB) Removal

NOTE
Replace the Main Printed Circuit Board (MPCB) only on RD52 disk drives with a part number 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 10-9).

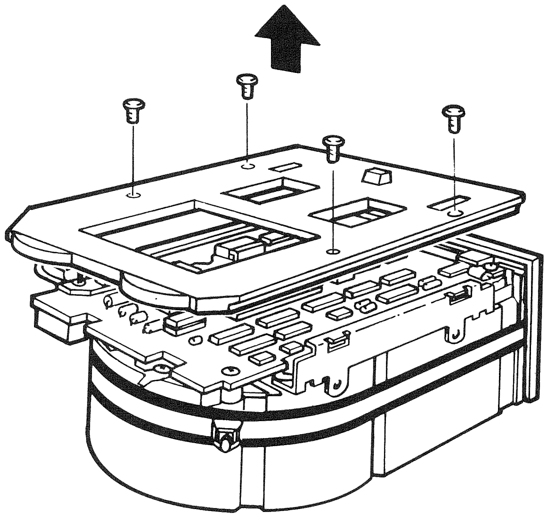


Figure 10-9 Slide Plate Removal

2. Unplug the two-pin connector (Figure 10-10).
3. Remove the two Phillips screws that attach the front bezel to the drive.

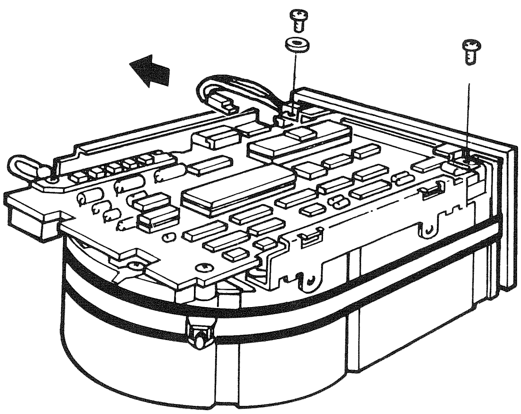


Figure 10-10 Two-Pin Connector and Screw Removal

4. Remove the front bezel by pulling it away from the drive. The bezel is held in place with pop fasteners (Figure 10-11).

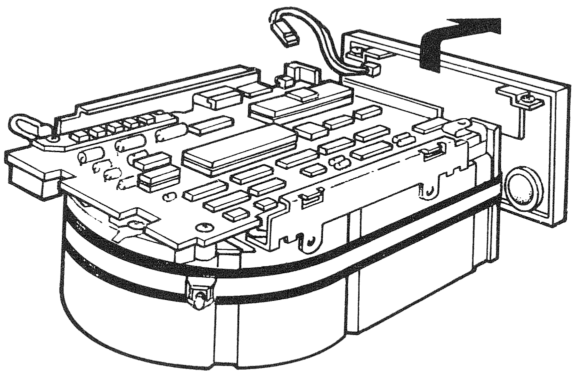


Figure 10-11 Front Bezel Removal

5. Remove the three Phillips screws from the heatsink, the grounding strip, and the corner opposite the heatsink (Figure 10-12).

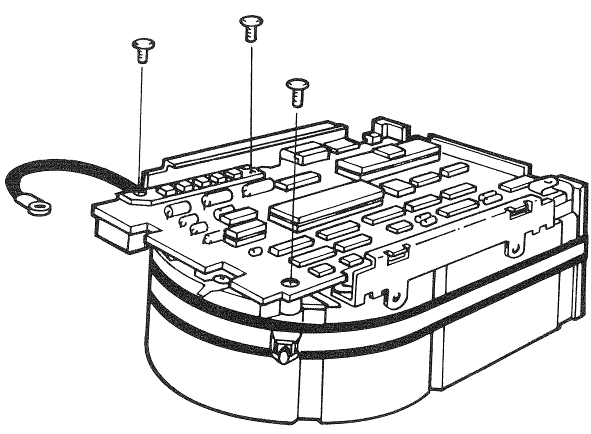


Figure 10-12 Removal of Phillips Screws from Heatsink

6. Lift the MPCB straight up until it clears the chassis. This disconnects P4, a 12-pin fixed plug (Figure 10-13).
7. Disconnect P5, a 10-pin connector.

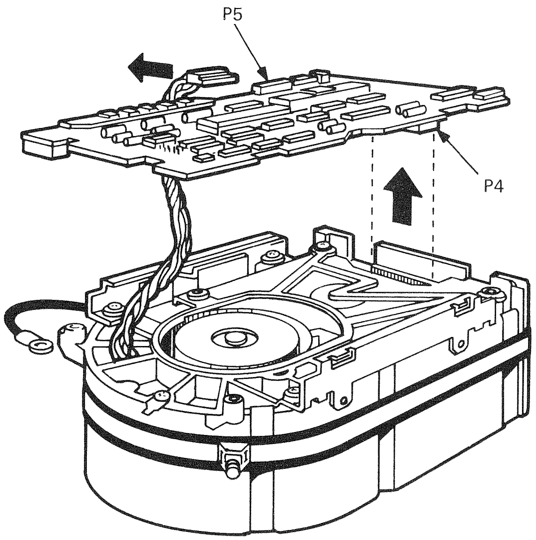


Figure 10-13 Main Printed Circuit Board Removal

10.5.2 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 10-14).
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 these with care.
5. Lift the read/write board out of the hinge slots.

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

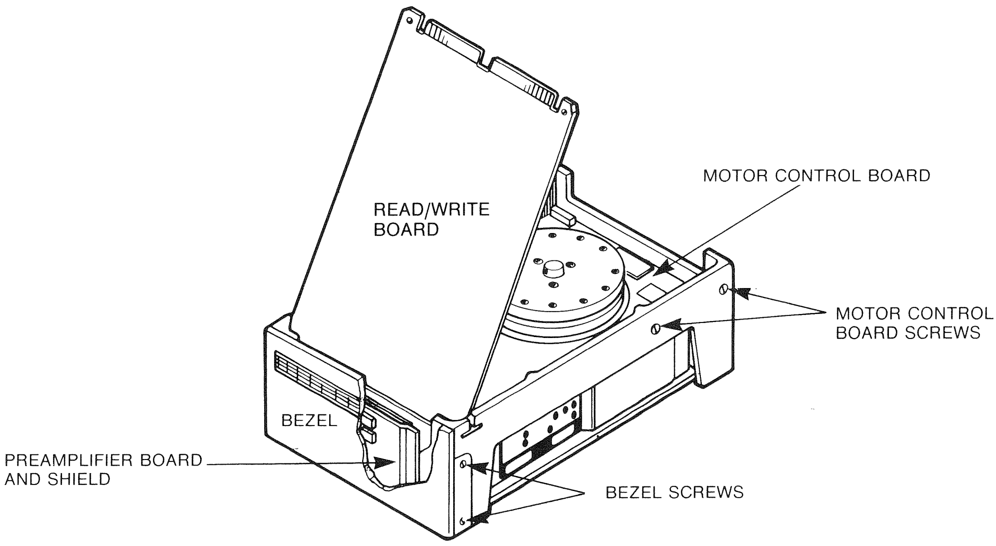


Figure 10-14 RD53 Read/Write Board Removal

10.6 FAN REMOVAL

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

10.6.1 Mass Storage Fan Removal

1. Remove the left-side panel as described in Section 10.2.2.

   NOTE
   Observe the alignment of the fan and power cable before removing them. Be sure to align the replacement fan and the power cable in the same direction.

2. Disconnect the dc power cable from the fan.
3. Remove the three screws that connect the fan's metal base plate to the enclosure frame (Figure 10-15).
4. Remove the four screws that connect the fan to the metal base plate.

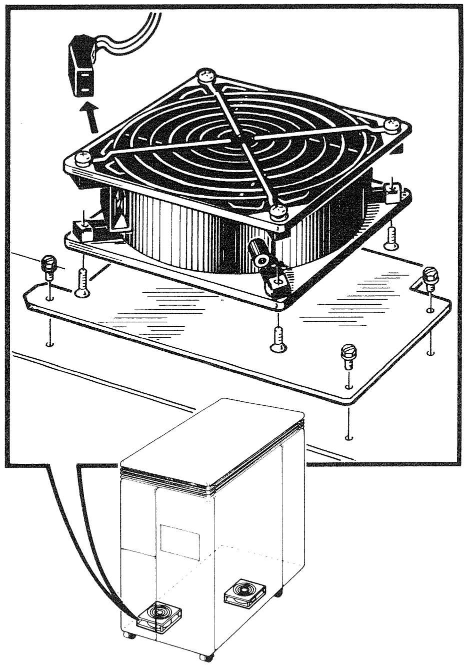


Figure 10-15 Mass Storage Fan Removal

10.6.2 Card-Cage Fan Removal

1. Remove the right-side panel, as described in Section 10.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.
3. Slide the tray below the card cage partially out (Figure 10-16).
4. Note that the cable's dc power plug is contoured to fit along the side of the fan. Disconnect the cable from the fan. When replacing the fan, be sure to align the cable the same way.
5. Remove the four screws that connect the fan to the tray.

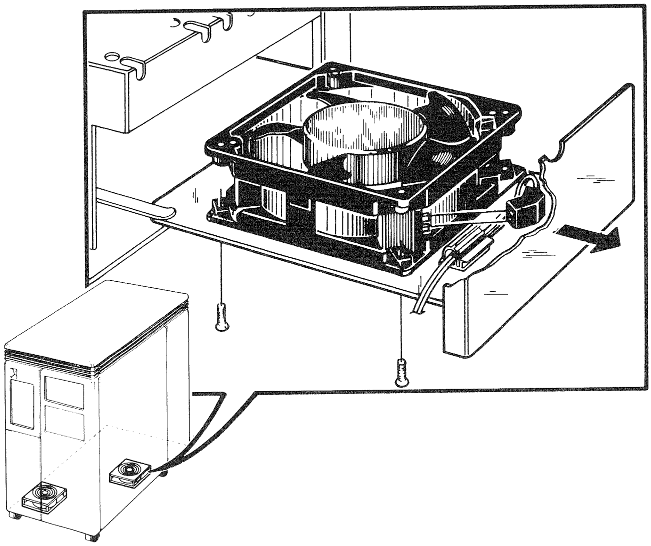


Figure 10-16 Card-Cage Fan Removal

10.7 MODULE REMOVAL

1. Remove the right-side panel as described in Section 10.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.

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

3. Slide the module partially out of the backplane (Figure 10-17).
4. Disconnect the cables. Make note of the alignment of any cables attached to the module.
5. Remove the module from the enclosure.

   NOTE
   Make sure the jumper and switch settings on the replacement module match the settings on the module you removed.

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

When removing modules from the card cage, carefully but firmly pull the levers that hold the module in place. When installing modules, make sure the levers latch properly to seat the module in the backplane.

Remove and install modules carefully to prevent damaging module components, damaging other modules, or 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.

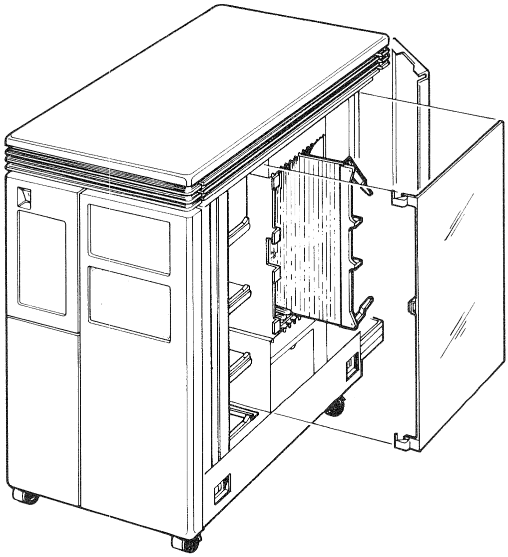


Figure 10-17 Module Removal

NOTE
If you install a dual-height module in slots 1 through 4 of the backplane, install it in the AB rows. A grant continuity card is not needed in the adjacent CD rows.

If you install dual-height modules in slots 4 through 12 of the backplane, install a grant continuity card (M9407) or a second dual-height module in the other two rows of the slot.

10.8 DOOR SWITCH REMOVAL

1. Remove the right-side panel as described in Section 10.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.
3. Disconnect the cable connecting the switch to the temperature sensor as shown in Figure 10-18.
4. Remove the two screws that connect the switch to the side of the card cage and remove the switch and the cable.

10.9 TEMPERATURE SENSOR REMOVAL

1. Remove the right-side panel, as described in Section 10.2.1.
2. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.
3. Disconnect the cable connecting the switch to the temperature sensor (Figure 10-18).
4. Disconnect the cable connecting the temperature sensor to the power supply.
5. Remove the temperature sensor from the four plastic brackets connecting it to the enclosure frame.

