KDJ11–D/S CPU System Maintenance

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Preface

This guide describes a base system, configuration, ROM-based diagnostics, and troubleshooting procedures for systems containing the KDJ11–D/S central processing unit (CPU).

Intended Audience

This document is intended only for DIGITAL Field Service personnel and qualified self-maintenance customers.

Organization

This guide has three chapters and two appendixes.

Chapter 1 provides an overview of the KDJ11–D/S CPU and the MSV11–P and MSV11–Q memory modules.

Chapter 2 contains system configuration guidelines and lists current, power, and bus loads for supported options.

Chapter 3 contains ROM-based diagnostic troubleshooting procedures for systems containing the KDJ11–D/S CPU.

Appendix A explains how to format RD- and RX-series disk drives in MicroPDP–11 systems.

Appendix B provides a list of related documentation.

Warnings, Cautions, and Notes

Warnings, cautions, and notes appear throughout this guide. They have the following meanings:

WARNING	Provides information to prevent personal injury.
CAUTION	Provides information to prevent damage to equipment or software.
NOTE	Provides general information about the current topic.

Chapter 1

KDJ11–D/S CPU Description

1.1 Introduction

This chapter describes the KDJ11–D/S CPU modules. There are six variants, listed in Table 1–1. Unless otherwise stated, the term KDJ11–D/S refers to all six variants.

Table 1–1: KDJ11–D/B Variants (MicroPDP–11/53)

Version	Module No.	On-Board Memory	Enclosure
KDJ11–DA	M7554	512 Kbytes; 15 MHz	BA23
KDJ11–DB	M7554	1.5 Mbytes; 15 MHz	BA23
KDJ11–SA	M7554–PA	512 Kbytes; 15 MHz	BA200-series
KDJ11–SB	M7554–PB	512 Kbytes; 18 MHz	BA200-series
KDJ11–SC	M7554–PC	1.5 Mbytes; 15 MHz	BA200-series
KDJ11–SD	M7554–PD	1.5 Mbytes; 18 MHz	BA200-series

This chapter also describes the following memory modules: MSV11–PK/–PL and MSV11–QA/–QB/–QC.

The KDJ11–S/D is designed for systems that use the extended LSI–11 bus, commonly called the Q22-bus. The KDJ11–D/S uses either the MSV11–P or MSV11–Q memory module(s) and a set of standard Q22-bus options.

1.2 KDJ11–D/S Overview

A system that contains a KDJ11–D/S CPU module is called a MicroPDP–11/53 system.

The KDJ11–D/S (M7554/M7554–P) is a quad-height module based on the DCJ11 microprocessor chip. The module operates at either 15 or 18 MHz and includes the CPU, memory management, local memory, a console serial line unit (SLU), and a printer port SLU.

The KDJ11–D/S executes the PDP–11/73 instruction set. The floating point instruction set is standard, but the floating point accelerator (FPA) is not an option. The extended instruction set (EIS) is also standard. Three protection (operating) modes provide full 22-bit memory management for both instruction and data references: kernel, supervisor, and user.

The KDJ11–D/S can address up to 4 Mbytes of memory. On-board (local) memory is 512 Kbytes or 1.5 Mbytes of dynamic RAM with no battery backup. An additional 3.5 or 2.5 Mbytes of memory can be addressed over the Q22-bus interface. The module's starting address is fixed at zero.

The KDJ11–D is the base module for the –S variants, which are for use in BA200-series enclosure only.

The KDJ11–D and KDJ11–S modules are functionally identical, but not interchangeable. The –S variants contain a handle, riveted to the side of the module, which replaces the internal cabling and I/O panel used in the BA23 enclosure. When installed with other modules with similar handles or covers in the card cage of BA200-series enclosures, the handle functions as a shield for electromagnetic interference (EMI) and simplifies maintenance.

The KDJ11–D (M7554) is shown in Figure 1–1. The KDJ11–S (M7554–P) is shown in Figure 1–2.

Figure 1–1: KDJ11–D Module Layout (M7554)

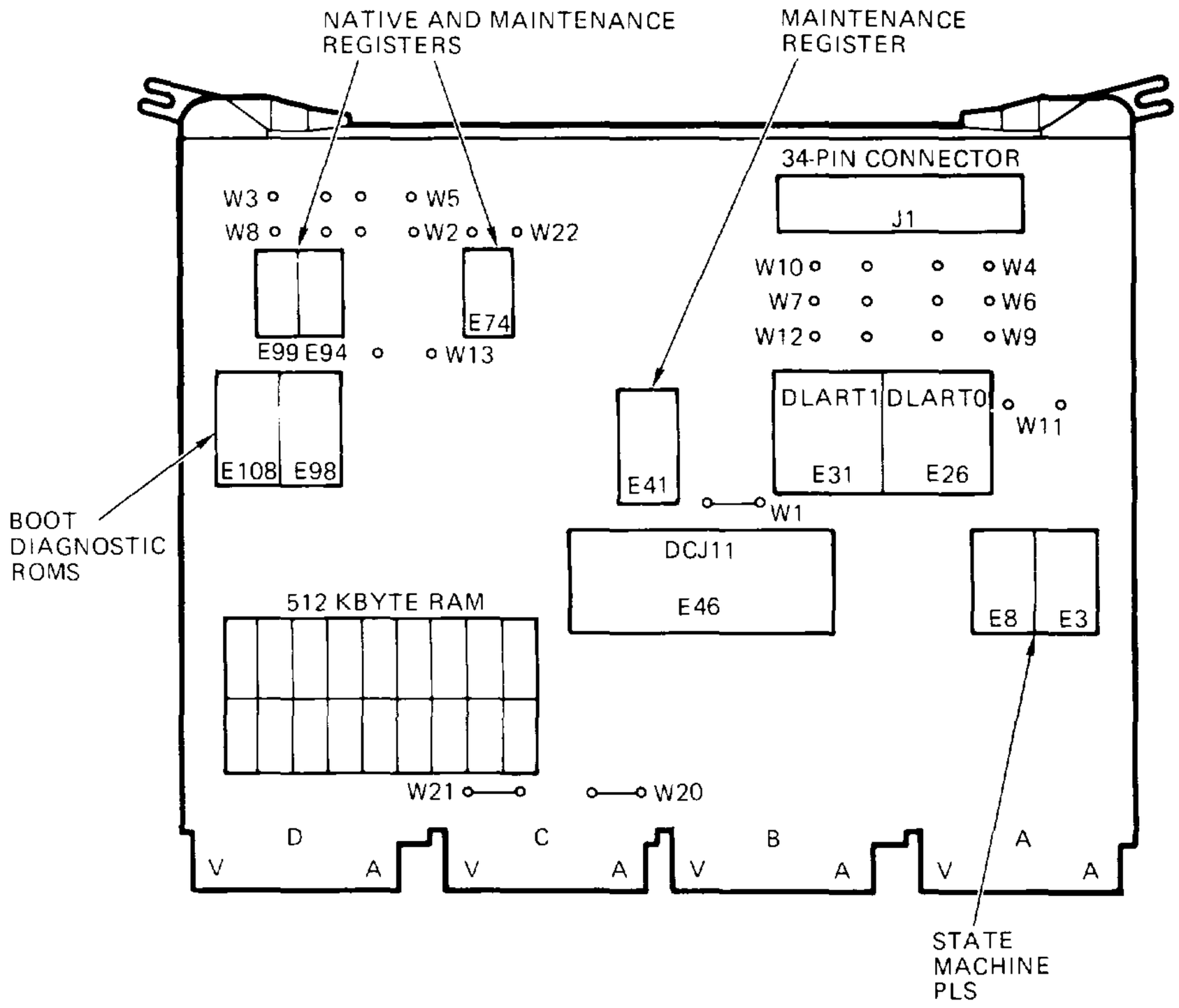
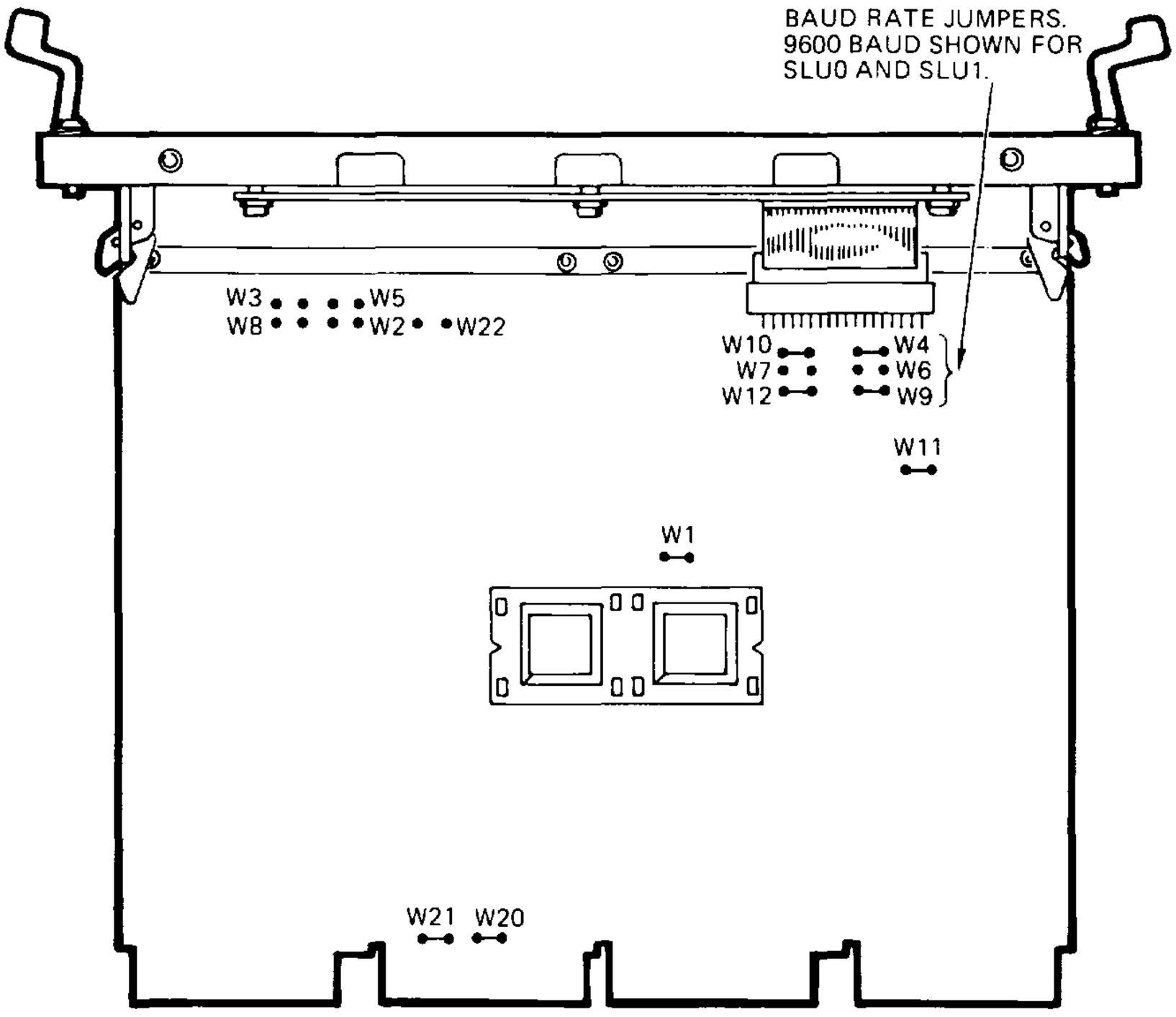


Figure 1–2: KDJ11–S Module Layout (M7554–P)

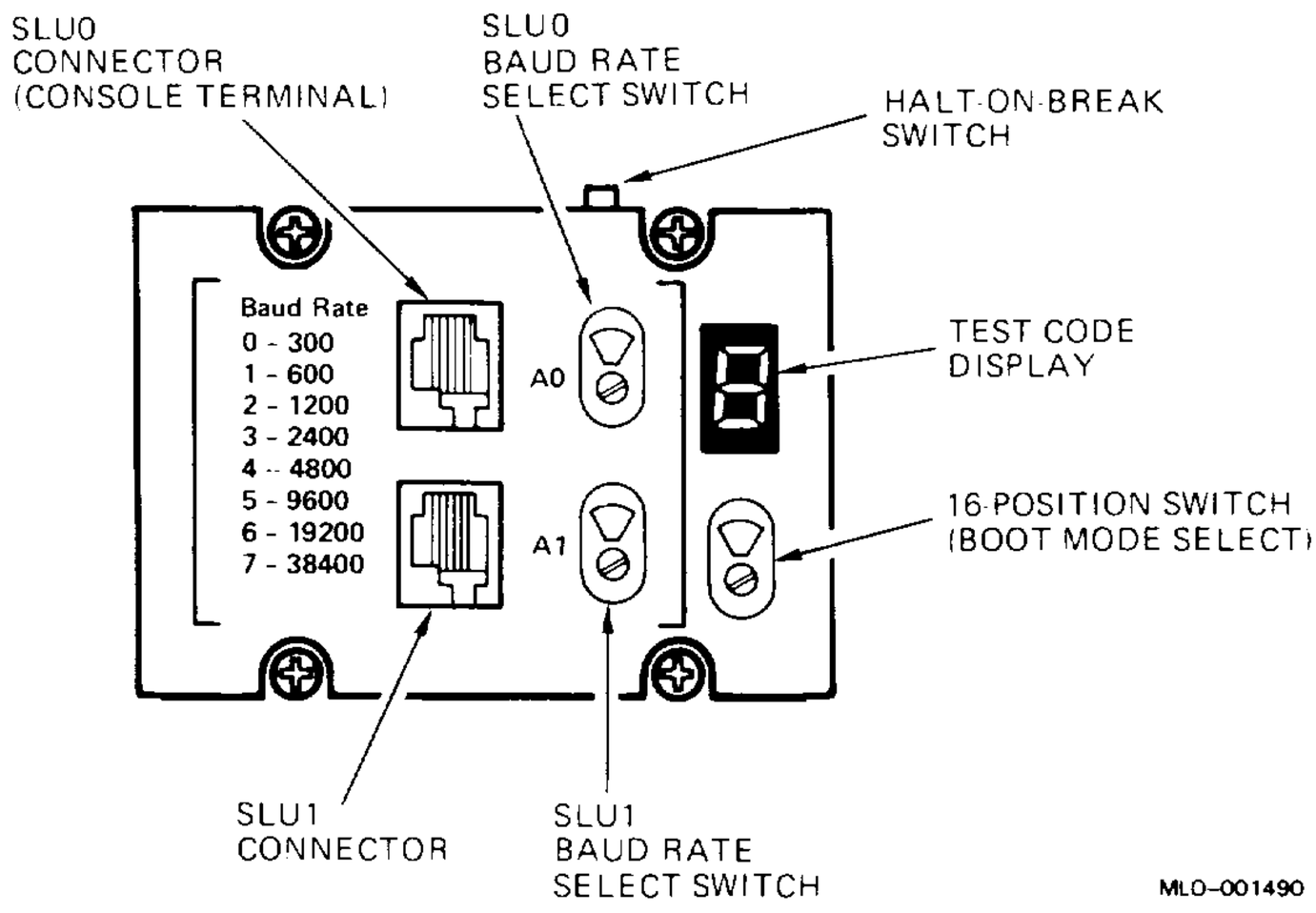


1.3 Configuration

Refer to Figure 1–1 for the location of the jumpers on the KDJ11–D. Refer to Figure 1–2 for the location of the connectors and jumpers on the KDJ11–S.

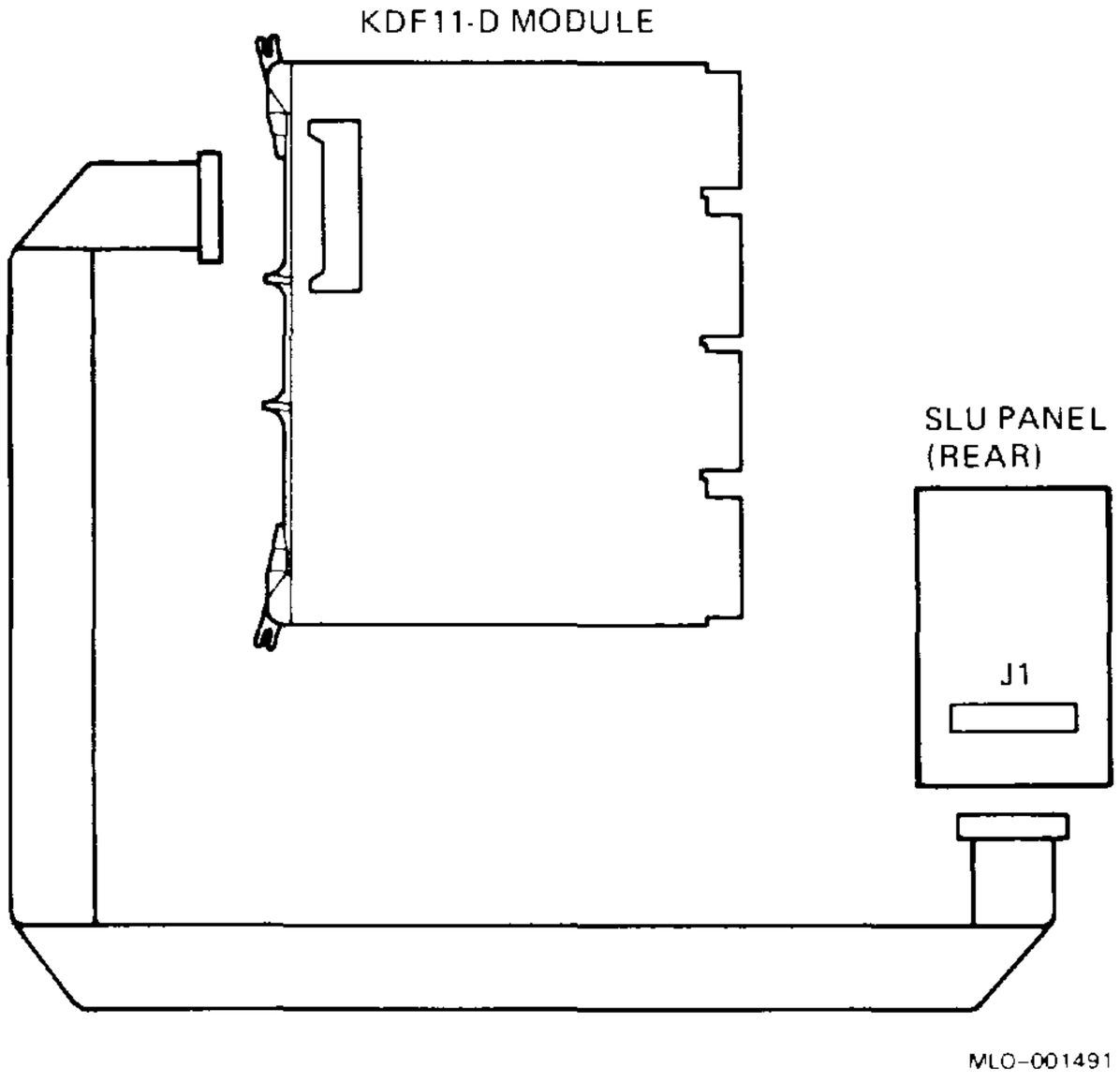
The KDJ11–D serial line unit (SLU) panel (Figure 1–3) contains SLU0 and SLU1 baud rate select switches, SLU0 and SLU1 connectors to the console terminal, a test code display, a halt-on-break switch, and a 16-position boot mode select switch.

Figure 1–3: KDJ11–D SLU Panel



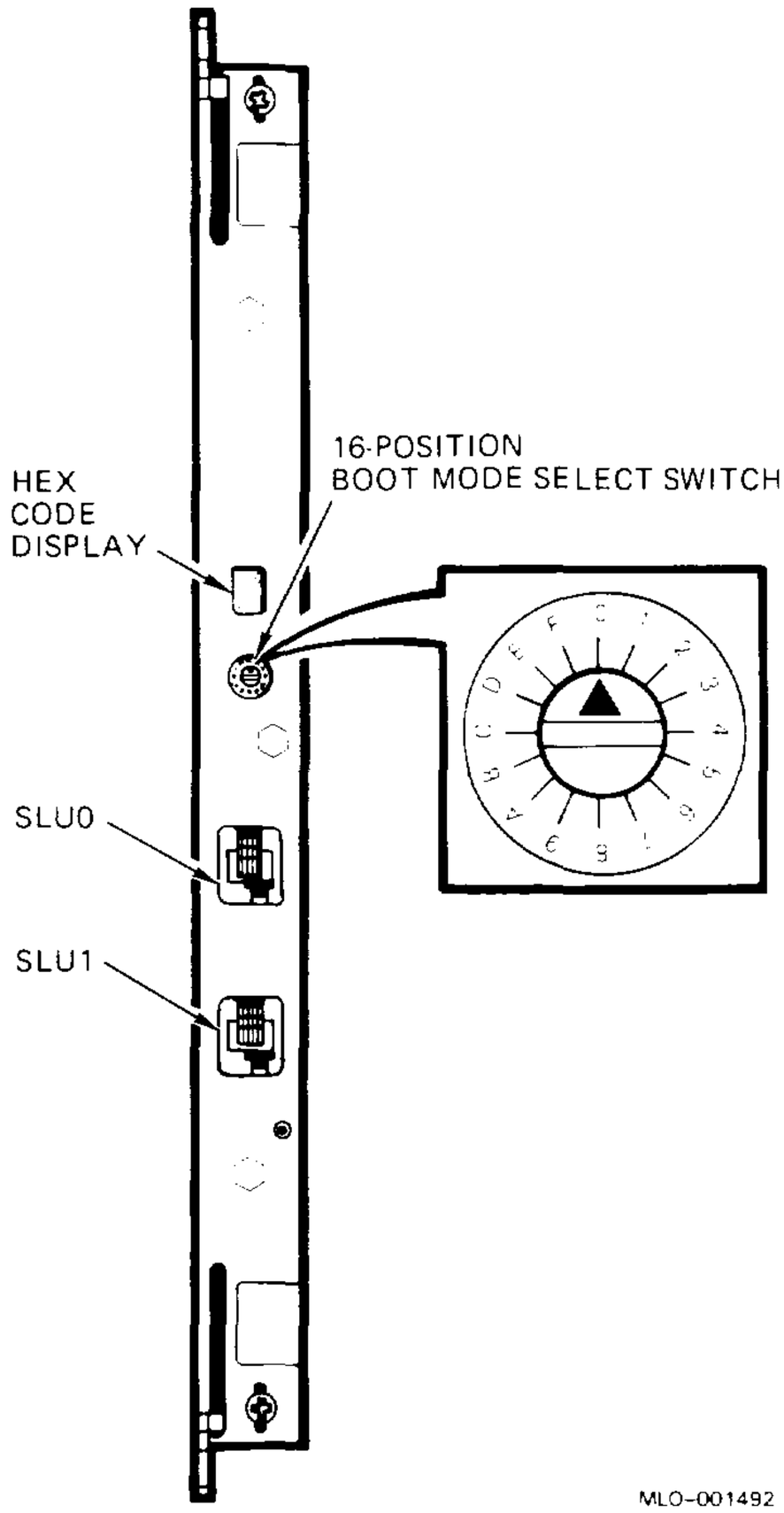
The internal cabling from the SLU panel to the KDJ11–D is shown in Figure 1–4.