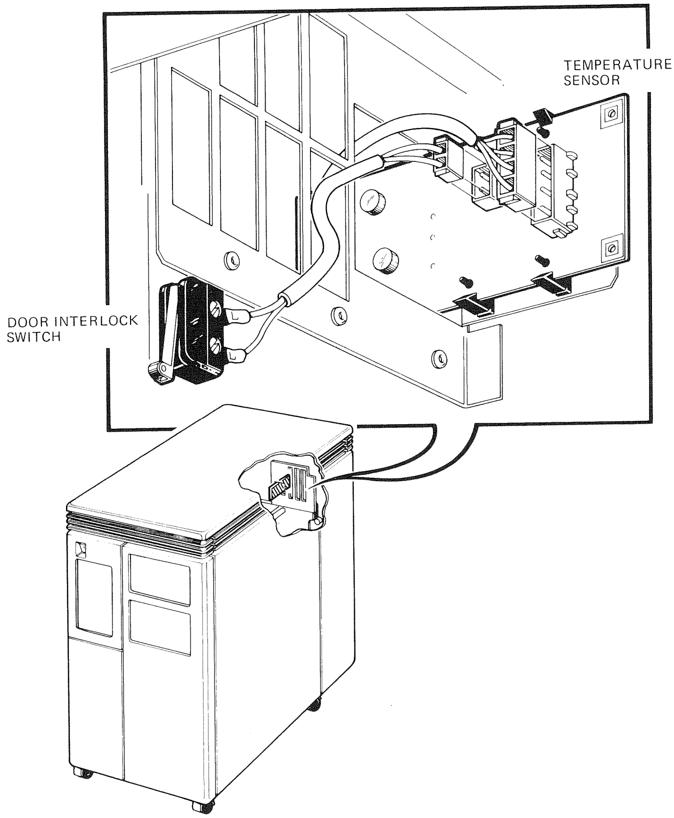


Figure 10-18 Temperature Sensor/Door Switch

10.10 POWER SUPPLY REMOVAL

1. Remove the left-side panel as described in Section 10.2.2.
2. Disconnect the ac power cable at the rear of the system and all cables from the power supply. Note the location and alignment of all cables attached to the power supply.
3. Remove the four 1/4-turn fasteners holding the power supply to the enclosure frame and remove the power supply (Figure 10-19).

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

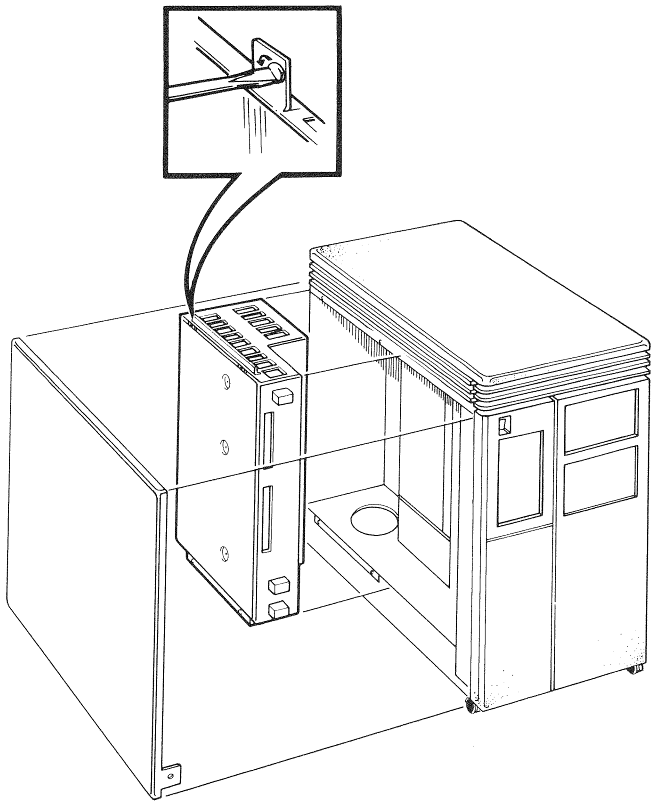


Figure 10-19 Power Supply Removal

10.11 BACKPLANE REMOVAL

1. Remove both side panels, as described in Sections 10.2.1 and 10.2.2.
2. Slide all modules partially out of the backplane, including the signal distribution board.
3. Remove the power supply as described in Section 10.10.
4. Remove from the enclosure frame the six screws that hold the metal plate located between the backplane and the power supply.
5. Lift the metal plate and the backplane out of the back of the card cage (Figure 10-20).
6. Remove the screws that hold the metal plate to the backplane.

Use the following procedure to replace the backplane:

1. Insert the screws that hold the metal plate to the backplane.
2. Place the backplane and the metal plate at the back of the card cage.
3. Insert a module in the first and the last card guide of the card cage.
4. Align the backplane so that the two modules can be fully inserted into the backplane. Insert the modules.

5. Insert the six screws that hold the metal plate to the enclosure frame.
6. Check the alignment of the backplane by inserting all of the system modules in their original slots.
7. Replace the power supply by reversing the procedure described in Section 10.10.

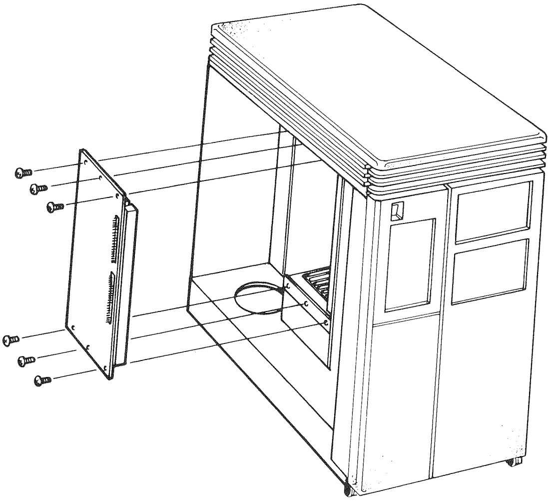


Figure 10-20 Backplane Removal

10.12 FILTER CONNECTOR AND INSERT PANEL REMOVAL

1. Turn the system off and unplug the ac power cord from the wall socket.
2. Open the rear door.
3. Disconnect any cables attached to the filter connector. Note where the cables were attached.
4. Remove the right-side panel as described in Section 10.2.1.
5. Remove the card-cage door by releasing the two clasps at the front end of the door and swinging the door open.

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

6. Disconnect any cables that connect the filter connector insert to modules inside the enclosure.
7. Remove the screws that hold the filter connector to the rear I/O panel (Figure 10-21).
8. Remove the filter connector.
9. Remove the four screws holding the panel insert to the rear I/O panel assembly and remove the insert.

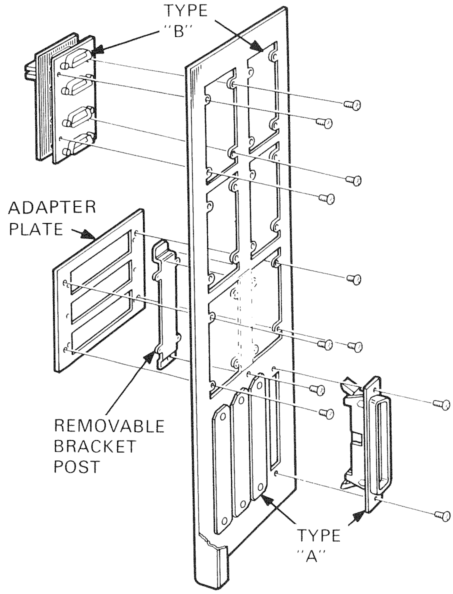


Figure 10-21 Filter Connector Removal

Appendix A
Configuration

A.1 CONFIGURATION RULES

When you configure a MicroPDP-11/23, MicroPDP-11/73, or MicroPDP-11/83 in a BA23-A or BA123-A enclosure, you must consider the following factors:

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

> **NOTE**
> **If the option has Q/CD jumpers, check the options documentation for the correct Q/CD jumper configurations. An incorrect jumper configuration can cause damage.**

A.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-BF and KDJ11-BC, -BB CPUs in slot 1.
- Install the KDJ11-BF CPU in slot 2 or 3.
- Install MSV11-P memory module(s) following the KDJ11-BB, -BC CPUs.
- Install MSV11-J memory module(s) immediately prior to the KDJ11-BF CPU.
- Install any dual-height modules in the A/B rows of slots 1 through 3 (slots 1 through 4 in a BA123-A enclosure). No grant continuity card is necessary.
- Install dual-height modules in either the A/B or C/D rows of slots 4 through 8 (slots 5 through 12 in a BA123-A enclosure). 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 A-1.

The relative priority of these options is based on their preferred interrupt and DMA priority.

Table A-1 Order of Modules in the BA23-A and BA123-A 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	Line printer	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	

A.3 BACKPLANE EXPANSION SPACE

The BA23-A backplane has eight slots available for you to install Q22-Bus compatible modules; the BA123-A backplane has 12 slots. The system configuration examples in this chapter show the slots occupied by modules and the number of open slots remaining.

A.4 BA23-A AND BA123-A POWER AND CURRENT REQUIREMENTS

Use the configuration worksheets (Figure A-1 for BA23-A systems, Figure A-2 for BA123-A systems) 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 A-2. Table A-3 lists the current drawn by the Q22-Bus for each module.

Table A-2 BA23-A Current and Power Limits

BA23-A Systems	BA123-A Systems
H7864-A power supply	30-23616-01 power supply
Current: at +5 Vdc = 36 amps at +12 Vdc = 7 amps	Current: at +5 Vdc = 36 amps at +12 Vdc = 7 amps
Power: 230 watts	Power: 230 watts maximum for each regulator.
H7864 power supply	
Current: at +5 Vdc = 36 amps at +12 Vdc = 6 amps	
Power: 230 watts	

A.5 REAR I/O DISTRIBUTION PANEL

The BA23-A rear I/O distribution panel contains two type A (1 × 4) and four type B (2 × 3) cutouts for mounting I/O panel inserts. The BA123-A has four type A, and six type B cutouts. You can convert the bottom two type B cutouts to provide for three additional type A cutouts. Table A-3 lists the type of inserts used for each module. Use the configuration worksheets (Figures A-1 or A-2) to keep track of the number of available inserts for your system.

Table A-3 BA23-A Power Requirements, Bus Loads, I/O Panel

Option	Module	Current +5 V	Current +12 V	Power (Watts)	Bus Loads ac	Bus Loads dc	I/O Inserts A=1 × 4, B=2 × 3
KDJ11-BC	M8190	5.5	0.1	28.7	2.3	1.1	1 × B
KDF11-BE	M8189	5.5	0.1	28.7	2.3	1.1	1 × B
MSV11-PK	M8067-K	3.45	–	17.25	2.0	1.0	–
MSV11-PL	M8067-L	3.6	–	17.5	2.0	1.0	–
DEQNA-KP	M7504	3.5	0.5	23.5	2.2	0.5	1 × A
DPV11-DP	M8020	1.2	0.3	9.6	1.0	1.0	1 × A
DRV11-JP	M8049	1.8	–	9.0	2.0	1.0	2 × A
DRV11-BP	M7950	1.9	–	9.5	3.3	1.0	2 × A
DRV11-LP	M7941	0.9	–	4.5	2.8	1.0	2 × A
LPV11-XP	M8027	0.8	–	4.0	1.4	1.0	1 × A
DLEV1-DP	M8017	1.0	1.5	23.0	1.6	1.0	1 × A
DLVJ1-LP	M8043	1.0	0.25	8.0	1.0	1.0	1 × B
DZV11-DP	M7957	1.2	0.39	10.7	3.9	1.0	1 × B
DHV11-AP	M3104	4.5	0.55	29.1	2.9	0.5	1 × B
DMV11-AP	M8053-MA	3.4	0.38	21.6	2.0	1.0	1 × B
DMV11-BP	M8053-MA	3.4	0.38	21.6	2.0	1.0	1 × A
DMV11-CP	M8064-MA	3.35	0.26	19.9	2.0	1.0	1 × B
DMV11-FP	M8053-MA	3.4	0.38	21.6	2.0	1.0	2 × A
DUV11-DP	M7951	1.2	0.39	10.7	3.0	1.0	1 × A
TQK25-KA	M7605	4.0	–	20.0	2.0	1.0	1 × A
TQK50	M7546	2.2	–	11.0	2.0	1.0	1 × A
KLESI-QA	M7740	3.0	–	15.0	2.3	1.0	1 × A

Table A-3 BA23-A Power Requirements, Bus Loads, I/O Panel (Cont.)

Option	Module	Current +5 V	Current +12 V	Power (Watts)	Bus Loads ac	Bus Loads dc	I/O Inserts A=1 × 4, B=2 × 3
RLV12-AP	M8061	5.0	0.10	26.2	2.7	1.0	1 × A
RQDX1	M8639-YA	6.4	0.25	35.0	2.0	1.0	–
RQDX2	M8639-YB	6.4	0.25	35.0	2.0	1.0	–
RX50-AA	–	0.85	1.8	25.9	–	–	
RD51-A	–	1.0	1.6	24.2	–	–	
RD52-A	–	1.0	2.5	35.0	–	–	
RD53-A	–	0.9	2.5	33.5	–	–	
TK50-AA	–	1.35	2.4	34.5	–	–	

1. Write the module and mass storage device name in the columns beside the backplane slot and mass storage space numbers.
2. Refer to Table A-3. Enter the +5 V and +12 V currents, power and I/O panel insert size for each module and mass storage device.
3. The column totals must not exceed the limits listed at the bottom.

NOTE
After you complete the worksheet for your system (Figure A-1 or A-2), go to Section A.6 to continue configuring your system.

ADD THESE COLUMNS

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

* IF MORE THAN TWO TYPE A FILTER CONNECTORS ARE REQUIRED, AN ADAPTER TEMPLATE (PN 74-27740-01) MAY BE USED. THIS WILL ALLOW THREE ADDITIONAL TYPE A FILTER CONNECTORS, BUT WILL REDUCE THE AVAILABLE TYPE B CUTOUTS TO TWO.

Figure A-1 BA23-A Configuration Worksheet

ADD THESE COLUMNS

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

*RECOMMENDED FOUR DRIVES MAXIMUM–TWO IN SHELVES 1 AND 2, TWO IN 3, 4 OR 5.

**IF MORE THAN FOUR 1 x 4 I/O PANELS ARE REQUIRED, AN ADAPTER TEMPLATE MAY BE USED.

Figure A-2 BA123-A Configuration Worksheet

A.6 MODULE CSR ADDRESSES/INTERRUPT VECTORS

Modules must be set to the correct CSR address and interrupt vector. Use Table A-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 contains a KDF11-B CPU 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 A-5 to determine the correct addresses for these devices.

A.6.1 Floating CSR Addresses

Table A-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 A-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 asterisk (*), the address of the following device(s) does not change.

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

Table A-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

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

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.

Substitute numbers below for the nnn in address 17760nnn to find the floating CSR address.

Table A-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			

NOTE
If the system you wish to configure does not resemble any of these common configurations, refer to the following list and Section A.9 for directions.

A.6.2 Floating Address Guidelines

- 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 Mass Storage Control Protocol (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, no more than one disk MSCP is present, and no more than one tape MSCP is present.

A.7 CONFIGURATION EXAMPLES

The BA23-A and BA123-A enclosures can be used in a variety of configurations. The following examples show typical base and advanced system configurations.

- Section A.7.1 – BA23-A system configuration
- Section A.7.2 – BA23-A advanced system configuration
- Section A.7.3 – BA123-A system configuration
- Section A.7.4 – BA123-A advanced system configuration

A.7.1 BA23-A System Configuration

Figure A-3 shows the cabling layout of a BA23-A base system in the following sequence:

Backplane → cabinet kit → I/O distribution panel

Figure A-4 shows the backplane setup for a system that can be expanded at a later time.

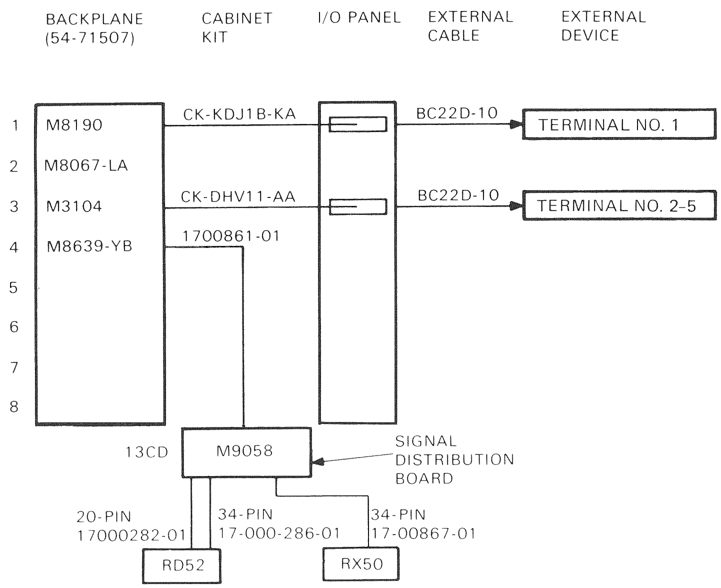


Figure A-3 Cable Connections for a BA23-A System

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 A-4 BA23-A Backplane Setup for an Expandable System

A.7.2 BA23-A Advanced System Configuration

Figure A-5 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 A-6 shows the expandability of the BA23-A enclosure. It includes the following features:

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

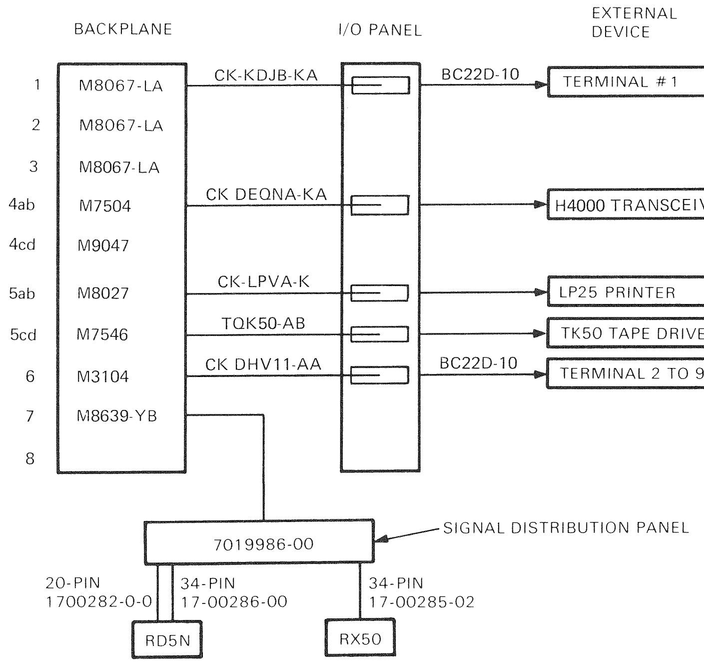


Figure A-5 Cable Connections for an Advanced Configuration

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

BACKPLANE SLOT NO.	ROW	I/O CUTOUTS (STANDARD I/O) (1 x4) 2	I/O CUTOUTS (STANDARD I/O) (2 x 3) 4
	A B C D		
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:	2	3
	AVAILABLE :	0	1

Figure A-6 BA23-A Advanced System

A.7.3 BA123-A System Configuration

Figure A-7 shows the cabling layout of a BA123-A base system in the following sequence:

Backplane → cabinet kit → I/O distribution panel

Figure A-8 shows the backplane setup for a system that can be expanded at a later time.

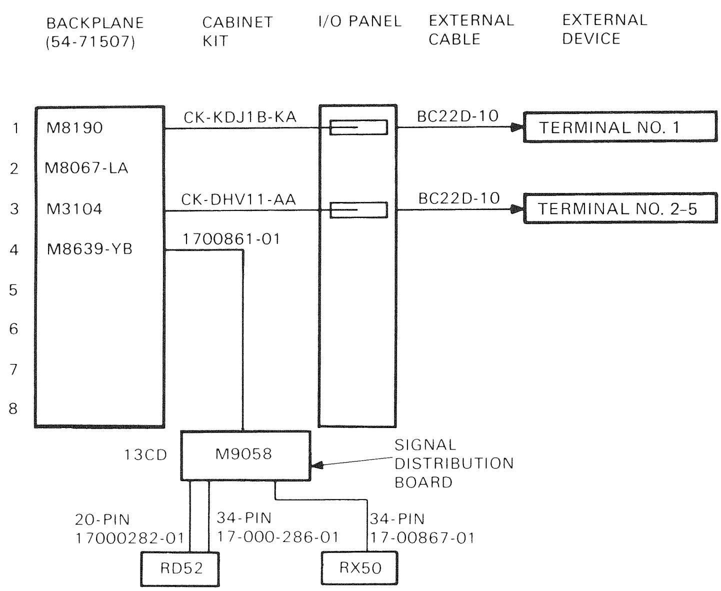


Figure A-7 Cable Connections for a BA123-A System

MASS STORAGE DEVICE: RX50
RD52

BACKPLANE SLOT NO.	ROW A	B	C	D	I/O CUTOUTS (STANDARD I/O) (1×4) 4	(2×3) 6
1	KDJ11-BC (QUAD) CPU					1
2	MSV11-PL (QUAD) 512 KB MEMORY					
3	DHV11 (QUAD) 8 LINE MULTIPLEXER					2
4	RQDX2 (QUAD) RD/RX CONTROLLER					
5						
6						
7						
8						
9						
10						
11						
12						
				TOTAL USED:	0	3
				AVAILABLE:	4	3

Figure A-8 BA123-A Backplane Setup for an Expandable System

A.7.4 BA123-A Advanced System Configuration

Figure A-9 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 A-10 shows the expandability of the BA23-A enclosure. It includes the following features:

- 2 Mbytes of main memory
- 2 RD52 fixed-disk drives, providing 60 Mbytes of mass storage
- 2 eight-line asynchronous multiplexers, providing ports for 16 terminals
- A DEQNA module to connect to Ethernet
- A DPV11 module to connect to a modem
- An LPV11 module for the LP25 printer
- A TQK50 tape drive for backup and restore

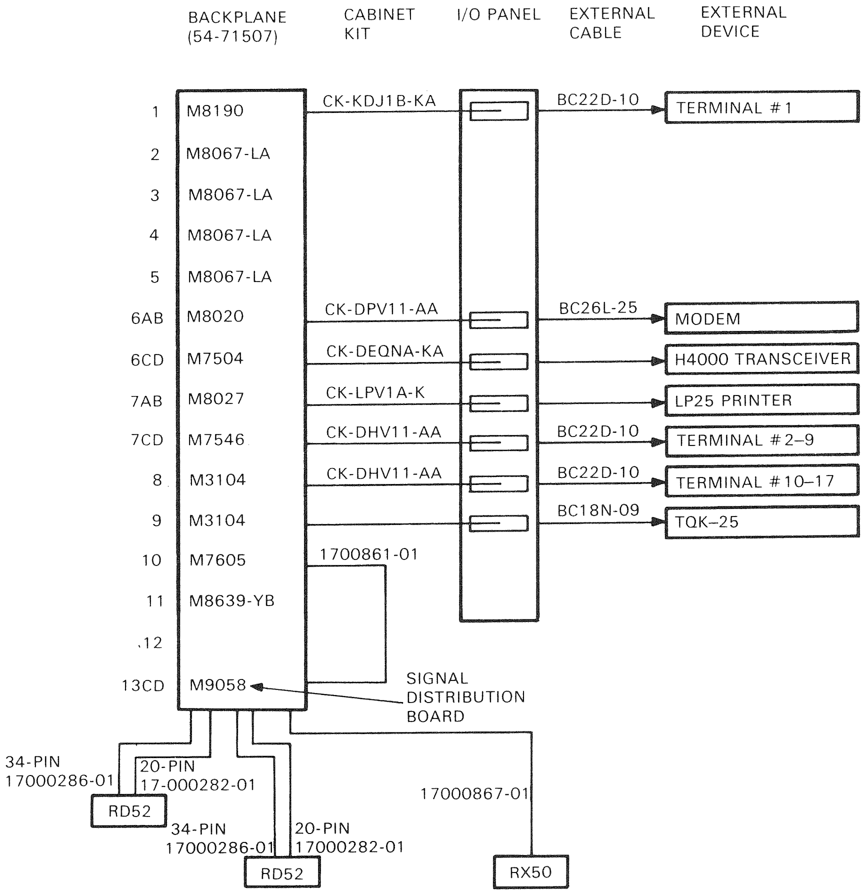


Figure A-9 BA123-A Cable Connections for an Advanced Configuration

MASS STORAGE DEVICES: RX50
RD52
RD52
BACKUP DEVICE: TQK50-AA

BACKPLANE SLOT NO.	BACKPLANE ROW A . B . C . D	I/O CUTOUTS (STANDARD I/O) (1X4) 4	(2X3) 6
1	KDJ11-B (QUAD) CPU		1
2	MSV11-PL (QUAD) 512 KB MEMORY		
3	MSV11-PL (QUAD) 512 KB MEMORY		
4	MSV11-PL (QUAD) 512 KB MEMORY		
5	MSV11-PL (QUAD) 512 KB MEMORY		
6	DPV11 COM (DUAL) DEQNA NET (DUAL)	2	
7	LPV11 PRT (DUAL) TQK50 CONT. (DUAL)	1	
8	DHV11 (QUAD) 8 LINE MUX.		2
9	DHV11 (QUAD) 8 LINE MUX.		2
10	RQDX2 (QUAD) RD/RX CONTROLLER		
11			
12			
	TOTAL USED:	3	5
	AVAILABLE:	1	1

Figure A-10 BA123-A Advanced System

A.8 PREPARE THE SETUP TABLE AND THE OPERATING SYSTEM

When your system is fully configured:

- Enter any devices you want to boot in the setup table (see 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) of CONFIG (configure) operation. Refer to the operating system software documentation for instructions.

A.9 BLANK CONFIGURATION WORKSHEET (SAMPLE)

This section provides instructions and a sample worksheet for generating floating CSR addresses for modules installed in Q-Bus systems. Samples are shown in Table A-6 for 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†	17760504
				DHV11	17760540

* DMSCP – Disk Mass Storage Control Protocol Device.

† TMSCP – Tape Mass Storage Control Protocol Device.

Table A-7 is a blank worksheet for you to copy and use when you determine the configuration of a system.

A.9.1 Instructions

Use the following procedure for generating floating CSR addresses for Q-Bus systems.

Table A-6 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.

A.9.2 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 A-6, 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 A-6 at ranks 26 and 27.

A.9.3 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 A-6 shows the CSR address of installed modules in square 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 A-6, 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 A-6).
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.

A.10 BLANK WORKSHEET

Use Table A-7 to configure your system if it does not match the common configurations shown in Table A-5.