Figure 1–4: KDJ11–D Internal Cabling



The module handle on the KDJ11–S contains console terminal connectors SLU0 and SLU1, a boot mode select rotary switch, and a hex code display (Figure 1–5).

Figure 1–5: KDJ11–S Handle



To change the baud rate on the KDJ11–S module, remove the module from the BA200-series enclosure and install or remove jumpers W4, W6, W7, W9, W10, and W12 on six pairs of wire-wrap pins. Figure 1–2, above, shows the baud rate jumpers for SLU0 and SLU1, set to baud rate 9600.

Table 1–2 lists the switch and jumper settings on the KDJ11–D/S module.

Table 1–2: KDJ11–D/S Switch and Jumper Settings

Function	Jumper/Position				Comments
Halt	W1				
	In				Trap-on-halt disabled[1]
	Out				Trap-on-halt enabled
Boot	W2				Boot select. See Table 1–3.
Select	W3				Boot select. See Table 1–3.
	W5				Boot select. See Table 1–3.
	W8				Boot select. See Table 1–3.
	W22				Boot select. See Table 1–3.
Baud Rate	W4	W6	W9	DLART0	
	W10	W7	W12	DLART1	Baud Rate[2]
	Out	Out	Out		300[3]
	Out	Out	In		600
	Out	In	Out		1200
	Out	In	In		2400
	In	Out	Out		4800
	In	Out	In		9600[4]
	In	In	Out		19,200
	In	In	In		38,400
Break	W11				
	Out				Console Break enabled[1]
	In				Console Break disabled
ROM Size[1,5]	W13	R14			
	In	Out			32-Kbyte self-test ROMs[6]
	Out	In			16-Kbyte self-test ROMs
Backplane[1,7]	W20	W21			
	In				Backplane pin CM2 to pin CN2[1]
		In			Backplane pin CR2 to pin CS2[2]

[1]Factory position, KDJ11–D and KDJ11–S.
[2]KDJ11–DA remote switch: remove all jumpers.
[3]Factory position, KDJ11–D only.
[4]Factory position, KDJ11–S only.
[5]W13, R14, and ROMs are factory installed.
[6]Factory position, KDJ11–SB only.
[7]Soldered in; not user selectable.

1.3.1 Boot Mode Selection

To choose the system boot mode, you set a boot mode select switch and position the following five jumpers: W2, W3, W5, W8, and W22.

On the KDJ11–D, the SLU contains the 16-position boot mode select switch (Figure 1–3). On the KDJ11–S, the module handle contains the 16-position boot mode select switch (Figure 1–5). Jumpers W2, W3, W5, W8, and W22 are located on the KDJ11–D/S module.

Table 1–3 describes the system boot selections for the boot mode select switch and the five jumpers. If you position the jumpers to 00000 or 10000, you can use switch positions 0 through 15 to select the test.

Table 1–3: Boot Select Options

Jumpers W: 22 2 3 5 8[1]	Switch Position[2]	Description
0 0 0 0 0	0	Test. Enter console mode using English text.[3,4]
0 0 0 0 1	1	Test. Enter console mode using French text.
0 0 0 1 0	2	Test. Enter console mode using German text.
0 0 0 1 1	3	Test. Enter console mode using Dutch text.
0 0 1 0 0	4	Test. Enter console mode using Swedish text.
0 0 1 0 1	5	Test. Enter console mode using Italian text.
0 0 1 1 0	6	Test. Enter console mode using Spanish text.[3]
0 0 1 1 1	7	Test. Enter console mode using Portuguese text.
0 1 0 0 0	8	Test. Enter console mode (reserved).
0 1 0 0 1	9	Test. Enter console mode (reserved).
0 1 0 1 0	10	Test. Enter console mode (reserved).
0 1 0 1 1	11	Test. Enter console mode (reserved).
0 1 1 0 0	12	Test.[5] Autoboot tapes and disks; user selects language.
0 1 1 0 1	13	Test. Autoboot DPV11, DUV11, DLV11–E/F, TU58, and RK05.
0 1 1 1 0	14	Test. Autoboot DEQNA 0 and DEQNA 1.
0 1 1 1 1	15	Manufacturing test loop.
1 0 0 0 0	0	Test. Autoboot tapes and disks using English text.[3,4]
1 0 0 0 1	1	Test. Autoboot tapes and disks using French text.
1 0 0 1 0	2	Test. Autoboot tapes and disks using German text.
1 0 0 1 1	3	Test. Autoboot tapes and disks using Dutch text.

[1] 0 = jumper installed; 1 = jumper removed.

[2] Jumpers W2, W3, W5, and W8 removed to use switch.

[3] With Version 1.0 ROMs, you can select only English (positions 00000 and 10000) or Spanish (positions 00110 and 10110). With Version 2.0 ROMs, you can select eight languages.

[4] Factory or default setting.

[5] High-speed autoboot; memory address/shorts test bypassed.

Table 1–3 (Cont.): Boot Select Options

Jumpers W: 22 2 3 5 8[1]	Switch Position[2]	Description
1 0 1 0 0	4	Test. Autoboot tapes and disks using Swedish text.
1 0 1 0 1	5	Test. Autoboot tapes and disks using Italian text.
1 0 1 1 0	6	Test. Autoboot tapes and disks using Spanish text.[3]
1 0 1 1 1	7	Test. Autoboot tapes and disks using Portuguese text.
1 1 0 0 0	8	Test. Autoboot tapes and disks (reserved).
1 1 0 0 1	9	Test. Autoboot tapes and disks (reserved).
1 1 0 1 0	10	Test. Autoboot tapes and disks (reserved).
1 1 0 1 1	11	Test. Autoboot tapes and disks (reserved).
1 1 1 0 0	12	Emulate power-up mode 24 with no messages.
1 1 1 0 1	13	Halt and enter octal debugging technique if trap-on-halt disabled, or loop.[6]
1 1 1 1 0	14	Test. Autoboot DEQNAs 0 and 1.
1 1 1 1 1	15	Test. Enter console mode; user selects a language.

[1]0 = jumper installed; 1 = jumper removed.

[2]Jumpers W2, W3, W5, and W8 removed to use switch.

[3]With Version 1.0 ROMs, you can select only English (positions 00000 and 10000) or Spanish (positions 00110 and 10110). With Version 2.0 ROMs, you can select eight languages.

[6]W1 = Trap-on-halt (enabled = removed; disabled = installed).

The items included in Table 1–3 for tapes and disks are DU 0–255, DU 0–255 at floating addresses, DL 0–3, DX 0–1, DY 0–1, MU 0, and MS 0. For DU, you boot removable media before fixed-media.

Version 1 (V1.0) supports English and Spanish text only. Switch positions 1 through 5 and 7 through 11 require you to select the desired language.

Version 2 (V2.0) supports English, Spanish, French, German, Dutch, Swedish, Italian, and Portuguese text. Switch positions 1 through 7 require you to select the desired language. Switch positions 8 through 11 are reserved for future languages.

To properly display the text for the various languages, the console terminal must have certain capabilities:

- For V1.00 of the ROM code, set up the terminal to display standard ASCII for both English and Spanish text only. Bit 7 of all input is stripped to 0.
- For V2.00 of the ROM code, some of the languages require that the terminal have the multinational character set (MCS) available along with ASCII. Set up the terminal so that characters from 0 to 127(10)

select ASCII, and characters from 128(10) to 255(10) select MCS. Some languages use 8-bit input also.

Table 1–4 lists the terminal requirements for the various languages.

Table 1–4: KDJ11–D/S Terminal Requirements

Language	Output Requirements	Input Requirements
English	ASCII	7-bit
French	ASCII and MCS	8-bit
German	ASCII and MCS	8-bit
Dutch	ASCII	7-bit
Swedish	ASCII and MCS	8-bit
Italian	ASCII	7-bit
Spanish	ASCII and MCS	8-bit
Portuguese	ASCII and MCS	8-bit

NOTE: *To display all the selections properly, the language selection message requires a terminal with MCS.*

If you use a VT220 terminal as the console terminal, set it to VT220 mode, to display MCS characters.

For more information on configuring the KDJ11–D/S, see the *KDJ11–D/S CPU Module User's Guide.*

1.4 Boot and Diagnostic ROM Code

Bootstrap and diagnostic programs reside in two ROMs or EPROMs on the KDJ11–D/S module. The programs (ROM code) test the CPU module and memory at power-up or restart, and boot the user's software from various devices.

The ROM code consists of three routines:

- Diagnostics that run when the ROM code is started. The diagnostics verify that the KDJ11–D/S and any additional Q22-bus memory modules are working correctly. The test run time is longer when additional memory modules are installed.
- Bootstrap routines for most DIGITAL tape, disk, and network products.
- All support routines and user commands.

1.5 Automatic Boot Mode

After the KDJ11–D/S start-up self-test completes, the ROM code automatically tries to load and start (boot) a program from the user's disk or tape drive. If successful, the ROM code displays a message at the console terminal.

Example 1–1 shows a message for a successful system bootstrap in automatic boot mode. In this example, the software is RT–11, booted from device DU0.

Example 1–1: Successful Automatic Boot Message

```
9 8 7 6 5 4 3 2 1
DUO
RT-11FB (S) V05.01
```

The descending number sequence (top line of Example 1–1) indicates that the tests are executing. Messages following DU0 are generated by the booted software, not the ROM code. At this point, the ROM code is not executing and all commands and messages are determined by the user's software.

1.5.1 Bootstrap Error Messages

If the autoboot is not successful, the ROM code displays an error message indicating that the autoboot was not successful, but will make continuous passes until successful or aborted.

There are two types of KDJ11–D/S bootstrap error messages: One is associated with automatic boot mode at power-up or restart, and the other with the console mode Boot command (Section 1.6.2).

Example 1–2 shows an error message for an unsuccessful system bootstrap in the automatic boot mode.

Example 1–2: Boot Error Message in Automatic Boot Mode

```
9 8 7 6 5 4 3 2 1
KDJ11-D/S E.01
No bootable devices found.
Boot in progress, press CTRL/C to exit.
```

When an error occurs in a boot program called with the Boot command, the ROM code displays one of the following error messages:

```
Drive not ready
Media not bootable
Non-existent controller, address = 177nnnnnn
Non-existent drive
Invalid unit number
Invalid device
Controller error
Drive error
```

Examples 1–3 and 1–4 show console mode Boot command error messages.

Example 1–3: Boot Error Message in Console Mode (Nonexistent Drive)

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  B DL3
KDJ11-D/S E.05
Non-existent drive.

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return.
```

Example 1–4: Boot Error Message in Console Mode (Nonexistent Controller)

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  B DL1
KDJ11-D/S E.04
Non-existent controller, address = 17772152

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return.
```

1.6 Console Mode

Console mode allows you to select a boot device, list available boot programs, run ROM tests, obtain a map of all memory and I/O page locations, and wrap the console SLU to the second SLU.

You can enter console mode in two ways:

- Depending on the contents of native register (NR) <12:08>, console mode is entered automatically after testing is completed. In console mode, the ROM code allows you to determine the execution sequence by entering keyboard commands through the console terminal.
- By typing CTRL/C during testing or the boot sequence; in this case, the NR bits are ignored.