Table A-6 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	27
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}**
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

Table A-7 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
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	40

Appendix B
The PDP-11/23 PLUS System

B.1 IDENTIFYING A PDP-11/23 PLUS SYSTEM

The PDP-11/23 Plus system contains a KDF11-BA CPU mounted in a BA11-S enclosure. The KDF11-BA (M8189) has diagnostic bootstrap ROMs, 23-339E2 and 23-340E2 installed. On startup, the system does a self-test and enters Octal Debugging Technique (ODT).

B.2 UPGRADING A PDP-11/23 PLUS SYSTEM

A KDF11-BA CPU can be field upgraded to MicroPDP-11/23 operation (KDF11-BE or BF) by installing new ROMs and changing jumpers.

B.3 FACTORY CONFIGURATION

Table B-1 shows the factory configuration of switches E102 and E114. Table B-2 shows the factory jumper configuration of the KDF11-BA and the jumper differences between the KDF11-BA and the KDF11-BE.

Table B-1 KDF11-BA Factory Switch Configurations

Switch S1 Number	(E102) Setting	Bootstrap/Diagnostic Control Function
1	On	Execute CPU diagnostic
2	On	Execute memory diagnostic
3	Off	DECnet boot disabled
4	On	Console test and dialog
5	Off	–
6	Off	–
7	On	RLO2 bootstrap program
8	Off	–
Switch S2 (E114) SLU Baud Rate Speed Select		
1	On	–
2	Off	Console SLU baud rate
3	Off	9,600
4	Off	–
5	On	–
6	Off	Second SLU baud rate
7	Off	9,600
8	Off	–

On = one = closed
Off = zero = open

Table B-2 KDF11-BA Factory Jumper Configuration

Jumper	State	Function
J4 to J5	In	Disables CPU HALT from console SLU break.
J6 to J7	In	For manufacturing use.
J8 to J9	In	For manufacturing use.
J18 to J19	In	CPU power-up mode = boot from location 773000.
J20 to J21	In	For manufacturing use.
J22 to J23*	In	ROMs are used (J23 to J24 must be removed).
J26 to J27	In	Connects output of console serial line driver to serial line.
J29 to J30	In	One stop bit for console SLU port.
J34 to J35	In	Connects LINMF(1)H to console SLU UART reset input.
J37 to J38	In	One stop bit for second SLU port.
J42 to J43*	In	On-board baud rate generator controls console SLU baud rate. External clock input from connector J1 is disabled.
J45 to J46*	In	On-board baud rate generator controls second SLU baud rate. External clock input from connector J2 is disabled.
W1	In	Provides grant continuity for BIAK signal.
W2	In	Provides grant continuity for BDMG signal.

* These jumpers are out for a KDF11-BE and -BF module. See Chapter 3 for more information.

All other jumpers are out.

B.4 JUMPER SWITCH FUNCTION DESCRIPTION

Tables B-3 to B-9 describe the function of the KDF11-BA jumpers and switches.

Table B-3 Break on Halt Jumper Configurations

Jumpers J3 to J4	J4 to J5	Break on Halt Feature
In	Out	Enabled
Out	In	Disabled

Stake J3 = DL1 FE H
Stake J4 = RQ HLT H
Stake J5 = ground
In = inserted
Out = not inserted

Table B-4 On-Board Device Selection Jumpers

Stake Number	Stake Name	Function
J10	Ground	Ground for other wire-wrap stakes.
J11	LTC ENBJ L	When grounded, the line clock interrupt enable flip-flop is set, and the LSI-11 bus BEVENT signal, not dependent on any other conditions, requests program interrupts.
J12	DL2 ADRJ L	When not grounded, the second SLU device and its vector addresses are as follows. Device Address Interrupt Vector RCSR 17776500 Receiver 300 RBUF 17776502 XCSR 17776504 Transmitter 304 XBUF 17776506

Table B-4 On-Board Device Selection Jumpers (Cont.)

Stake Number	Stake Name	Function
		When grounded, the device and vector addresses are as follows. Device Address Interrupt Vector RCSR 17776540 Receiver 340 RBUF 17776542 XCSR 17776544 Transmitter 344 XBUF 17776546
J13	DL2 DISJ L	When grounded, second serial line registers are disabled. When not grounded, device and vector addresses for the second SLU are determined by the status of jumper DL2 ADRJ L.
J14	DL1 DISJ L	When grounded, console serial registers are disabled. When not grounded, the device and vector addresses for the console SLU are as follows. Device Address Interrupt Vector RCSR 1777560 Receiver 060 RBUF 1777562 XCSR 1777564 Transmitter 064 XBUF 1777566 If DL1 DISJ L is grounded, the break on halt feature must be disabled.
J15	BDK DISJ L	When grounded, the boot/diagnostic ROMs, and the line clock registers are disabled.

Table B-5 Halt/Trap Jumper Configuration

Processor Jumper	Mode	Function
Out	Kernel	Processor enters console ODT microcode when it executes a HALT instruction.
In	Kernel	Processor traps to location 10(8) when it executes a HALT instruction.
X	User	HALT instruction decodes results to location 10(8) in a trap regardless of the status of the halt/trap jumper.

In = inserted
Out = not inserted
X = does not matter

Table B-6 Power-Up Mode Jumper Configurations

Jumpers J17 to J18	J18 to J19	Mode Number	Mode Name
Out	Out	0	PC@24, PC@26
In	Out	1	Console ODT
Out	In	2	Bootstrap
In	In	3	Extended Microcode

In = inserted
Out = not inserted

Table B-7 ROM or EPROM Jumper Configurations

Jumper From	To	Memory Type Installed ROM	EPROM	Function
J22	J23	Out	In	Connects +5 Vdc to pin 21 of the two ROM sockets.
J23	J24	In	Out	Connects BTRA 13 H to pin 21 of the two ROM sockets.

In = inserted
Out = not inserted

Table B-8 SLU Character Format Jumper Configurations

Console SLU from Stake	Second SLU from Stake	Character Format Selected
J36†	J28†	
In*	In*	Parity check enabled
Out	Out	Parity check disabled
J37	J29	
In*	In*	One-stop bit
Out	Out	Two-stop bit
J39†	J31†	
In*	In*	7-bit characters
Out	Out	8-bit characters
J40	J32	
In*	In*	Odd parity if J36(28) is in
Out	Out	Even parity if J36(28) is in

In = inserted
Out = not inserted

* Stake J38 is ground. When a jumper is in, it is connected from the named stake to J38.

† If J39(31) to J38 is out selecting 8-bit characters, J36(28) to J38 controlling parity must be out.

Table B-9 Switch S2 (E114) SLU Baud Rate Speed Select

Baud Rate	Console SLU S2-1	S2-2	S2-3	S2-4	Second SLU S2-5	S2-6	S2-7	S2-8
50	On	On	On	On	On	On	On	On
75	Off	On	On	On	Off	On	On	On
110	On	Off	On	On	On	Off	On	On
134.5	Off	Off	On	On	Off	Off	On	On
150	On	On	Off	On	On	On	Off	On
300	Off	On	Off	On	Off	On	Off	On
600	On	Off	Off	On	On	Off	Off	On
1,200	Off	Off	Off	On	Off	Off	Off	On
1,800	On	On	On	Off	On	On	On	Off
2,000	Off	On	On	Off	Off	On	On	Off
2,400	On	Off	On	Off	On	Off	On	Off
3,600	Off	Off	On	Off	Off	Off	On	Off
4,800	On	On	Off	Off	On	On	Off	Off
7,200	Off	On	Off	Off	Off	On	Off	Off
9,600*	On	Off	Off	Off	On	Off	Off	Off
19,200	Off	Off	Off	Off	Off	Off	Off	Off

On = one = closed
Off = zero = open

* Standard baud rate set by manufacturing.

B.5 BA11-S ENCLOSURE

The BA11-S enclosure is both a mounting box and an expander box designed for use with the PDP-11/23 PLUS system and extended LSI-11 (Q22-Bus) modules. The BA11-S enclosure mounts in a standard 48.3-cm (19-inch) wide equipment rack.

Each BA11-S enclosure comes with two cooling fans (a 70-CFM (Cubic Feet per Minute) fan cools the logic boards and a 100-CFM fan cools the power supply), an H403-B ac input unit, a power supply, and a nine-slot backplane that accepts both dual- and quad-height Q22-Bus modules (Figure B-1). The terms extended LSI-11 and Q22-Bus are used synonymously. The term Q22-Bus is used in the rest of this chapter.

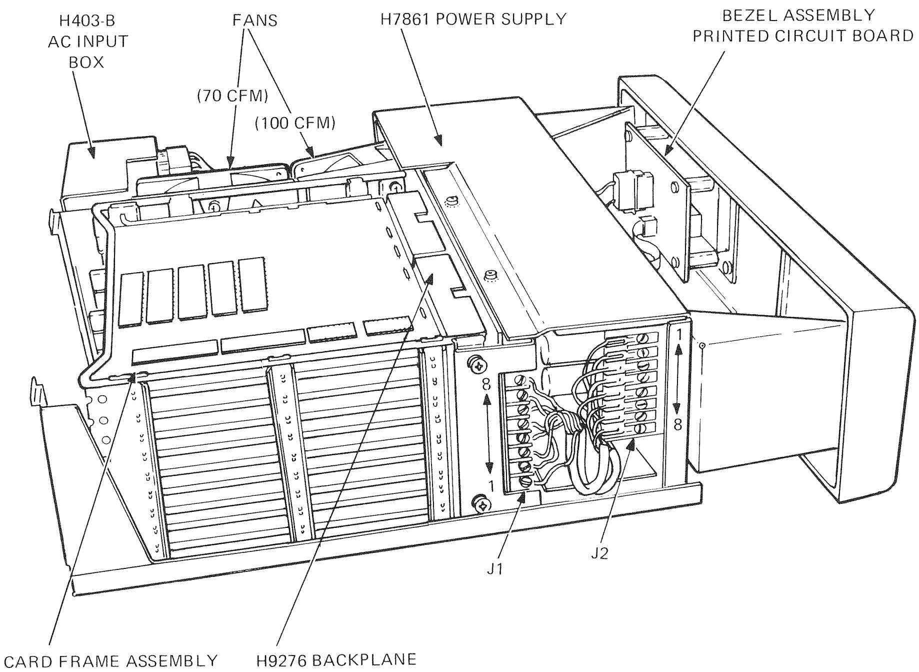


Figure B-1 BA11-S Major Assemblies

The BA11-S enclosure is available for both 120 V and 240 V systems. Either a front bezel equipped with operating switches and indicators, or a blank front bezel (for expander box use) is available.

B.6 BA11-S SPECIFICATIONS

Dimensions (Including Bezel)

Width	48.3 cm (19 in)
Height	13.2 cm (5.19 in)
Depth (Without mounting brackets)	57.8 cm (22.75 in)

Environmental Conditions

Operating Temperature*	5° to 60°C (41° to 140°F)
Operating Humidity	10% to 95%, with a maximum wet bulb temperature of 32°C (90°F) and a minimum dew point of 2°C (36°F)

Input Voltage

BA11-SA, SC, SE	120 Vac
BA11-SB, SD, SF	240 Vac

Input Current

BA11-SA, -SC, -SE	6 A max.
BA11-SB, -SD, -SF	3 A max.
Output Voltage	+5 V at 2 A to 35 A +12 V at 0.0 A to 5 A

When the equipment is being operated at the maximum allowable temperature, air flow must maintain air temperature rise to a maximum of 7°C (44.5°F).

* The maximum allowable operating temperature is based on operation at sea level. Reduce the maximum operating temperature by a factor of 1.8°C/100 m (1.0°F/100 ft) for operation at higher altitude sites.

B.7 BA11-S DESCRIPTION

Figure B-2 shows the BA11-S with the enclosure cover removed. The ac input box, power supply, and H9276 logic assembly (which includes the fans and the backplane) attach to the enclosure base. The front bezel attaches to the power supply. The power supply assembly is hinged to the base and can be swung open to expose the internal components.

The complete assembly can be removed from the base and replaced. The H349 I/O distribution panel drops down to allow installation of Q22-Bus modules in the backplane.