When you enter console mode, the ROM code displays the message shown in Example 1–5, then waits for you to enter a command.

Example 1–5: Successful Power-Up to Console Mode Message

```
9 8 7 6 5 4 3 2 1

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return.
```

You can select from the six console mode commands, listed in the prompt message. For a brief description of the commands, type either ? RETURN or H RETURN. Table 1–5 lists the console mode commands and control characters.

Table 1–5: Console Mode Commands and Characters

Command	Description
Help	Lists console mode commands.
Boot	Boots from selected device.
List	Lists ROM boot programs.
Map	Sizes memory and map I/O page.
Test	Runs tests 3 through 6.
Wrap	Wraps SLU0 to SLU1.
?	Alternate form of Help command.
/A	Boot command switch: nonstandard CSR address.
/A	Wrap command switch: wraps SLU0 to specified SLU.

Table 1–5 (Cont.): Console Mode Commands and Characters

Command	Description
/O	Boot command switch: overrides boot block definition.
Delete	Deletes previous command character.
RETURN	Command delimiter.
CTRL/C	Aborts operation. Enters/requests console mode.
CTRL/D	Aborts wrap and reenters console mode.
CTRL/H	Console is a hard-copy terminal.
CTRL/L	Displays language inquiry message.
CTRL/R	Redisplays command line.
CTRL/U	Deletes command line.
CTRL/V	Console is a video terminal.

To execute a console mode command, type the first character of the command and then press RETURN.

If you enter an invalid command, a message is displayed and the prompt is displayed again to request additional input. Example 1–6 shows an invalid entry.

Example 1–6: Invalid Entry Message

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  MP
Invalid Input

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return.
```

1.6.1 Help Command

The Help command displays a brief description of all console mode commands. Press either ? [RETURN] or H [RETURN]. Example 1–7 shows the Help command message. Console mode continues when you exit from Help.

Example 1–7: Help Command Message

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  H

Command    Description

Boot  Load and start a program from a device
List  List boot programs
Map  Map memory and I/O page
Test  Run continuous self test - press CTRL/C to exit
Wrap  Wrap console to SLU1, press CTRL/D to exit

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return.
```

1.6.2 Boot Command

The Boot command allows you to select a boot device. The command uses arguments and optional switches.

Arguments specify the device name and unit number. The device name is a two-letter mnemonic that describes the device. An optional third letter specifies the controller. If you omit the unit number, the program assumes unit zero.

Enter the Boot command in either of the following two ways:

- Type B, then press [RETURN]. The system prompts for the device name and unit number as shown in Example 1–8. Example 1–9 shows a successful boot message using device DL2.
- Type B, press the space bar, type the device name and unit number, then press [RETURN].

Example 1–8: Boot Command Argument Prompt

```
-------------------------------------------------------
 Enter device name and unit number then press Return.
-------------------------------------------------------
```

Example 1–9: Boot Command Using DL2

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  B DL2
DL2
RT-11FB (S) V05.01

.SET IT QUIET
.R DATIME
```

You can use two switches with the Boot command:

- /A. Requests that you type in a nonstandard CSR address for the controller.
- /O. Overrides the standard boot block definition.

You type the switch immediately after the Boot command and before the device name and unit number. For example: B/A.

1.6.3 List Command

The List command displays a list of all available boot programs found in the ROM. The list includes the device name, unit number, and a short device description (Example 1–10).

Example 1–10: List Command Messages

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  L

Device Unit Description

DU 0-225 RDnn, RXnn, RC25, RAnn
DL 0-3 RL01, RL02
DX 0-1 RX01
DY 0-1 RX02
DD 0-1 TU58
DK 0-7 RK05
MU 0-225 TK50
MS 0-3 TSV05, TK25
XH 0-1 DECnet Ethernet
NP 0-1 DECnet DPV11
NU 0-15 DECnet DUV11
NE 0-15 DECnet DLV11-E
NF 0-15 DECnet DLV11-F

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press RETURN.
```

The device name is usually a two-letter mnemonic. The valid letter range is A through Z.

The unit number range is the valid range for a particular boot program. The range varies from 0 to 225, depending on the device.

The description, or device type, is the name of the physical device.

1.6.4 Map Command

The Map command displays the current ROM code version number, determines and displays the size of consecutive memory, identifies all memory in the system, and maps all locations in the I/O page.

Memory is mapped in 1-Kbyte increments from location zero to the I/O page. The map routine tries to identify the size of each memory module and its CSR address (if applicable). If two or more noncontiguous memory modules are present, the ROM code displays their descriptions, separated by a blank line.

NOTE: *If two memory modules share some common addresses or have CSRs with the same address, the Map command does not work correctly.*

After all memory is mapped, you are prompted to press RETURN (Example 1–11). Mapping continues and all responding I/O page addresses are displayed. The I/O page map addresses are 17760000 to 17777776. In addition, all responding CPU addresses are listed with a short description.

There is no description for addresses that respond and are on the external bus, with the exception of memory CSRs, if present, and Q-bus devices DU, MU, and XH. The map only identifies DU (disk MSCP controller) and MU (tape MSCP controller) at their standard addresses of 17772150/2 and 17774500/2. The map identifies XH at addresses 17774440/56 and 17774460/76.

When the on-board line time clock CSR at address 17777546 is reached during the I/O page portion of the Map command, the ROM code follows the LTC CSR printout with either BEVENT=0 (signal is not present on Q-bus) or BEVENT=1 (signal is present on Q-bus). The line time clock test does not fail if the BEVENT signal is not present.

When the ROM code detects a device at addresses 17774440 to 17774456 or 17774460 to 17774476 during the I/O page portion of the Map command, it identifies that device as XH for an Ethernet controller and then reads and types the six-byte station address starting at either 17774440 or 17774460. The ROM code prints out in hexadecimal bits 7:4 then 3:0 of each of the six bytes. The Map command message in Example 1–11 shows one DEQNA present at location 17774440 to 17774456.

Example 1–11: Map Command Message

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  M

KDJ11-D/S ROM V1.0
512 Kbytes

00000000 - 01777776      512 KB        CSR = 17772100
Press the Return key when ready to continue.
```

Example 1–11 Cont'd. on next page

Example 1–11 (Cont.): Map Command Message

```
17772100   MCSR
17772150 - 17772152  DU
17772200 - 17772216  SIPDRO-7
17772220 - 17772236  SDPDRO-7
17772240 - 17772256  SIPARO-7
17772260 - 17772260  SDPARO-7
17772300 - 17772316  KIPDRO-7
17772320 - 17772336  KDPDRO-7
17772340 - 17772356  KIPARO-7
17772360 - 17772376  KDPARO-7
17772516   MMR3
17773000 - 17773776  CPU ROM
17774440 - 17774456  XH  08-00-2B-02-71-E2
17774500 - 17774502  MU
17776500 - 17776506  SLU1
17777520   NR
17777546   LTC CSR, BEVENT=1
17777560 - 17777566  SLU0
17777572 - 17777576  MMR0, 1, 2
17777600 - 17777616  UIPDRO-7
17777620 - 17777636  UDPDRO-7
17777640 - 17777656  UIPARO-7
17777660 - 17777660  UDPARO-7
17777750   MREG
17777766   CPUER
17777772   PIRQ
17777776   PSW

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press the Return key.
```

1.6.5 Test Command

The Test command causes the ROM code to run most of the power-up tests in a continuous loop. The ROM code starts at test 3, runs all applicable tests and subtests, then restarts the loop after test 6 is completed. To abort testing and restart console mode, enter CTRL/C at any time. If an error occurs, the test 3 through 6 error routine is entered. Two actions are possible at this time:

- Restart the console mode by entering CTRL/C.
- Loop through all the tests, ignoring errors, by typing L RETURN.

On exiting from the test loop, the ROM code displays the total number of loops (passes) and the total number of errors (if any) in the following format, where n is the number of errors and x is the number of times the tests were attempted:

nnn/xxx

In Example 1–12, the Test command is entered to run all loopable tests. After four passes, the testing sequence is aborted with no errors.

Example 1–12: Test Command Message

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  T

Continuous self-test - type CTRL/C to exit.

0/4

Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return.
```

1.6.6 Wrap Command

The Wrap command transmits all input from the console terminal (DLARTO) to the second SLU (DLART1), or to a selected SLU. All input from DLART1 or the selected SLU is sent to the console terminal. This action allows you, at DLART0, to communicate with another system through DLART1 or another selected SLU. The command has one optional switch: switch /A.

Entering the Wrap command with switch /A causes the ROM code to request an alternate SLU address. The valid alternate address range is 17776500 to 17776676.

Example 1–13 shows the Wrap command without the switch. The console wraps to the second SLU at address 17776500.

Example 1–14 shows the Wrap command with an alternate SLU address.

Example 1–13: Wrap Command Message Without Switch

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  T

Wrap Console to SLU1, type CTRL/D to exit.
```

Example 1–14: Wrap Command Message With Switch

```
Commands are Help, Boot, List, Map, Test, and Wrap.
Type a command then press Return:  W/A

Address = 17776520
Wrap Console to SLU1, type CTRL/D to exit.
```

1.6.7 Command Keys

The command keys and their functions are listed below:

- Delete. Deletes the previously entered character.
- CTRL/H. Selects the console terminal as a hard-copy terminal. Affects output only if you press the Delete key. When you press Delete, the ROM code identifies deleted characters with / (forward slash) characters.
- CTRL/U. Deletes the entire command line.
- CTRL/V. Selects the console terminal as a video terminal. Affects output only if you press the Delete key. When you press Delete, the deleted characters are erased from the screen (default).
- CTRL/R. Reprints the command line. Normally used on hard-copy terminals to reprint command lines that are obscured by pressing the Delete key.

1.7 MSV11–P Memory

The MSV11–P memory is a quad-height module that occupies the slot(s) in the backplane immediately following the KDJ11–D/S CPU in slot 1.

The MSV11–P module contains 64K metallic oxide semiconductor (MOS) chips that provide storage for 18-bit words (16 data bits and 2 parity bits). The MSV11–P also contains parity control circuitry and a control status register.

The memory module variants and their storage capacities are:

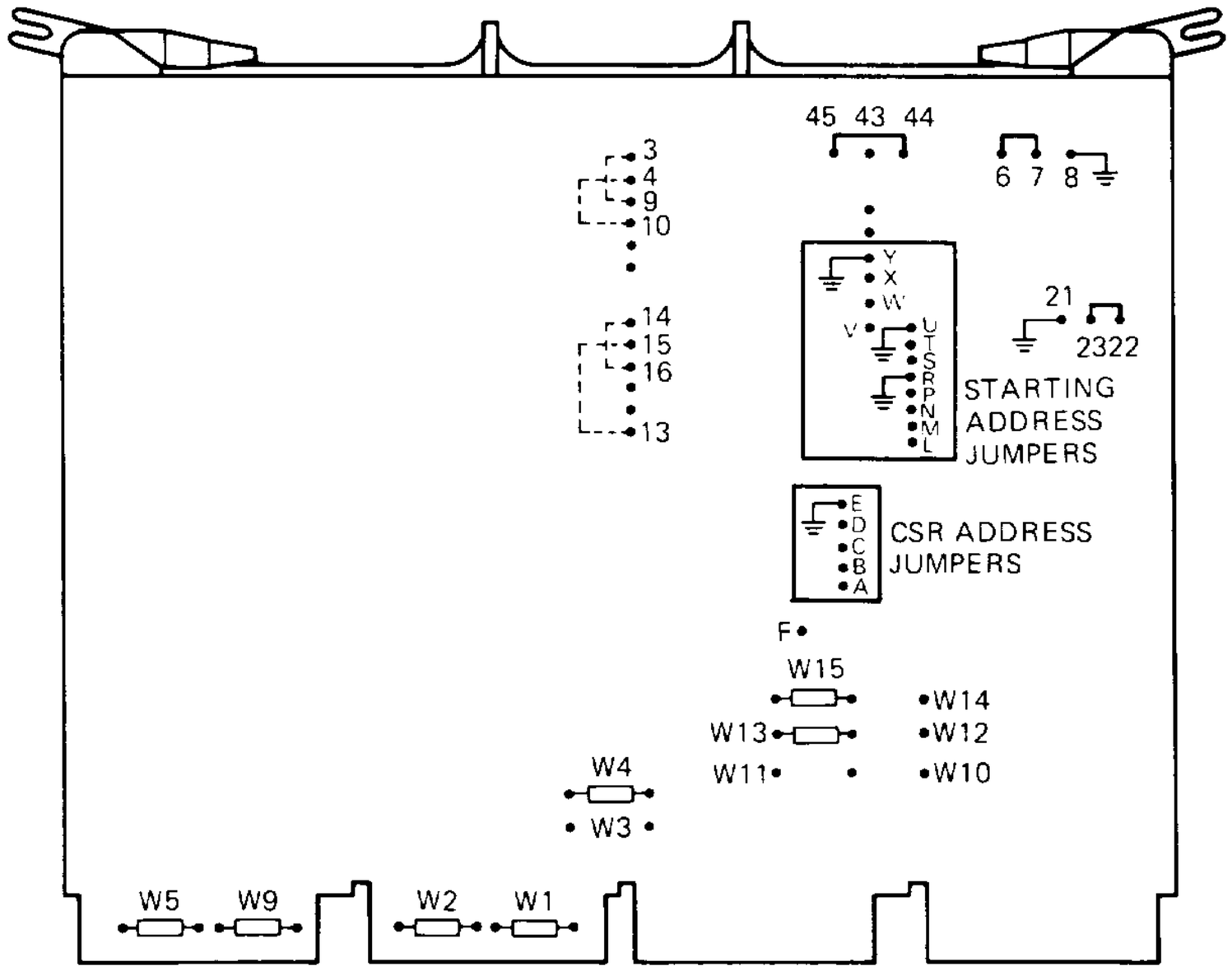
- MSV11–PK (M8967–K): 256 Kbytes
- MSV11–PL (M8067–L): 512 Kbytes

You configure the MSV11–P, shown in Figure 1–6, by means of jumpers and wire-wrap pins. The –PK and –PL modules have the same factory configuration.

The MSV11–P module has two LEDs that show the following status:

- A green LED: lights to indicate that +5 Vdc is present.
- A red LED: lights to indicate that a parity error has been detected.

Figure 1–6: MSV11–P Module Layout



MLO-001275

1.7.1 MSV11–P Expansion Addresses

You can install additional MSV11–P modules for system expansion.

For each memory module that you add to the Q22-bus, you must reposition jumpers on the wire-wrap pins to provide a CSR address and a starting address.

Figure 1–6 shows the CSR address jumpers on the MSV11–P module. Table 1–6 lists the CSR address and corresponding jumper configurations for each memory module (–PK or –PL) added to the system.

Table 1–6: MSV11–P CSR Addresses and Jumpers

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

The starting address depends on the amount of memory already present in the system.

Table 1–7 lists the first address ranges (FAR) to select the 256K word range. Table 1–8 lists the partial starting address (PSA) ranges for additional MSV11–P memory modules.

Table 1–7: MSV11–P First Address Ranges

First Address Ranges		
Decimal K Words	**Octal K Words**	**Pins to Wire-Wrap**
000–248	00000000–01740000	None
256–504	02000000–03740000	V to Y
512–760	04000000–05740000	W to Y
768–1016	06000000–07740000	W to Y, V to Y
1024–1727	10000000–11740000	X to Y
1280–1528	12000000–13740000	X to Y, V to Y
1526–1784	14000000–15740000	X to Y, W to Y
1742–2040	16000000–17740000	X to Y, W to Y, V to Y

Table 1–8: MSV11–P Partial Starting Address Ranges

Partial Starting Address		
Decimal K	**Octal**	**Pins to Wire-Wrap**
0	00000000	None
8	00040000	T to R
16	00100000	L to R
24	00140000	L to R, T to R
32	00200000	M to R
40	00240000	M to R, T to R
48	00300000	M to R, L to R
56	00340000	M to R, L to R, T to R
64	00400000	N to R
72	00440000	N to R, T to R
80	00500000	N to R, L to R
88	00540000	N to R, L to R, T to R
96	00600000	N to R, M to R
104	00640000	N to R, M to R
112	00700000	N to R, M to R, L to R
120	00740000	N to R, M to R, L to R, T to R
128	01000000	P to R
136	01040000	P to R, T to R
144	01100000	P to R, L to R
152	01140000	P to R, L to R, T to R

Table 1–8 (Cont.): MSV11–P Partial Starting Address Ranges

Partial Starting Address		
Decimal K	**Octal**	**Pins to Wire-Wrap**
160	01200000	P to R, M to R
168	01240000	P to R, M to R, T to R
176	01300000	P to R, M to R, L to R
184	01340000	P to R, M to R, L to R, T to R
192	01400000	P to R, N to R
200	01440000	P to R, N to R, T to R
208	01400000	P to R, N to R, L to R
216	01540000	P to R, N to R, L to R, T to R
224	01600000	P to R, N to R, M to R
232	01640000	P to R, N to R, M to R, T to R
240	01700000	P to R, N to R, M to R, L to R
248	01740000	P to R, N to R, M to R, L to R, T to R

Table 1–9 lists the jumper configuration for additional MSV11–PK modules.

Table 1–9: MSV11–PK Starting Address Jumpers (256-Kbyte Increments)

Module No. in System	Pins to Wire-Wrap
1	None
2	P to R
3	V to Y
4	V to Y, P to R
5	W to Y
6	W to Y, P to R
7	W to Y, V to Y
8	W to Y, V to Y, P to R

Table 1–10 lists the jumper configuration for additional MSV11–PL modules.

Table 1–10: MSV11–PL Starting Address Jumpers (512-Kbyte Increments)

Module No. in System	Pins to Wire-Wrap
1	None
2	V to Y
3	W to Y
4	V to Y, W to Y
5	X to Y
6	X to Y, V to Y
7	X to Y, W to Y
8	X to Y, W to Y, V to Y

For more information on the MSV11–P memory, refer to the *MSV11–P User's Guide* (EK–MSVOP–UG).

1.8 MSV11–Q Memory

The MSV11–Q memory is a quad-height module, shown in Figure 1–7, that occupies the slot(s) in the backplane immediately following the KDJ11–D/S CPU in slot 1.

The MSV11–Q module has a 1, 2, or 4 Mbyte capacity using either 64K or 256K MOS dynamic RAMs. The control status register (CSR) contains bits used to store the parity error address bits. You can force wrong parity by setting a bit in the CSR to check the parity logic.

Figure 1–7: MSV11–Q Module Layout

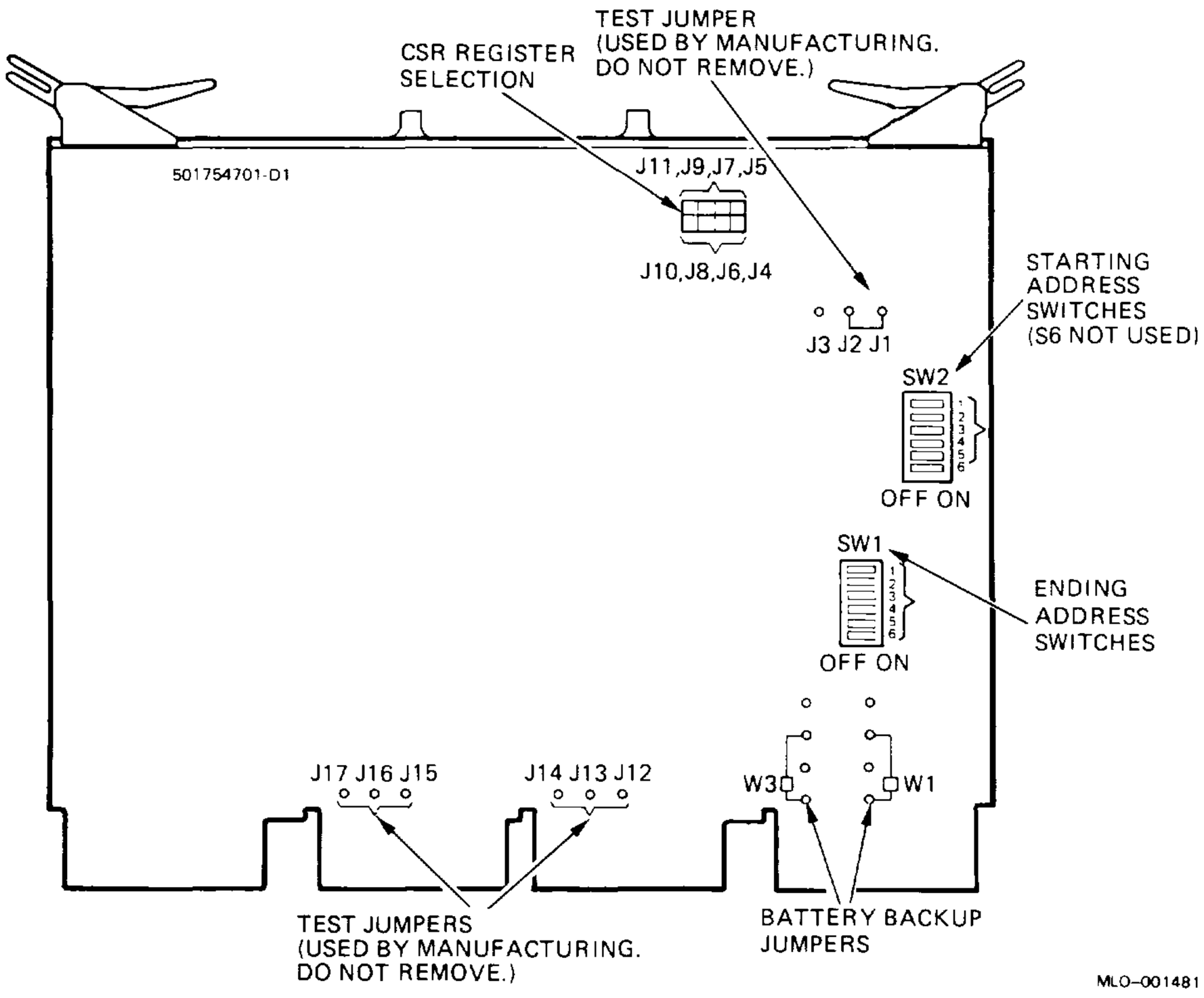


Table 1–11 lists the memory module variants and their storage capacities.

Table 1–11: MSV11–Q Variations

Revision[1]	Option	Module	Storage	RAM Size
A, C	MSV11–QA	M7551–AA	1 Mbyte	56K
C	MSV11–QB	M7551–BA	2 Mbyte	256K (half populated)
C	MSV11–QC	M7551–CA	4 Mbyte	256K (fully populated)

[1]Identify the revision level by the following printed circuit board number:

A = 5017547A1 on upper right corner of component side of module
C = 5017547–01–C1 on upper left corner of component side of module

You must configure the MSV11–Q starting and ending addresses using DIP switches SW1 and SW2 (Figure 1–7). SW1 is the ending address and SW2 is the starting address.

Table 1–12 lists the switch settings for the starting and ending addresses.

Table 1–12: MSV11–Q Starting and Ending Addresses

Starting Address (in Kbytes)	SW2 Position[1] 12345[2]	SW1 Position 6	Ending Address (in Kbytes)	SW1 Position 12345[2]
0	00000	0	128	1111
128	11111	1	256	01111
256	01111	1	384	10111
384	10111	1	512	00111
512	00111	1	640	11011
640	11011	1	768	01011
768	01011	1	896	10011
896	10011	1	1024 (1 Mbyte)	00011
1024 (1 Mbyte)	00011	1	1152	11101
1152	11101	1	1280	01101
1280	01101	1	1408	10101
1408	10101	1	1536	00101
1536	00101	1	1664	11001
1664	11001	1	1792	01001
1792	01001	1	1920	10001
1920	10001	1	2048 (2 Mbytes)	00001
2048 (2 Mbytes)	00001	1	2176	11110
2176	11110	1	2304	01110
2304	01110	1	2432	10110
2432	10110	1	2560	00110
2560	00110	1	2688	11010
2688	11010	1	2816	01010
2816	01010	1	2944	10010
2944	10010	1	3072 (3 Mbytes)	00010
3072 (3 Mbytes)	00010	1	3200	11100

[1]Switch S6 of SW2 is not used. For a memory starting address of 0, set switch S6 of SW1 to on (0). For all other starting addresses, set switch S6 of SW1 to off (1).

[2]1 = off; 0 = on

Table 1–12 (Cont.): MSV11–Q Starting and Ending Addresses

Starting Address (in Kbytes)	SW2 Position[1] 12345[2]	SW1 Position 6	Ending Address (in Kbytes)	SW1 Position 12345[2]
3200	11100	1	3328	01100
3328	01100	1	3456	10100
3456	10100	1	3584	00100
3584	00100	1	3712	11000
3712	11000	1	3840	01000
3849	01000	1	3968	10000
3968	10000	1	4096 (4 Mbytes)	00000

[1]Switch S6 of SW2 is not used. For a memory starting address of 0, set switch S6 of SW1 to on (0). For all other starting addresses, set switch S6 of SW1 to off (1).

[2]1 = off; 0 = on

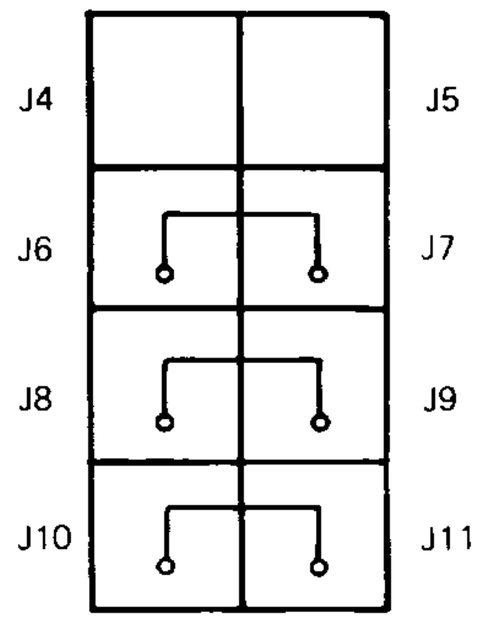
You configure the MSV11–Q CSR address by setting jumpers J4 through J11 (Figure 1–7). Table 1–13 shows the jumper positions and the corresponding CSR register addresses for up to 16 locations. Figure 1–8 shows the jumper settings for a CSR register address of 17772102, representing a second MSV11–Q.

Table 1–13: MSV11–Q CSR Addresses

Number CSR Memory[1]	Jumper J4 to J5	Jumper J6 to J7	Jumper J8 to J9	Jumper J10 to J11	CSR Address
1	In	In	In	In	x00
2	Out	In	In	In	x02
3	In	Out	In	In	x04
4	Out	Out	In	In	x06
5	In	In	Out	In	x10
6	Out	In	Out	In	x12
7	In	Out	Out	In	x14
8	Out	Out	Out	In	x16