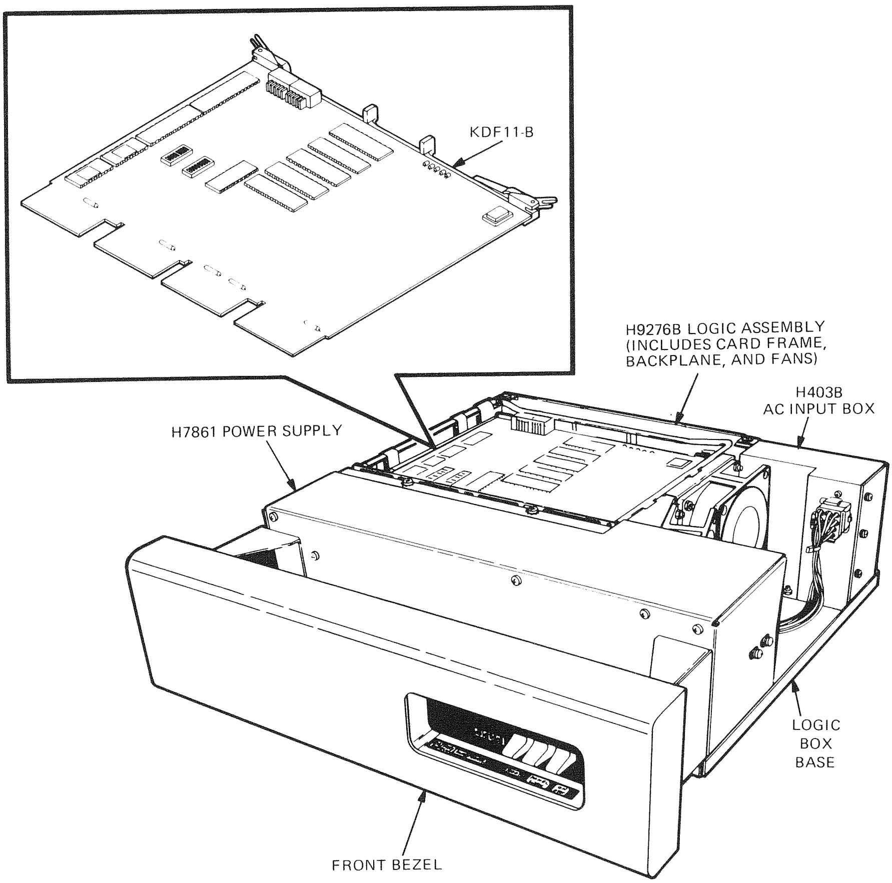


Figure B-2 BA11-S Enclosure with Cover Removed

When the enclosure is mounted in an equipment rack, the cover attaches to the rack with mounting hardware. The enclosure base slides into the rackmounted cover. A restraint cable attaches between the H403-B ac input box and the rack frame to prevent the base from being pulled completely out of the cover.

B.7.1 Controls

The BA11-S enclosure can have either a blank front bezel or one equipped with a control panel that consists of three switches and three indicators. Figure B-3 shows the front bezel switches and indicators (the spare indicator is not used by PDP-11/23 PLUS systems). Table B-10 lists the switches and indicators and describes the function of each.

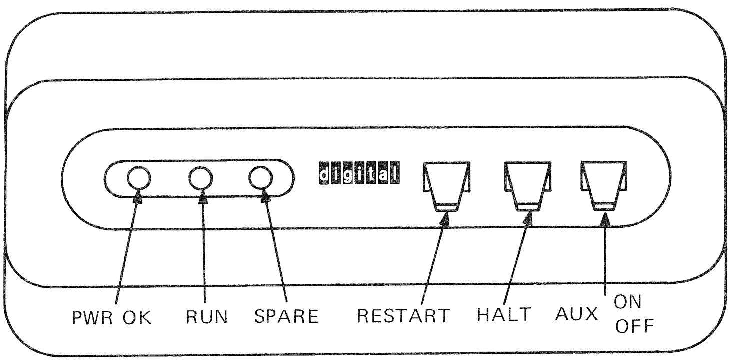


Figure B-3 Front Panel Switches and Indicators

Table B-10 BA11-S Front Panel Controls and Indicators

Controls/ Indicators	Function
AUX ON/OFF	Can be used for any needed function (switch is rated at 48 Vdc, 1 A). Two specific functions follow: When the BA11-S is wired to control system power, the AUX switch turns the power on and off. When the BA11-S is not wired to control system power, the switch can control the LTC signal, disabling the signal when the switch is in the off position.
HALT	In the down position, the **HALT** switch forces the CPU to suspend usual program execution, enables console ODT microcode operation, and permits single-instruction execution. To continue program execution, return the **HALT** switch to the up position and enter a **P** command from the console terminal. Refer to the Microcomputer Processor Handbook for a description of console ODT commands.
RESTART	When you press the momentary **RESTART** switch, the CPU automatically carries out a power-up sequence. You can then reboot the CPU from the front panel.
PWR OK	The PWR OK indicator is lit when the power supply is generating the correct dc voltages.
RUN	The RUN indicator is lit when the CPU is executing programs.

In addition to the front panel switches and indicators, there is an on/off switch and a primary voltage selection switch, both on the ac input box.

If you use a power controller to apply primary power to the BA11-S enclosure, the on/off switch stays in the on position.

If a power controller is not used, you can use the switch to turn power on and off.

B.7.2 Bezel Assembly Printed Circuit Board

The bezel assembly printed circuit board (Figure B-4) contains four jumper positions: W1, W2, W3, and W4. The factory configuration has jumpers inserted in positions W1, W2, and W4; W3 is left blank. Table B-11 describes the condition under which jumpers can be inserted or removed.

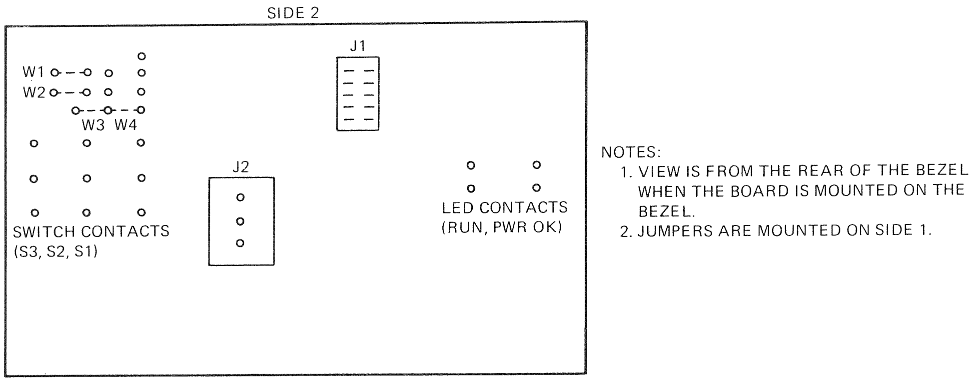


Figure B-4 Bezel Assembly Printed Circuit Board

Table B-11 Bezel Assembly Jumpers

Jumper	Jumper(s) In	Jumper(s) Out
W1, W2	When the bezel AUX ON/OFF switch is used to control the power supply-generated LTC signal. (When the switch is in the AUX ON position, LTC-initiated interrupts are enabled.	When the bezel AUX ON/OFF switch is used to turn the system power controller on and off.
W3	When the bezel is to be mounted on an expander box. (W3 permits the HALT switch to light the RUN indicator.)	When the bezel is part of the main box containing the CPU.
W4	When the bezel is part of the main box. (W4 enables the S RUN L signal to light the RUN indicator.)	When the bezel is mounted on an expander box.

The bezel assembly attaches to two brackets mounted on the power supply frame. Figure B-5 shows the bracket on the right front side and the hardware that holds the bezel to the bracket. Do not open the power supply to remove the bezel assembly; it is shown open in Figure B-5 for illustration purposes only.

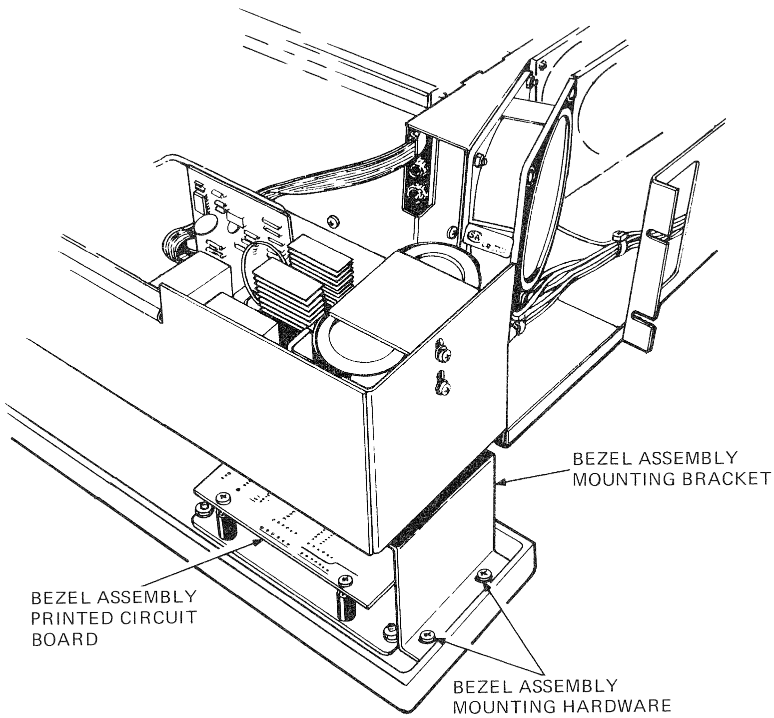


Figure B-5 Bezel Assembly

B.7.3 Ac Input Box (H403-B)

The ac input box is located in the rear of the BA11-S enclosure and is bolted to both the base and the door assembly. Power to the H403-B comes from the ac mains by either a 120 V line cord or a 240 V line cord.

The ac input box (Figure B-6) includes an ac input connector, a circuit breaker, and a line filter. It also includes a voltage select switch that makes the correct connections to the fans and the power supply for both the 120 Vac and 240 Vac line voltages.

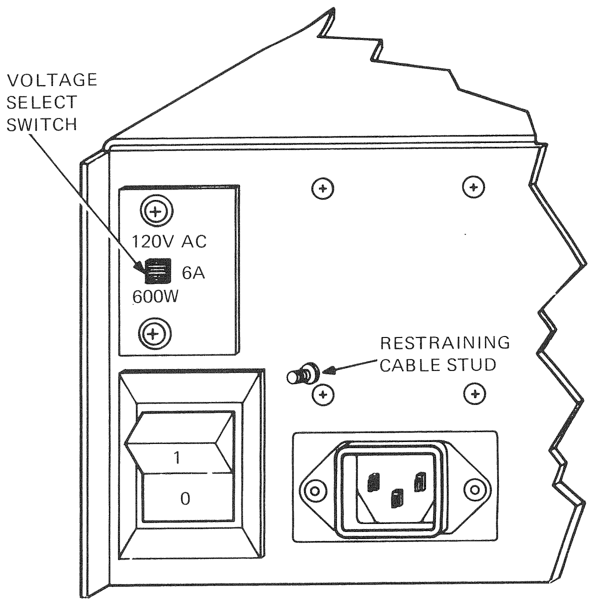


Figure B-6 BA11-S Voltage Selection Switch

The output of the box is taken to the fans and the power supply by an ac power harness. Connectors P1 and P4 of the harness are 12-pin and 9-pin connectors in that order. P2 and P3 are molded ac plugs that break out of the harness to plug into terminals on the fans.

B.7.4 H7861 Power Supply

The H7861 power supply is located on the front of the BA11-S enclosure. It attaches to the enclosure with two screws and two hinges. When you remove the two screws, you can tip open the power supply on the hinges, allowing access to the printed circuit boards mounted within the power supply.

To remove the power supply, remove the screws, unlatch the hinges, and disconnect a maximum of four cables (three, if a blank front panel is used).

Refer to Table B-12 for H7861 power supply specifications.

Table B-12 H7861 Power Supply Specifications

Item	Specifications
Current Rating	5.5 A at 120 V rms 2.7 A at 240 V rms
Inrush Current	100 A peak, for ½ cycle at 128 V rms or 256 V rms
Apparent Power	630 VA
Power Factor	The ration of input power to apparent power shall be greater than 0.6 at full load and low input voltage
Output Power	+5 Vdc ±150 mV, at 36 A (a minimum of 2 A of +5 Vdc power must be drawn to ensure that the +12 Vdc supply regulates correctly)
Power Up/Down Characteristics	+12 Vdc, at ±360 mV, at 5 A
Static performance	
Power up	BDCOK H goes high: at 75 Vac BPOK H goes high: at 85 Vac
Power down	BPOK H goes low: at 80 Vac BDCOK H goes low: at 75 Vac
Dynamic performance	
Power up	3 ms (min.) from dc power within specification to BDCOK H asserted
	70 ms (min.) from BDCOK H asserted to BPOK asserted
Power down	4 ms (min.) from ac power Odd to BPOK H negated
	4 ms (min.) from BPOK H negated to BDCOK H negated
	5 μs (min.) from BDCOK H negated to dc power out of specification

Three printed circuit boards contain all the power supply components. The control board and the power monitor board are installed in connectors on the master board.

B.7.4.1 Control Board – The control board circuits monitor the regulated output voltages from the master board, compare them to reference voltages, and feed them back to the main converter. If either regulated voltage varies, the appropriate control circuit varies the duty cycle of the rectangular-wave as needed. Adjustment potentiometers are provided in each control circuit.

The signals generated on the control board are sent to the backplane and to the front bezel assembly by two different cable assemblies.

B.7.4.2 Power Monitor Board – The power monitor board generates the BPOK H and BDCOK H signals that enable the CPU to carry out specific power-up and power-down operations. A clock generator produces the line-time clock signal. This signal generates vectored (at the line frequency) at the CPU.

B.7.4.3 Master Board – The H7861 power supply master board contains an ac input circuit, the +5 V and +12 V regulators, and a +12 V start-up supply. The ac input includes a thermostat that protects the supply from too much heat. The regulated dc voltages generated on the master board are sent to the H9276 backplane through a dc harness that connects on both ends to screw terminals.

B.7.5 H9276 BACKPLANE

The H9276 backplane accepts both dual- and quad-height modules and contains nine slots of four rows of connectors each. Rows A and B of each slot supply the Q22-Bus signal. The pins of the C and D rows are not bussed; however, the pins of adjacent slots are connected.

The backplane supports Q-Bus modules that support 18-bit and 22-bit addressing.

There are three jumpers (Figure B-7) on the H9276 backplane; W1, W2, and W3. Table B-13 summarizes the jumper settings.

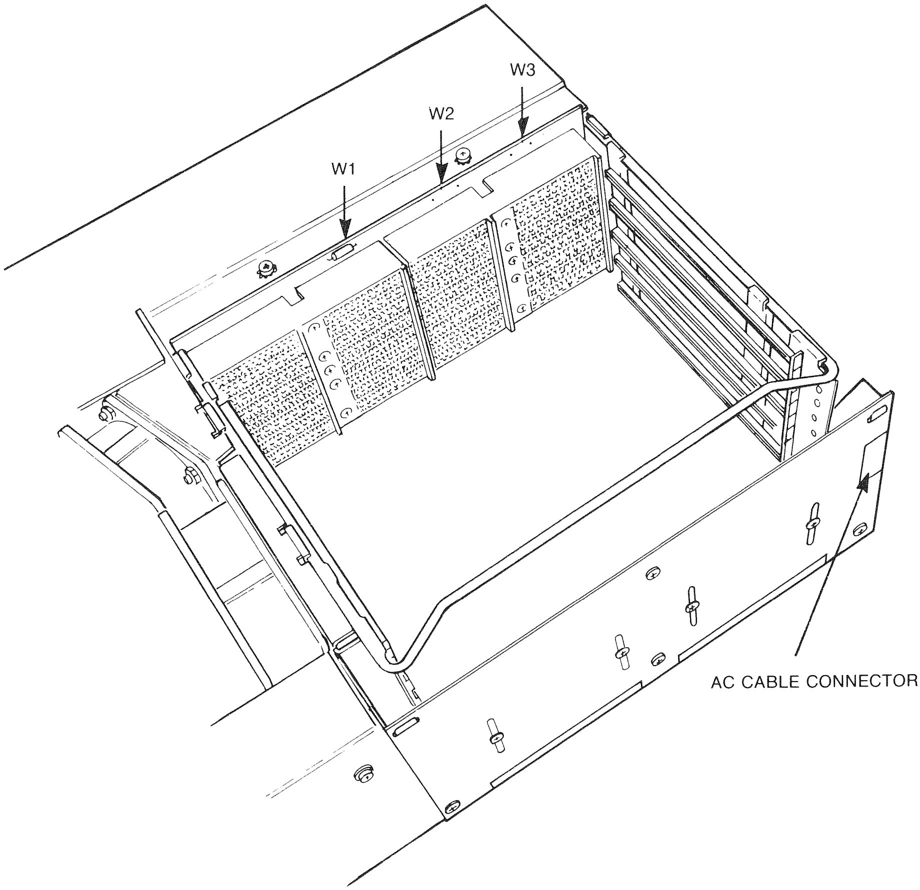


Figure B-7 H9276 Backplane Jumpers

Table B-13 H9276 Backplane Jumper Settings

Jumper	Jumper(s) In	Jumper(s) Out
W1	When the H7861 power-supply-generated LTC signal is used to assert the Q22-Bus BEVENT L signal (inserted for CPU box)	When the line time clock should not source BEVENT L, such as when an external source is used instead
W2, W3	Usually unused	Unused

When a BA11-S enclosure is used in multiple-box systems, the W1 jumper must be inserted in the backplane of the first box in the system, and removed from all others.

B.7.6 H349 I/O Distribution Panel

External devices connect to the PDP-11/23 PLUS through the rear H349 I/O distribution panel mounted on a BA11-S enclosure (Figure B-8).

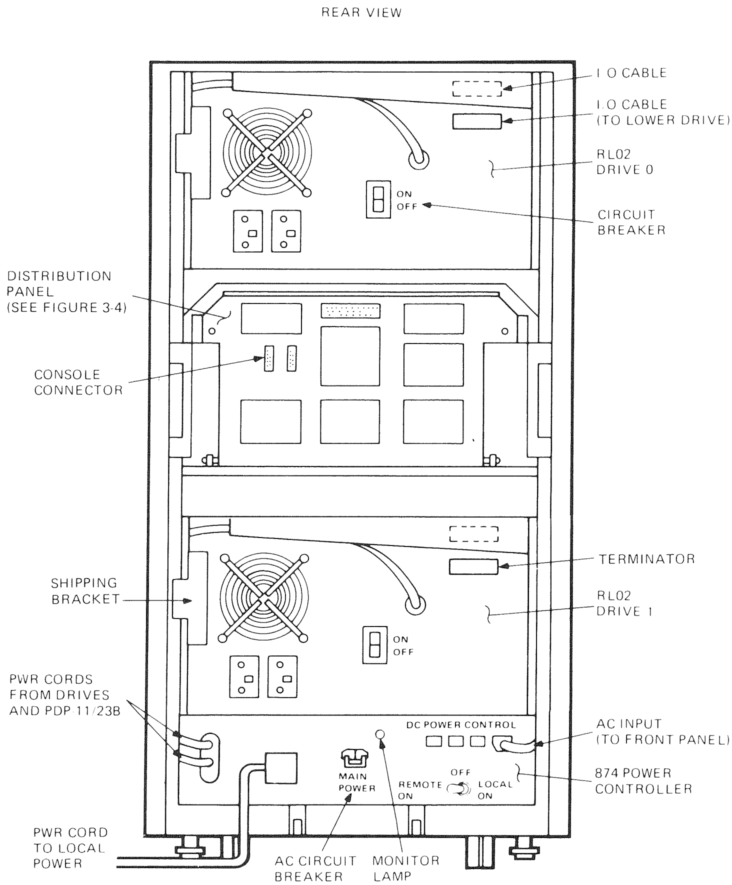


Figure B-8 PDP-11/23 PLUS System (Rear View)

The following terms, which appear in other documents, are interchangeable with the term "I/O distribution panel."

- Bulkhead
- I/O Connector Panel
- Connector Panel
- Patch and Filter Panel
- Distribution Panel
- Filter Connector Panel

B.7.6.1 Insert Panels and Filter Connectors – The H349 I/O distribution panel has 10 cutouts that provide a place to install up to 15 insert panels (Figure B-9). Mounting locations J6 and J7 accommodate the two KDF11-BA or KDF11-BF serial line connectors (one assembly).

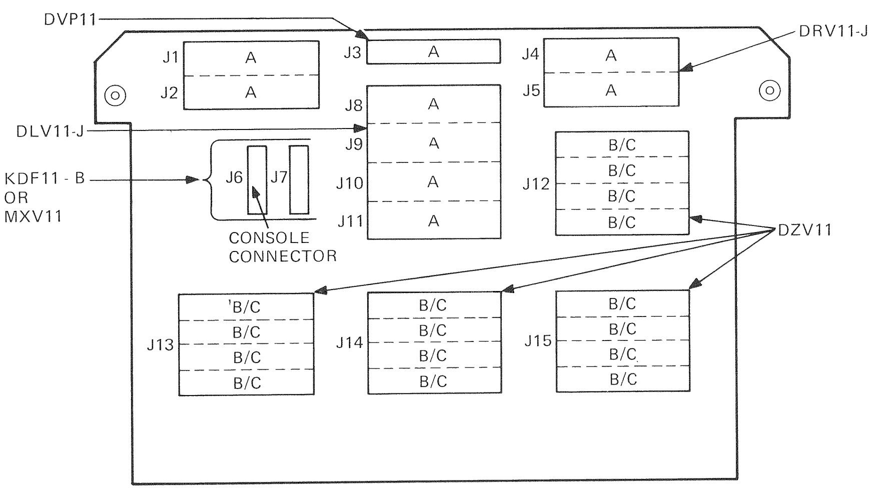


Figure B-9 H349 I/O Distribution Panel

The mounting locations accept nine type A, 40-pin or 50-pin filter connectors and four type B, four-channel EIA insert panels (Figure B-10). There is one large opening for a variety of user applications.

NOTE
Cover plates must be installed over unused openings on the I/O distribution panel to prevent RF leakage.

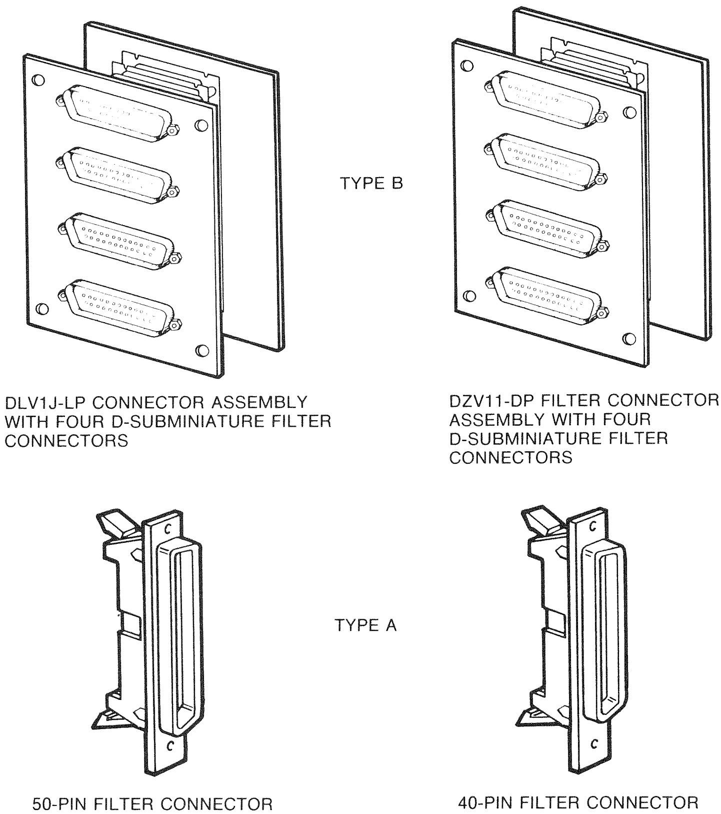


Figure B-10 Filter Connectors and Filter Connector Assemblies

B.7.6.2 Internal Cables – The PDP-11/23 PLUS system uses 76.2-cm (30-inch) internal cables to connect the option modules to the inner side of the I/O distribution panel. System options purchased for the PDP-11/23 PLUS are supplied with the correct cable length for internal connections.

B.7.6.3 External Cables – To comply with FCC regulations, all cables exiting a PDP-11/23 PLUS system must be shielded cables connected to filter connectors on the I/O distribution panel.

B.8 MODULE AND FILTER CONNECTOR INSTALLATION

To access the rear of the H349 I/O distribution panel and install modules and filter connector assemblies, use the following procedure:

- Switch off the PDP-11/23 PLUS system and unplug it from its wall outlet or power controller.
- Open the I/O distribution panel with a ¼-inch key and swing it to expose the inside of the I/O distribution panel.
- Install any options in the backplane and corresponding filter connector assemblies in the I/O distribution panel. Refer to Chapters 5 and 6 or documentation provided with the options for details.
- Connect the internal option cable(s) from each option module to the rear of the I/O distribution panel as diagrammed in Figure B-11.
- Connect any shielded ground wires, if present, to the chassis ground studs.

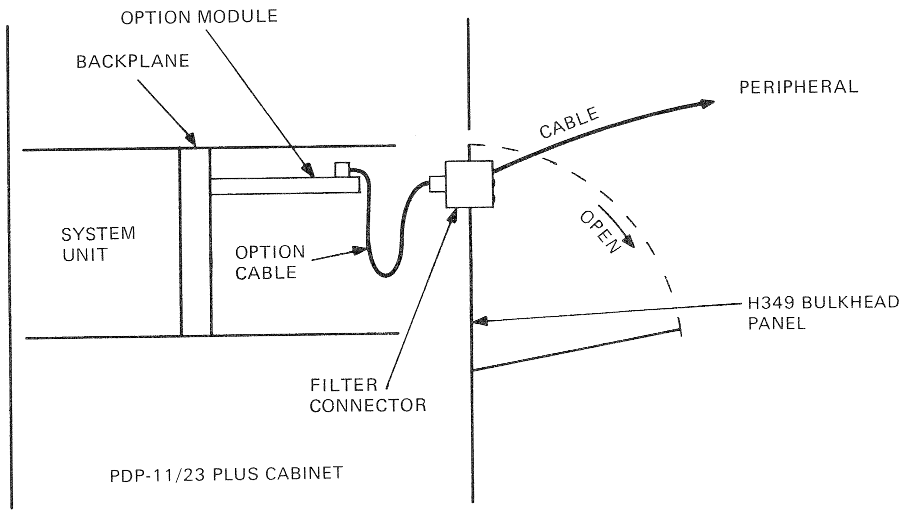


Figure B-11 PDP-11/23 PLUS Internal Cabling

Figure B-12 shows how a PDP-11/23 PLUS system may look when cabled to a printer and a video terminal, plus the routing of the I/O and power cables.