9	In	In	In	Out	x20
10	Out	In	In	Out	x22
11	In	Out	In	Out	x24
12	Out	Out	In	Out	x26
13	In	In	Out	Out	x30
14	Out	In	Out	Out	x32
15	In	Out	Out	Out	x34
16	Out	Out	Out	Out	x36

[1]If more than one CSR parity-type memory is installed, use care to ensure that no two modules have the same address.

Figure 1–8: MSV11–Q CSR 17772102 Setting



The factory configuration for the remaining jumpers is listed in Table 1–14.

Table 1–14: MSV11–Q Factory Jumper Settings

Jumper	State	Condition
J1 to J2	In	For manufacturing test only. Do not remove.
J13 to J14	In	Selects 64K RAMs. Do not remove.
J15 to J16	In	Selects 64K RAMs. Do not remove.
W3, W1	In	Battery backup configuration.

For more information on the MSV11–Q, see *MSV11–Q MOS Memory User's Guide* (KE–MSV1Q–QG).

Chapter 2
Configuration

2.1 Introduction

This chapter describes the rules and guidelines for changing the configuration of a KDJ11–D/S system. Before you change a system's configuration, you must consider the following factors:

Module order in the backplane
Module configuration
Mass storage device configuration

Section 2.2 lists the guidelines for module order and configuration. These guidelines apply to the KDJ11–D/S CPU in the BA23 and BA200-series enclosures.

If you are adding a device to a system, you must know the capacity of the system enclosure in the following areas:

Backplane
I/O panel
Power supply
Mass storage devices

Worksheets for the enclosures (Section 2.5) provide information about system capacities.

2.2 Module Order

The order of modules in the backplane depends on four factors:

- Relative use of devices in the system
- Expected performance of each device relative to other devices
- The ability of a device to tolerate delays between bus requests and bus grants (known as "delay tolerance" or "interrupt latency")
- The tendency of a device to prevent devices farther from the CPU from accessing the bus

The relative use and performance of devices depends on the application. This means the order of modules also depends on the application. Most applications try to balance the use of devices. To achieve maximum system performance, use the recommended order listed in Table 2–1. The order is based on the Q-bus DMA transfer characteristics; use it as a guideline. Make sure you read the rules and guidelines in Section 2.3 for placement of the CPU and memory modules.

Table 2–1: Q-Bus Recommended Module Order

Option Type	Option Example	Comments
Communications	DPV11	Synchronous
	DEQNA	Ethernet interface
	DRV11–J	General purpose
Line printer	LPV11	
Communications	DLVJ1	Asynchronous
	DMV11	Synchronous (DMA)
Disk controller	RLV12	
	RRD50	Read only
	KDA50	
	RQDX3	MSCP
Disk/tape controller	KLESI	
Tape controller	TQK50	
Disk controller	RQDX2	
General purpose interface	DRV11	

CAUTION: *If an option has Q/CD jumpers, check the documentation for that option for the correct Q/CD jumper settings. An incorrect jumper setting can cause damage to the option.*

When devices do not perform as expected, you can change the recommended module order to meet the needs of the application. Often, performance problems involve a device that is heavily used or has a low delay tolerance. Usually, there are other heavily used devices between the device with the low delay tolerance and the CPU. In this case, move the problem device closer to the CPU.

2.3 Configuration Rules

Follow these configuration rules when you install or remove modules from the card cage:

- Always install the KDJ11–D/S CPU module in slot 1.
- Always install the MSV11–P or MSV11–Q memory module(s) in the slots immediately following the CPU, beginning with slot 2.
- Maintain the Q22-bus grant continuity for all Q22-bus devices in the system. Each Q22-bus slot that comes before a Q22-bus device on the grant continuity chain must contain an M9047 grant continuity card or another Q22-bus device.
- Install modules following the CPU and memory using the sequence shown in Table 2–1.
- Refer to the applicable enclosure maintenance documentation for enclosure-specific guidelines for the I/O panel and configuration of the backplane.

2.4 Configuration Procedure

Each module in a system must use a unique device address and interrupt vector. The device address is also known as the control status register (CSR) address. Most modules have switches or jumpers for setting the CSR address and interrupt vector values.

Calculating address and vector values is a complex procedure because some modules use floating addresses and vectors. The value of a floating address depends on the other modules in the system.

See *Microsystems Options* for CSR addresses and interrupt vectors for MicroPDP–11 options. Most modules have switches and jumpers to change their operating characteristics. For some applications, you may have to change the factory switch and jumper positions according to the guidelines in *Microsystems Options*.

NOTE: *Changing the factory positions may affect the operation of the diagnostics for the device.*

2.5 Configuration Worksheets

Use the following configuration worksheets, located at the end of this chapter, to make sure a configuration does not exceed a system's limits for expansion space, I/O space, power, and bus loads:

Enclosure	Worksheet
BA23	Figure 2–1
BA200-series	Figure 2–2

If you use standard DIGITAL modules, you will not exceed the limits for bus loads.

Use the configuration worksheet as follows:

1. List all the devices already installed in the system.
2. List all the devices you plan to install in the system.
3. Fill in the information for each device, using the data listed in Table 2–2 for BA200-series enclosures or Table 2–3 for the BA23 enclosure.
4. Add up the columns. Make sure the totals are within the limits for the enclosure power supply.

Table 2–2: Power and Bus Load Data (BA200-Series)

		Current (Amps)		Power	Bus Loads	
Option	**Module**	**+5 V**	**+12 V**	**Watts**	**AC**	**DC**
AAV11–SA	A1009–PA	1.8	0.0	9.0	2.1	0.5
ADV11–SA	A1008–PA	3.2	0.0	16.0	2.3	0.5
AXV11–SA	A026–PA	2.0	0.0	10.0	1.2	0.3
KWV11–SA	M4002–PA	2.2	0.130	11.16	1.0	0.3
CXA16–M	M3118–YA	1.6	0.20	10.4	3.0	0.5
CXB16–M	M3118–YB	2.0	0.0	10.0	3.0	0.5
CXY08–M	M3119–YA	1.8	0.30	12.6	3.2	0.5
DELQA–SA	M7516–PA	2.7	0.5	19.5	2.2	0.5
DEQNA–SA	M7504–PA	3.5	0.50	23.5	2.2	0.5
DFA01	M3121–PA	1.97	0.40	14.7	3.0	1.0
DPV11–SA	M8020–PA	1.2	0.30	9.6	1.0	1.0
DRV1J–SA	M8049–PA	1.8	0.0	9.0	2.0	1.0
DRV1W–SA	M7651–PA	1.8	0.0	9.0	2.0	1.0
DZQ11–SA	M3106–PA	1.0	0.36	9.3	1.4	0.5
IEQ11–SA	M8634–PA	3.5	0.0	17.5	2.0	1.0
KDJ11–S	M7554–P	3.5	0.18	19.7	3.0	1.0
KMV1A–SA	M7500–PA	2.6	0.2	15.4	3.0	1.0
KWV11–SA	M4002–PA	2.2	0.13	11.16	1.0	0.3
LPV11–SA	M8086–PA	1.6	0.0	8.0	1.8	0.5
M9060	M9060–YA	5.3	0.0	26.5	0.0	0.0
MSV11–PK	M8067–K	3.45	–	17.25	2.0	1.0
MSV11–PL	M8067–L	3.6	–	17.5	2.0	1.0
MSV11–QA	M7551–AA	2.4	0.0	12.0	2.0	1.0
MSV11–QB	M7551–BA	2.3	0.0	11.5	2.0	1.0
MSV11–QC	M7551–CA	2.5	0.0	12.5	2.0	1.0
RD31	–	0.9	0.9	38.8	–	–
RD32	–	0.9	0.6	33.0	–	–
RF30–S	–	1.25	2.85	18.3	–	–
TK50	–	1.35	2.4	33.55	–	–
TQK50	M7546	2.9	0.0	14.5	2.0	1.0

Table 2–3: Power, Bus Load, and I/O Insert Data (BA23, BA123)

		Current (Amps)		Power	Bus Loads		
Option	**Module**	**+5 V**	**+12 V**	**Watts**	**AC**	**DC**	**Insert[1]**
AAV11–D[2]	A1009	1.8	0.0	9.0	1.0	1.0	–
ADV11–D[2]	A1008	3.2	0.0	16.0	1.0	1.0	–
DEQNA	M7504	3.5	0.5	23.5	2.8	0.5	A
DELQA	M7516	2.7	0.5	19.5	2.2	0.5	A
DHV11	M3104	4.5	0.55	29.1	2.9	0.5	B (2)
DLVEI–DP	M8017	1.0	1.5	23.0	1.6	1.0	A
DLVJ1	M8043	1.0	0.25	8.0	1.0	1.0	B
DMV11–M	M8053	3.4	0.4	21.8	2.0	1.0	A
DMV11–AP	M8053–MA	3.4	0.38	21.6	2.0	1.0	B
DMV11–BP	M8053–MA	3.4	0.38	21.6	2.0	1.0	A
DMV11–CP	M8064–MA	3.35	0.26	19.9	2.0	1.0	B
DMV11–FP	M8053–MA	3.4	0.38	21.6	2.0	1.0	A (2)
DMV11–N	M8064	3.4	0.4	21.8	2.0	1.0	A
DPV11	M8020	1.2	0.3	9.6	1.0	1.0	A
DUV11–DP	M7951	1.2	0.39	10.7	3.0	1.0	A (2)
DZV11	M7957	1.2	0.39	10.7	3.9	1.0	B
KDJ11–DA	M7554	2.80	0.20	16.4	3.0	1.0	–
KDJ11–DB	M7554	3.20	0.19	19.8	3.0	1.0	–
KWV11–C[2]	M4002	2.2	0.013	11.2	1.0	1.0	–
LPV11	M8027	0.8	0.0	4.0	1.4	1.0	A
MRV11–D[3]	M7942	1.6	0.0	8.0	3.0	0.5	–
MRV11–D	M7942	2.8	0.0	14.0	1.8	1.0	–
MSV11–PK	M8067–K	3.45	0.0	17.25	2.0	1.0	–
MSV11–PL	M8067–L	3.6	0.0	17.5	2.0	1.0	–
MSV11–QA	M7551–AA	2.4	0.0	12.0	2.0	1.0	–
MSV11–QB	M7551–BA	2.3	0.0	11.5	2.0	1.0	–
MSV11–QC	M7551–CA	2.5	0.0	12.5	2.0	1.0	–
RC25	–	1.0	2.5	35.0	–	–	–
RD31	–	0.9	0.9	38.8	–	–	–
RD32	–	0.9	0.6	33.0	–	–	–
RD33	–	0.9	1.0	15.7	–	–	–
RD51	–	1.0	1.6	24.2	–	–	–