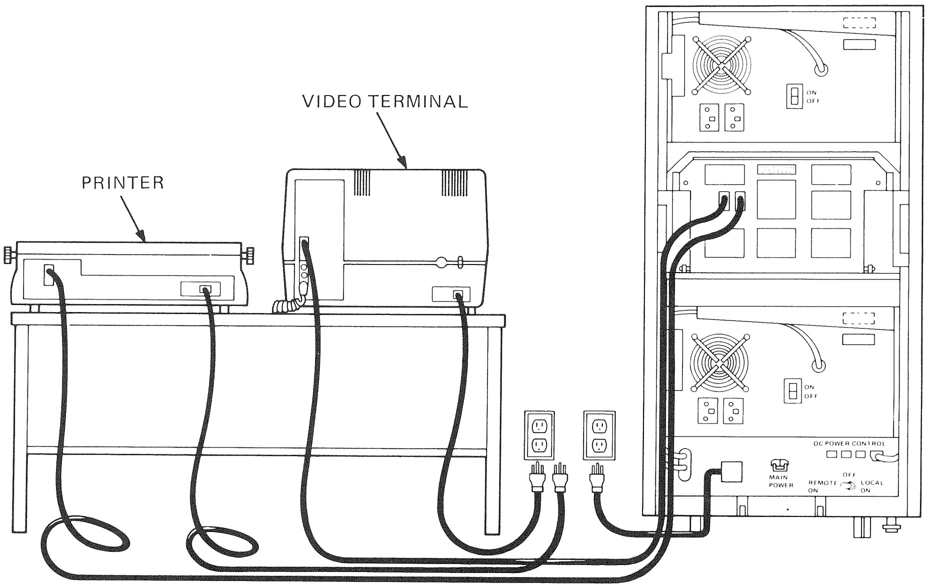


Figure B-12 PDP-11/23 PLUS External Cable Routing

C.1 PROCEDURE

Before you start formatting a MicroPDP-11 system, make sure you write-protect any other fixed-disk drives present in the system.

User responses in this procedure are shown in color.

Insert the Field Service Test Diskette 4 (CZXD4D0) in drive 1. 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 C0 or later. Earlier versions format the RD52 as though it is 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 questions.

CHANGE HW (L)?

This is a program that answers hardware questions and is prebuilt to format unit 0 with default answers. Type **N** (no) and press the **Return** key.

CHANGE SW (L)

This program answers software questions. Type **N** and 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. Answer 0 if you are formatting the fist fixed-disk drive installed on the system; answer 1 if you are formatting the second disk drive installed on the system.

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 format an RD51, and approximately 30 minutes to format an RD52, or RD53. The N (no) response doubles the time taken to format the disk drive.**

CONTINUE IF BAD BLOCK INFORMATION IS INACCESSIBLE

Type **Y** and 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 one minute after starting, error 5 from one to ten minutes, and errors 6 and 7 after ten 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 Chapters 8 and 10, FRU Removal and Replacement Procedures).

(2) INITIAL FAILURE ACCESSING FCT

The Format Control Table (FCT) 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 three causes the diagnostic to stop and print a message if a bad spot is found.

- **Reformat Mode** – If your answer to question one 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 one 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 one and two, 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 identifies. This takes about 30 minutes.

Appendix D
Logical Unit Number Designation

D.1 LOGICAL UNIT NUMBERS

The Logical Unit Numbers (LUN) and the LUN jumpers provide for future expansion 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 D-1 shows the standard LUN jumper configuration.

Table D-1 RQDX Standard LUN 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 as anywhere from zero and up. Only one jumper setting per module is allowed. Use the format in Table D-2 to configure a module with a starting LUN of other than zero.

Table D-2 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 D-3 shows an example of unit number designation when LUN jumper 4 is installed.

Table D-3 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 E
RQDXE (M7513) Jumper Configurations

E.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-C 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 in a BA23-C 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 Section 5.5 for guidelines when you install an RQDXE extender module.

E.2 RQDXE (M7513) JUMPER CONFIGURATIONS (COMMON ARRANGEMENTS)

In the following examples, the term "Host" is used for simplicity. The "Host" referred to is 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 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 Equipment Corporation, are desktop or rackmounted RX50 diskette drive units, 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.

E.2.1 Factory Configuration

Figure E-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 shown.

Table E-1 shows the RQDXE factory configuration. This configuration supports one RX50 and two fixed-disk drives. You can use this configuration with dual BA23 systems or with a subsystem.

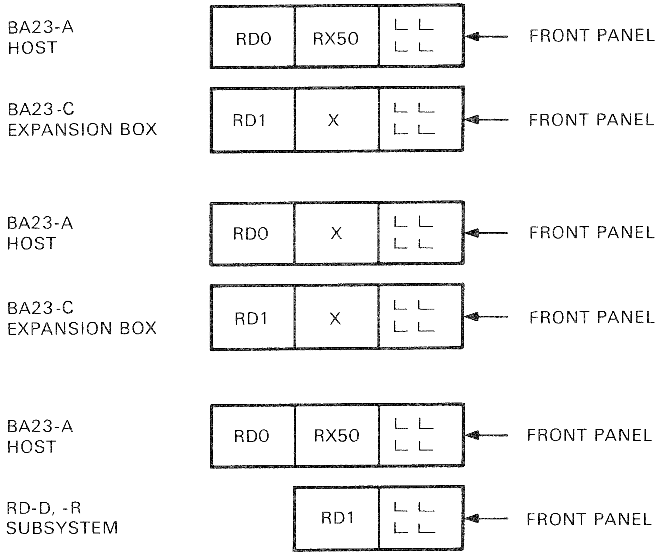


Figure E-1 Three Possible Disk Drive Arrangements (Factory Setting)

Table E-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

E.2.2 Jumper Setting for Three Fixed-Disk Drives

Figure E-2 shows a configuration using the RQDXE extender module with three fixed-disk drives, one in the BA23-A enclosure and two subsystems. Table E-2 shows the RQDXE jumper setting to support three RD5n(s).

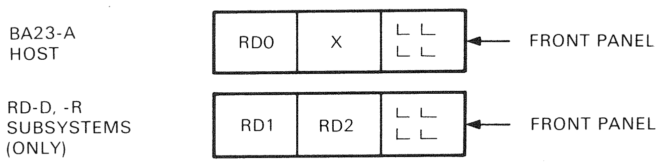


Figure E-2 Three Fixed-Disk Drives with an RQDXE (Arrangement 1)

Table E-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			

E.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.

E.3.1 Additional Arrangements, Example 1

Figure E-3 shows a configuration using an RQDXE with an RX50 and a fixed-disk drive. Table E-3 shows the jumper configuration to support this arrangement.

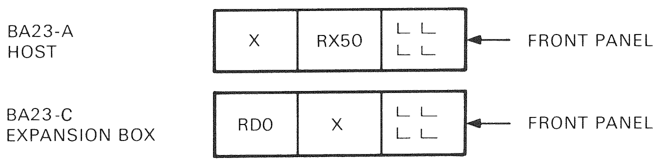


Figure E-3 An RX50 and a Fixed-Disk Drive with an RQDXE

Table E-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				

E.3.2 Additional Arrangements, Example 2

Figure E-4 shows a configuration using an RQDXE with an RX50 and two fixed-disk drive subsystems. Table E-4 shows the jumper configuration to support this arrangement.

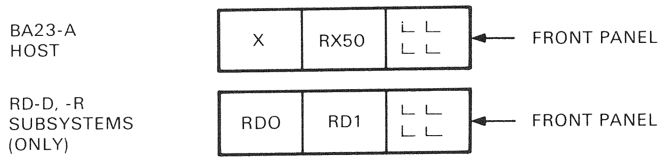


Figure E-4 An RX50 and Two RD5n Disk Drives with an RQDXE (Arrangement 1)

Table E-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			

E.3.3 Additional Arrangements, Example 3

Figure E-5 shows a configuration using an RQDXE with a fixed-disk drive and an RX50 in a BA23-C expansion box or as subsystems. Table E-5 shows the jumper configuration to support this arrangement.

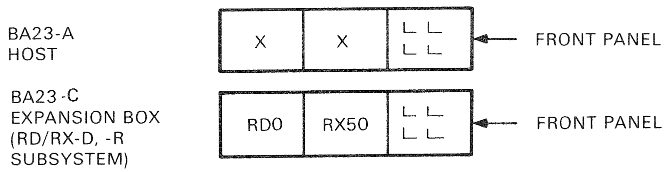


Figure E-5 A Fixed-Disk Drive and an RX50 in a BA23-C Expansion Box

Table E-5 RQDXE Jumper Setting for a Fixed-Disk Drive and an RX50 in a BA23-C 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				

E.3.4 Additional Arrangements, Example 4

Figure E-6 shows an alternate configuration using an RQDXE with an RX50 and two fixed-disk drive subsystems. Table E-6 shows the jumper configuration to support this arrangement.

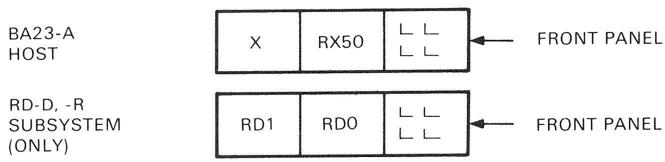


Figure E-6 An RX50 and Two Fixed-Disk Drives (Arrangement 2)

Table E-6 RQDXE Jumper Setting for a 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			

E.3.5 Additional Arrangements, Example 5

Figure E-7 shows another alternate configuration using an RQDXE with two fixed-disk drives and an RX50 diskette drive in a BA23-C expansion box or subsystems. Table E-7 shows the jumper configuration to support this arrangement.

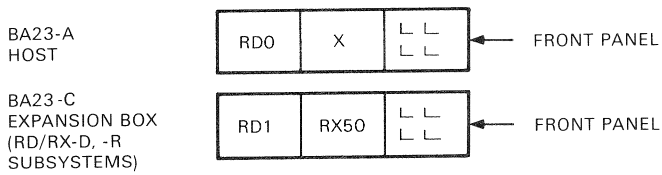


Figure E-7 Two Fixed-Disk Drives and an RX50 (Arrangement 3)

Table E-7 RQDXE Jumper Setting for Two Fixed-Disk Drives and an RX50 (Arrangement Three)

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				

E.3.6 Additional Arrangements, Example 6

Figure E-8 shows an alternate configuration using an RQDXE with three fixed-disk drives, one in a BA23-A enclosure and two as subsystems. Table E-8 shows the jumper configuration to support this arrangement.

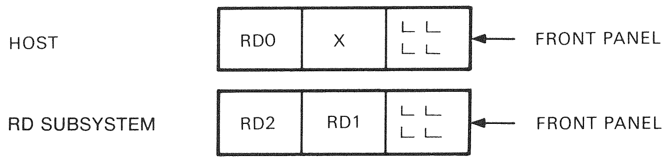


Figure E-8 Three Fixed-Disk Drives (Arrangement 2)

Table E-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			

F.1 PURPOSE

The tables in this appendix form a worksheet. This worksheet should be used to report and confirm the setup parameters to be contained in the setup EEPROM on the KDJ11-BC CPU module.

F.2 FUNCTION

This worksheet should be filled out (at installation of a KDJ11-BC CPU module) to contain all pertinent information about changes made to the setup parameters and programming for any future replacement KDJ11-BC CPU modules. Once filled out, it is to be left with the system for future use.

Use a pen to fill out the current blocks and a pencil for the new blocks.

NOTE
Use setup command 1 to exit and setup command 7 to list current values (at the time of a change) to ensure that the changes made have been programmed correctly.

Use setup command 9 to copy any changes you make to the setup table into the EEPROM.

Use setup command 14 to write a boot from memory into the EEPROM.

Table F-1 Setup Command 2

		Default	Current	New
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		

Table F-2 Setup Command 3

		Current	New
T1			
Device name	=		
Unit number	=		
CSR address	=		
TT2			
Device name	=		
Unit number	=		
CSR address	=		
TT3			
Device name	=		
Unit number	=		
CSR address	=		
TT4			
Device name	=		
Unit number	=		
CSR address	=		
TT5			
Device name	=		
Unit number	=		
CSR address	=		
TT6			
Device name	=		
Unit number	=		
CSR address	=		
TT7			
Device name	=		
Unit number	=		
CSR address	=		
TT8			
Device name	=		
Unit number	=		

Table F-2 Setup Command 3 (Cont.)

		Current	New
CSR address	=		
TT9			
Device name	=		
Unit number	=		
CSR address	=		

Table F-3 Setup Command 4

		Current	New
Boot 1	=		
Device name	=		
Boot 2	=		
Device name	=		
Boot 3	=		
Device name	=		
Boot 4	=		
Device name	=		
Boot 5	=		
Device name	=		
Boot 6	=		
Device name	=		

Table F-4 Setup Command 6 – Switches 2, 3, and 4

					Current	New
On	On	On	(SPECIAL)	=		
On	On	Off	(SB1)	=		
On	Off	On	(SB2)	=		
On	Off	Off	(SB3)	=		
Off	On	On	(SB4)	=		
Off	On	Off	(SB5)	=		
Off	Off	Off	(NORMAL)	=		

Use the following sheets to record any other changes, additions, or deletions you make to the setup of the KDJ11-B module.

NOTES

NOTES

NOTES

Appendix G
Version 7 and Version 6 ROM Differences

G.1 INTRODUCTION

The KDJ11-B CPU modules (M8190) are currently shipping with an enhancement to the EPROMs. These new ROMs (Version 7.0) can be ordered (by Digital Equipment Corporation part number) to upgrade earlier (Version 6.0) KDJ11-B CPU modules.

When you enter setup mode from dialog mode, the system displays the version of the ROM code in the upper right corner of the screen.

Table G-1 lists the ROM version and Digital Equipment Corporation part numbers.

Table G-1 KDJ11-CPU ROM Part and Version Numbers

Socket Location on CPU (M8190)	V7.0 Part Number	V6.0 Part Number
E116 (Low Byte)	23-116E5-00	23-077E5-00
E117 (High Byte)	23-117E5-00	23-078E5-00

G.2 DIFFERENCES BETWEEN VERSION 7.0 AND VERSION 6.0

The following sections describe the differences between Version 6 and Version 7 KDJ11-B CPU EPROMs.

G.2.1 Boot Support for Tape MSCP Devices (TK50)

Version 7.0 contains a built-in tape MSCP boot program for the TK50. The device name is MU.

Version 6.0 does not contain this feature.

G.2.2 Disable Setup Mode Parameter

Version 7.0 contains an added setup mode parameter that allows the user to disable entry into setup mode if force dialog mode is not selected. This prevents unauthorized entry into setup mode.

This change assumes the force dialog switch is controlled, or that switch 5 on the KDJ11-B CPU is on to prevent unauthorized access to setup mode. When setup mode is disabled and the ROM code is in dialog mode, all references to the SETUP command are eliminated. Typing SETUP causes an invalid command response from the ROM code.

In Version 6.0, setup mode can always be entered from dialog mode.

G.2.3 Disable All Testing Parameter

Version 7.0 has an added parameter to parameters command 2. This parameter disables all memory and cache testing if force dialog is not set. Force dialog causes all testing to be run.

Version 6.0 does not contain this feature.

G.2.4 Edit/Create Command

In the Version 7.0 setup mode edit/create command for EEPROM boots, the highest unit number entry is decimal.

In Version 6.0, the user types an octal number which converts to a decimal value.

G.2.5 Disk MSCP Autoboot Routine

In Version 7.0 MSCP autoboot, the boot program tries to boot removable media from units 0 to 255, then tries fixed-media units from 0 to 255.

The boot program attempts to boot each unit using the standard disk MSCP address. If this fails, the program attempts to boot the same unit number using the first floating MSCP device (if present) before continuing to the next unit number. The first floating MSCP address is 17760334 if there are no floating devices from 17760010 to 17760330 (see Appendix A).

In Version 6.0 MSCP autoboot, the boot program tries to boot removable media from units 0 to 7, then tries fixed-media units 0 to 7. The program tries only drives attached to the controller at the standard disk MSCP address (17772150).

G.2.6 Disk MSCP Boot Differences

In the Version 7.0 dialog mode boot command, the ROM code automatically tries the first floating controller if the standard controller reports an error. If an error exists on both controllers, the system displays an error message for each controller. The system does not display nonexistent error messages unless the unit is nonexistent on both controllers.

If the second controller does not exist at the proper floating address, the ROM code prints only messages associated with the standard controller.

If the translation table or the /A switch is used, only one controller is tried regardless of the existence of two or more controllers.

In the Version 6.0 dialog mode boot command, the ROM code tries only the standard controller. The system displays a nonexistent error message if the unit is not present on the standard controller.

In Version 6.0, a floating controller can boot MSCP devices under software control.

G.2.7 Initialize Command

In Version 7.0, the initialize command sets the PMG count value to 7. In Version 6.0, the initialize command sets the PMG count value to 0.

> **NOTE**
> **The recommended value for the PMG count is 7 for all KDJ11-Bs.**

G.2.8 Memory Testing

In Version 7.0, all consecutive memory starting from location 0 is written at least once at power-up unless all testing has been disabled.

In Version 6.0, memory above 248 KB cannot be written if the long memory test is disabled or **<CTRL> C** is typed.

G.2.9 Power-Up Set to 3 with Battery-Backup Memory

For Version 7.0, if the selected mode is 3 at power-up, the battery indicates that the voltages are lost and the Ignore Battery function is not set. Execute the restart mode selection if it is not mode 3. Otherwise, go to dialog mode.

For Version 6.0, if the selected mode is 3 at power-up, the battery indicates that the voltages are lost, and the Ignore Battery function is not set. Go to Dialog mode regardless of the restart mode selection.

G.2.10 Enabling Halt On Break

In Version 7.0, the Halt on Break bit is set immediately after the "Testing in progress – Please wait message" is printed out. Since Halt on Break is generally enabled only in a single-user environment, this feature was not needed and has been removed. This allows the ROM code to ignore the break that often comes from certain terminals when they are powered up.

In Version 6.0, the Halt on Break bit in the BCSR is not enabled until one of the following occurs

- One break has been received and discarded.
- Any valid character has been received except XON.
- The ROM code has given up control of the CPU.

G.2.11 <CTRL> R and <CTRL> U Echoing

Version 7.0 does not echo the **<CTRL> R** and **<CTRL> U** inputs. Version 6.0 echoes these inputs as ^R and ^U.

G.2.12 Setup Command 5

In Version 7.0, setup mode command 5 has been deleted. If the command is typed it is ignored.

In Version 6.0, setup mode command 5 (List/Change Terminal Setup Message) allows the user to specify an octal message of up to ten characters to be sent to the console terminal. Use this command if the console terminal does not power-up with the current language characters.

G.2.13 Automatic Boot Sequence Message

In Version 7.0, the ROM code prints a message indicating when the automatic boot sequence starts if autoboot mode is selected. This message indicates that all tests are complete, that the ROM code is starting the autoboot sequence, and the name and unit number of the device booted (Figure G-1).

```
Testing in progress - Please wait
Memory size is 512 K Bytes
9 Step memory test
Step 1 2 3 4 5 6 7 8 9

Starting automatic boot

Starting system from DU0
```

Figure G-1 Sample Autoboot Display

G.2.14 Boot Command List Addition

In Version 7.0, "L" has been added to the boot command list. L causes the automatic boot sequence to continuously loop until one of the selected devices boots. Normally, the last device in the autoboot table is followed with an E which terminates the table.

If no devices are bootable, the ROM code prints an error message and requests input before proceeding. The ROM code continuously tries every device in the table until one boots or the operator types **<CTRL> C**.

Version 6.0 ROMs do not contain this feature. However, it can be implemented by writing a small EEPROM boot.

G.2.15 Local Language Support

Version 7.0 supports local language translations. Version 6.0 does not support local language translations.

Access time

The total time taken to find data in a storage location. For disks, the access time is equal to the sum of the average latency time and the average seektime.

ANSI

The acronym for American National Standards Institute.

Answerback

A preprogrammed response from a terminal.

Assembled program count

The address of an instruction relative to the starting address of the program.

BOT

- The acronym for beginning of transmission.
- The acronym for beginning of tape.

Buffer

A storage area meant to temporarily hold data being transferred between two devices.

Bus error trap

A high-priority interrupt that halts the processor routine and initiates a subroutine. The interrupt occurs because of an error on the bus (for example, a device fails to answer at its expected address), and usually indicates a faulty CPU or memory module.

Bus grant

Comprises two signals which are used by the CPU to acknowledge requests for the bus:

- The bus interrupt acknowledged (BIAK) signal acknowledges an interrupt request.
- The bus direct-memory-access grant (BDMG) signal acknowledges a DMA request.

A device receiving one of these signals will pass the signal on to the next device on the backplane, only if it does not require the bus itself. Therefore devices closer to the CPU have priority over those farther down the backplane.

CCITT

The acronym for Comité Consultatif Internationale de Téléphonie et Télégraphie (International Telephone and Telegraph Consultative Committee).

Channel

A path for electrical transmission between two points.

Control status register

A register that contains status information about a device.

CRC

The acronym for cyclic redundancy check. A method of detecting errors.

Default

The value of a selection assumed by the computer when a specific value is not supplied by the user.

Delimiter

A character that terminates a character string or message, or separates it from surrounding text.

DMA

The acronym for direct memory access. A facility that allows input/output transfers to bypass the CPU's general registers and go directly to and from memory.

DTR

The acronym for data terminal ready. A control signal that enters a modem from the terminal or communications device that is using the modem. When the signal is set, it informs the modem that the terminal is ready to transmit or receive data. When the signal is clear, the terminal is not ready.

Dual-height module

An option for Q22-Bus systems that requires half a slot on the backplane.

Duplex

In communications, simultaneous, two-way, independent transmission in both directions; also called full-duplex.

EIA

The acronym for Electronic Industries Association.

EIA interface

The standard code defined by the Electronic Industries Association for use in data exchange.

EOT

- The acronym for end of transmission.
- The acronym for end of tape.

EPROM

The acronym for erasable programmable read only memory. A ROM that can be reprogrammed by a user.

FCC

The acronym for the Federal Communications Commission, Washington D.C.

Firmware

A program of instructions that is in read only memory (ROM) so it will not be changed. For example, the MicroPDP-11 and MicroVAX systems firmware includes the self-test program that runs every time you turn the computer on.

First address range

The range within which the starting address of a memory module must occur. The actual starting address is determined by the combination of the first address range and the partial starting address.

Floating-point processing

A method of calculation that automatically moves the decimal point.

FRU

The acronym for field replaceable unit.

Full-duplex

A form of data transmission in which messages can pass through a circuit, in both directions, simultaneously.

Half-duplex

A form of data transmission in which messages can pass through a circuit in both directions. However, transmission in both directions cannot take place simultaneously.

Hertz (Hz)

A unit of frequency equal to one cycle per second.

Instruction set

A group of commands that tells the computer what operation to perform.

Interrupt

A break in a program, caused by an external source, which requires that control should pass temporarily to another program.

I/O page address

The physical address of a device register.

ISAM

The acronym for index sequential access method. The technique for accessing records in files that have an indexed sequential organization.

Jumper

An electrical conductor used to complete a circuit and so affect the logic of the circuit board.

Latency time

The delay while waiting for data on a rotating disk to reach the disk head. The average latency is equal to half the time taken for one revolution of the disk.

LED

The acronym for light emitting diode.

LSI

The acronym for large-scale integration.

Memory management unit

A device that extends the amount of memory that the CPU can access to 64 K bytes or more. The memory management unit also protects and organizes areas of memory.

Mode

A state, such as line or local mode, or method of operation, such as console dialog mode.

Modem

The acronym for modulator-demodulator. A telecommunications device that provides an interface between a computer and a communications link.

MOS

The acronym for metallic-oxide semiconductor.

MSCP

The acronym for mass storage control protocol.

Nonvolatile memory

A storage medium that retains its data in the absence of power.

ODT

The acronym for on-line debugging technique.

Parity bit

An extra bit added to a byte or word to ensure that there is always either an even or odd number of bits, according to the logic of the system.

Parity error

An error caused when the value calculated for the parity bit is not equal to the actual value of the parity bit.

Partial starting address

The starting address of a memory module relative to the first address range for that module. The actual starting address of the module is determined by the combination of the first address range and the partial starting address.

Processor status word

A register in some computers that indicates the current priority of CPU operation, the condition of the previous operation, and other basic control items.

Program counter

A register in the CPU that holds the address of the next instruction (except in the case where the current instruction causes a jump).

PROM

The acronym for programmable read only memory. A ROM that can be programmed by a user.

Protocol

A formal set of conventions governing the format and relative timing of message exchange between two communicating processes.

Q22-Bus

An extended version of the LSI-Bus that allows 22-bit addressing.

Quad-height module

An option for Q22-Bus systems that requires a full slot on the backplane.

RAM

The acronym for random access memory. A memory in which the CPU can access all locations with equal facility.

Random access

Pertaining to a storage device from which data or blocks of data can be read in any order.

Real-time

Refers to the actual time during which a process takes place.

Reserved instruction

An instruction that is not available to the system. For example, instructions relating to floating-point operations will not be available to systems that do not have a floating-point option installed.

Reserved instruction trap

A jump to a specified location that occurs when the system attempts to execute a reserved instruction.

ROM

The acronym for read only memory. Preprogrammed memory that can be read from, but not written to.

RTS

The acronym for request to send. A signal sent from a terminal to a modem to inform the modem that the terminal is ready to transmit data.

Seektime

The time taken for the disk read/write heads to move to the required track on the disk.

Serial line unit

A device that provides an interface between a serial communications line and the CPU module.

Serial transmission

A method of transferring data in which the bits of the characters are sent sequentially on a single path.

Stop bits

In serial transmission, one or two bits that are transmitted at the end of a data word. The stop bits give the receiver time to ready itself for the next word.

Synchronous

- Having identical time periods.
- A communications format in which each data character uses the same time period. The data, including blank time, is controlled by an external clock device or modem.

System mapping routine

A program that finds and displays the hardware addresses of the devices in a system.

Trap

A conditional jump to a known memory location, performed automatically by hardware. The jump occurs when the execution of an instruction causes an unexpected result. The address location from which the jump is made is stored in the status register. (A trap is distinguished from an interrupt in that an interrupt is caused by an external event.)

Track

A path on a diskette, disk, or tape that holds data.

UART

The acronym for universal asynchronous receiver/transmitter. A device that performs parallel-to-serial and serial-to-parallel conversion.

Utility program

A program used to perform some frequently required process in the operation of a computer.

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