RD52	–	1.0	2.5	35.0	–	–	–

[1]A = 2.5 cm x 10.0 cm (1 in x 4 in).
B = 5.0 cm x 7.5 cm (2 in x 3 in).

[2]Usually connected through a universal data input panel (UDIP), using a 13.13-cm (5.25-in) mass storage slot.

[3]Unpopulated module.

Table 2–3 (Cont.): Power, Bus Load, and I/O Insert Data (BA23, BA123)

Option	Module	Current (Amps) +5 V	Current (Amps) +12 V	Power Watts	Bus Loads AC	Bus Loads DC	Insert[1]
RD53	–	0.9	2.5	34.5	–	–	–
RD54	–	1.3	1.34	23.7	–	–	–
RD54A–EA		1.3	1.34	22.6	–	–	–
RLV12–AP	M8061	5.0	0.10	26.2	2.7	1.0	A
RQDX1	M8639–YA	6.4	0.25	35.0	2.0	1.0	–
RQDX2	M8639–YB	6.4	0.1	33.2	2.0	1.0	–
RQDX3	M7555	2.48	0.06	13.2	1.0	1.0	–
RQDXE	M7513	0.5	0.0	2.5	1.0	0.0	–
RX33	–	0.5	0.3	5.6	–	–	–
RX50	–	0.85	1.8	25.9	–	–	–
TK50	–	1.35	2.4	33.55	–	–	–
TK50–AA	–	1.35	2.4	34.5	–	–	–
TK50E–EA	–	1.35	2.4	35.6	–	–	–
TQK25–KA	M7605	4.0	–	20.0	2.0	1.0	A
TQK50	M7546	2.9	0.0	14.5	2.8	0.5	–
TSV05	M7196	6.5	0.0	32.5	3.0	1.0	A

[1]A = 2.5 cm x 10.0 cm (1 in x 4 in).
B = 5.0 cm x 7.5 cm (2 in x 3 in).

Figure 2–1: BA23 Enclosure Worksheet

ADD THESE COLUMNS

BACKPLANE SLOT	MODULE	CURRENT (A) +5 V	CURRENT (A) +12 V	POWER (W)	I/O INSERTS B	I/O INSERTS 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						
MASS STORAGE 1						
2						
COLUMN TOTALS:						
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. THE ADAPTER ALLOWS THREE ADDITIONAL TYPE-A FILTER CONNECTORS, BUT REDUCES THE AVAILABLE TYPE-B CUTOUTS TO TWO.

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Figure 2–2: BA200-Series Enclosure Worksheet

12 SLOT ENCLOSURE

RIGHT HALF POWER SUPPLY						
SLOT (ABCD)	MODULE	CURRENT 5 V	AMPS 12 V	POWER (WATTS)	BUS LOADS AC	BUS LOADS DC
1						
2						
3						
4						
5						
6						
MASS STORAGE TAPE 1					0.0	0.0
DISK 1					0.0	0.0
TOTAL RIGHT-HALF POWER SUPPLY					—	—
MUST NOT EXCEED:		33.0	7.0	230.0 *	—	—
LEFT-HALF POWER SUPPLY					—	—
SLOT (ABCD)	MODULE	CURRENT 5 V	AMPS 12 V	POWER (WATTS)	—	—
7						
8						
9						
10						
11						
12						
MASS STORAGE DISK					0.0	0.0
DISK					0.0	0.0
DISK					0.0	0.0
TOTAL LEFT-HALF POWER SUPPLY						
MUST NOT EXCEED		33.0	7.0	230.0 *		
TOTAL BUS LOADS						
MUST NOT EXCEED					35.0	20.0

6 SLOT ENCLOSURE

POWER SUPPLY						
SLOT (ABCD	MODULE	CURRENT 5 V	AMPS 12 V	POWER (WATTS)	BUS LOADS AC	BUS LOADS DC
1						
2						
3						
4						
5						
6						
TOTAL POWER SUPPLY					—	—
MUST NOT EXCEED		33.0	7.0	230.0 *	—	—
TOTAL BUS LOADS						
MUST NOT EXCEED					35.0	20.0

* NOTE POWER SUPPLIES MAY DIFFER CHECK YOUR POWER SUPPLY SPECIFICATIONS TO CONFIRM THE MAXIMUM WATTAGE

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Chapter 3
Troubleshooting

3.1 Overview

This chapter describes the KDJ11–D/S CPU power-up self-test procedure and error messages.

NOTE: *The XXDP V2 diagnostic monitor is described in the XXDP User's Manual.*

Read the Troubleshooting section of the customer documentation before using this chapter. Many apparent system problems have simple causes, such as incorrect external cabling or monitor settings. Always check for obvious problems before troubleshooting the system.

The KDJ11–D/S CPU and most option modules run self-tests when you power up the system. A module self-test can detect hard or repeatable errors, but not intermittent errors.

The LEDs on the module indicate test results. A successful module self-test does not guarantee that the module is performing correctly, because the test checks the controller logic only. The test does not check the module's Q22-bus interface, line drivers and receivers, or connector pins. An unsuccessful module self-test is accurate; the test does not require any other part of the system to be working.

Refer to *Microsystems Options* for a description of self-tests for individual modules. For detailed information, including the contents of the command status register (CSR) of the module's Q22-bus interface, see the user's guide for the module.

3.2 General Procedures

System problems are generally of two types:

- The system fails to boot (Section 3.2.1).
- The system boots, but a device in the system fails (Section 3.2.2).

You should ask two questions before troubleshooting any problem:

- Has the system been used before, and did it work correctly?
- Have changes been made to the system recently?

Two common problems occur when you make a change to the system:

- Cabling is incorrect.
- Module configuration errors (incorrect CSR addresses and interrupt vectors) are introduced.

When you troubleshoot problems, note the status of cables and connectors before you perform each step. Since cables are not always keyed, you can easily install them backward, or into the wrong connector. Label cables before you disconnect them, to prevent introducing new problems that make it more difficult to diagnose the original problem.

3.2.1 System Fails To Boot

The KDJ11–D/S CPU module self-test is described in Section 3.3. If the system fails (or appears to fail) to boot the operating system, then load and boot the XXDP diagnostic monitor.

If you cannot boot XXDP V2, do the following:

- Check the console terminal screen for an error message. Error messages are listed in Section 3.3.
- If no error message appears, make sure the on/off power switches on the console terminal and the system are set to on (1). Check the DC OK light on both, if applicable.
- Check the cabling to the console terminal.
- Check the hex display on the CPU I/O panel. If the display does not light, check the CPU module's LEDs and the CPU cabling. If a hex error message appears (F through 1) on the I/O panel or the module, see Section 3.3.
- If the console terminal remains off, check the power supply and power supply cabling.

If you can boot XXDP V2, and the system passes all tests, then the fault may be in the operating system.

3.2.2 System Boots, but Device Fails

If the system boots successfully, but a device seems to fail or an intermittent failure occurs, run the XXDP diagnostic monitor to isolate the failure to an FRU. The failing device is usually in one of the following areas:

CPU
Memory
Mass storage
Communications devices

Here are some common indications of an intermittent or device-specific problem:

- Operating system error messages appear at power-up for a particular communications device.
- Periodic operating system error messages indicate that a device is not present or cannot be found.
- Periodic data loss or scrambled data occur on one or more communications lines.
- Attached devices either do not work, or work incorrectly.
- The system cannot communicate with another computer.

3.3 KDJ11–D/S Self-Test

The KDJ11–D/S CPU is configured at the factory for automatic self-test and boot mode. The self-test is stored in boot ROMs, and runs each time the system is turned on or restarted. The self-test performs tests on the following:

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

The self-test first tests a small portion of the CPU module, then progressively tests the rest of the system. The system enters automatic boot mode (Section 1.5) upon successful completion of the self-test. If the self-test discovers an error or failure, the system displays a message. Table 3–1 lists and describes the start-up self-test error messages.

Table 3–1: KDJ11–D/S Start-Up Self-Test Error Messages

Error Number	Description
0	Halt switch on, CPU fault, power supply fault, or control has passed from ROM code to secondary boot.
1	Preliminary CPU testing; limited error messages.
2	Console SLU testing.
3	CPU testing.
4	On-board memory testing.
5	External memory testing.
6	Floating point, LTC interrupt, SLU0 interrupt, SLU1 interrupt, and MMU abort testing.
7, 8, 9, A, and B	Not used.
C	Octal debugging techinque (ODT) mode in progress.
D	Wrap mode in progress.
E	Boot in progress.
F	Console mode in progress.

If any part of the self-test or boot diagnostics fails, the system normally displays a message in three locations:

- On the console terminal
- On the KDJ11–D/S LEDs
- On the SLU panel

Sections 3.3.1 through 3.3.4 explain the KDJ11–D/S self-test results.

3.3.1 Test 1

When started, the ROM code runs a series of tests that verify the basic MMU operation and verify the ROM code. The comprehensive error message display routines are disabled at this point in the testing sequence. If an error occurs during test 1, the ROM code displays the following error message:

```
KDJ11-D/S 1.00
```

This message indicates that a fatal error condition occurred. The ROM code ignores any keyboard input, except to redisplay the error message each time input is received.

3.3.2 Test 2

Test 2 checks the console SLU. When the SLU0 test is running, the ROM code assumes that error messages cannot be displayed. Therefore, if an error occurs, the ROM code loops on the error.

3.3.3 Tests 3 through 6

Tests 3 through 6 are the main CPU and memory tests. These tests continuously loop when you enter the Test command. If an error is detected during these tests, the ROM code displays a brief error message.

If an error occurs and you did not select a language, the ROM code prompts you for a language, then displays the error message. In Example 3–1, the user selected English at the language inquiry prompt. Note that each line of the language inquiry displays the associated language.

Example 3–1: Language Inquiry and Error Prompt

```
English          Type 1 and press the Return key.
Francais         Tapex 2 et appuyez sur Retour.
Deutsch          Geben Sie 3 ein und drucken Sie WR.
Nederlands       Typ 4 en druk op Return.
Svenska          Skriv 5 och tryck sedan pa Ret.
Italiano         Introdurre 6 e premere Ritorno.
Espanol          Presione el 7 y luego la tecla Retorno.
Portuguese       Escreva 8 seguido de Return.

KDJ11-D/S>       1

KDJ11-D/S  3.015
Error, see troubleshooting section in owner's manual for
assistance
ROM   VPC=024722

KDJ11-D/S>
```

The error messages are shown in Examples 3–2 through 3–4. An explanation of the third line in these error messages follows Example 3–4.

Example 3–2: On-Board RAM Test Error Message

```
KDJ11-D/S  3.15
Error, see troubleshooting section in owner's manual for
assistance
RAM  VPC=024722   PA=17604722   01000000/125200 <> 125252

KDJ11-D/S>
```

Example 3–3: Q22-Bus RAM Test Error Message

```
KDJ11-D/S  3.15
Error, see troubleshooting section in owner's manual for
assistance
Q-bus RAM CSR  VPC=nnnnnn

KDJ11-D/S>
```

Example 3–4: J11 Unexpected Trap Error Message

```
KDJ11-D/S  3.15
Error, see troubleshooting section in owner's manual for
assistance
J11  004  VPC=024722

KDJ11-D/S>
```

The third line in Examples 3–2 through 3–4 contains up to four parts:

1. A short description of the failed area, as follows:

J11	J11 test error
J11 FP	J11 floating point test error
J11 MMU	J11 memory management test error
J11 nnn	J11 unexpected trap to virtual address nnn
LTC CSR	Line time clock test error
SLU0	SLU test error in the first console
SLU1	SLU test error in the second console
ROM	ROM checksum test error
RAM	On-board memory test error
RAM CSR	On-board memory parity test error
Q-bus RAM	Q-bus memory test error
Q-bus CSR	Q-bus memory parity test error

2. The virtual PC (VPC) of the failure. Useful only with a program listing.
3. Physical address of the failure. Useful only with a program listing.
4. Displays the failing location, the faulty data, and the expected data. Displayed only with RAM errors.

All errors are treated as fatal errors; you are expected to fix the problem before continuing, although you can override errors for troubleshooting purposes (Section 3.3.4).

3.3.4 Override Errors

To override an error, you must type one of the two override commands shown in Table 3–2 when the error message is displayed. The ROM code displays the KDJ11–D/S prompt and waits for input.

CAUTION: *Either remove or write-protect system media before overriding an error.*

Table 3–2: Error Override Commands

Command	Result
CTRL/O 4 RETURN	Overrides error and enters console mode.
L RETURN	Restarts tests at test 2. Loops through tests, ignoring errors. Enter CTRL/C to exit loop.

3.3.5 Octal Debugging Technique (ODT) Mode

You enter console octal debugging technique (ODT) mode in one of three ways:

- By pressing the console terminal Break key if halt-on-break jumper W11, located on the CPU module, is not installed or halt-on-break switch is not disabled. Also, make sure you enable the Break key on the terminal.
- By executing a Halt instruction in kernel mode, if halt option jumper W1 on the CPU module is installed.
- When the Q22-bus BHALT line is asserted on the backplane.

When the system enters console ODT mode, it displays the following on the console terminal:

```
nnnnnn
@
```

The number nnnnnn is the contents of PC (R7), and @ is the ODT prompt character.

ODT consists of commands and routines to find error conditions and to communicate with the system. You can examine or modify the contents of the system's registers and memory locations by entering ODT commands. The console ODT commands are listed and described in Table 3–3.

Table 3–3: KDJ11–D/S Console ODT Commands

Command	Symbol	Function
Internal register	S or R	Specifies the location as a processor register if followed by 0 through 7 or S. For example, R9, $1, and so on.
PSW designator	S	Specifies the location as the processor status word (PSW) if preceded by R or $.
Open location	/	Prints the contents of a specified location.
Close location	Return	Closes an open location.
Close, then open location	Line feed	Closes an open location, then prints the contents of the next contiguous location.
Go	G	Starts program execution.
Proceed	P	Resumes program execution.
Binary dump	CTRL/S	For manufacturing use only.

Appendix A
Formatting RD- and RX-Series Disk Drives

A.1 Disk Formatting

Format an RD- or RX-series disk drive as follows:

CAUTION: *Do not format disks without first backing up the data. The disk formatting procedure destroys previous disk contents.*

1. Insert the formatter diskette or the tape cartridge into its drive. Press RETURN.

2. Type R ZRQx?? after the . (period) prompt; x is B for RQDX1 or RQDX2, C for RQDX3, and F for RX33. The question marks allow you to use any revision of the program. Press RETURN.

   NOTE: *When formatting an RD52 drive, make sure you have Version C0 or later. Earlier versions format the RD52 (31 Mbytes) as though it were an RD51 (11 Mbytes).*

   A prompt similar to the following appears on the terminal:

   ```
   DR>
   ```

3. To run the program, type START and press RETURN. The following dialog takes place:

   ```
   CHANGE HW (L)?
   ```

   Type N (no) and press RETURN.

   ```
   CHANGE SW (L)?
   ```

   Type N and press RETURN.

   ```
   ENTER DATE (in mm-dd-yy format) (A)
   ```

   Type the current date (for example, 11-15-88). Press RETURN.

   ```
   ENTER UNIT NUMBER TO FORMAT <0>
   ```

Type 0 for the first fixed-disk drive, or type 1 for the second. Press RETURN.

```
USE EXISTING BAD BLOCK INFORMATION?
```

Type Y (yes) and press RETURN. This activates the reformat mode (Section A.1.1).

NOTE: *The program requires about 12 minutes to format an RD51 and about 30 minutes to format an RD52 or RD53. Typing N (no) doubles the time required to format the disk drive.*

```
CONTINUE IF BAD BLOCK INFORMATION IS INACCESSIBLE?
```

Type Y and press RETURN.

```
ENTER A NON-ZERO SERIAL NUMBER:
```

Type your serial number (located on top of the disk drive) and press RETURN.

```
FORMAT BEGUN
```

After about 12 minutes, the system displays a completion message as follows:

```
FORMAT COMPLETED
```

If the formatting is not successful, the system displays a message when the error occurs (Section A.1.2). Remove the diskette or tape cartridge if the formatting has completed successfully.

A.1.1 Format Modes

The program can run three types of format modes: reformat, restore, or reconstruct. In order, the program asks you the following questions. Your answers determine the format mode that runs.

1. Use existing bad block information?
2. Down-line load?
3. Continue if bad block information is inaccessible?

The second question does not appear unless you answer N to the first question. Answering N to the third question causes the diagnostic program to stop and print a message if a problem is found.

The format modes operate as follows:

- **Reformat mode**. If you answer Y to question one, no further questions are asked. The format program reads the manufacturer's bad blocks from a block on the disk. It then formats the disk except for these bad

blocks. The process requires about 12 minutes. If the program fails, try restore mode.

- **Restore mode**. If you answer N to question one, the program asks you to type in a list of the bad blocks. It then formats the disk except for the bad blocks you specify. You can specify the bad blocks using the list that comes with the drive. The program asks you for the last eight digits of the serial number (found at the top of the disk drive). Restore mode requires about 15 minutes.

- **Reconstruct mode**. If you answer N to questions one and two, the program searches the disk and identifies the bad blocks. It does not use the manufacturer's bad block information. It then formats the disk except for the identified bad blocks. Reconstruct mode requires about 30 minutes.

A.1.2 Formatter Messages

Table A–1 lists the formatter messages, their probable causes, and actions to correct the problem. The first few errors can occur almost immediately. The remaining errors can occur from one minute to longer than ten minutes after the program starts.

Table A–1: MicroPDP–11 Formatter Messages

Message	Description/Action
Unit is not Winchester or cannot be selected.	Unit is either unavailable or is an RX-series diskette drive. Check to make sure the fixed-disk is not write-protected. Make sure the jumper on the disk drive is set correctly.
Initial failure accessing FCT.	The format control table (FCT) cannot be read. Try reconstruct mode (Section A.1.1).
Factory bad block information is inaccessible.	Occurs only in reformat mode. Run in reconstruct mode (Section A.1.1).
Seek failure during actual formatting.	There is a hardware error. Check for hardware problems.
Revector limit exceeded.	The disk is bad. Replace the disk.
RCT write failure.	Write to disk failed after successful formatting and surface analysis. Check write-protect status.
Failure closing FCTS.	Disk is marked as unformatted.

Appendix B
Related Documentation

The following documents contain information relating to MicroVAX or MicroPDP–11 systems.

Document Title	Order Number
Modules	
CXA16 Technical Manual	EK–CAB16–TM
CXY08 Technical Manual	EK–CXY08–TM
DEQNA Ethernet User's Guide	EK–DEQNA–UG
DHV11 Technical Manual	EK–DHV11–TM
DLV11–J User's Guide	EK–DLV1J–UG
DMV11 Synchronous Controller Technical Manual	EK–DMV11–TM
DMV11 Synchronous Controller User's Guide	EK–DMV11–UG
DPV11 Synchronous Controller Technical Manual	EK–DPV11–TM
DPV11 Synchronous Controller User's Guide	EK–DPV11–UG
DRV11–J Interface User's Manual	EK–DRV1J–UG
DRV11–WA General Purpose DMA User's Guide	EK–DRVWA–UG
DZQ11 Asynchronous Multiplexer Technical Manual	EK–DZQ11–TM
DZQ11 Asynchronous Multiplexer User's Guide	EK–DZQ11–UG
DZV11 Asynchronous Multiplexer Technical Manual	EK–DZV11–TM
DZV11 Asynchronous Multiplexer User's Guide	EK–DZV11–UG
IEU11–A/IEQ11–A User's Guide	EK–IEUQ1–UG
KA630–AA CPU Module User's Guide	EK–KA630–UG
KA640–AA CPU Module User's Guide	EK–KA640–UG
KA650–AA CPU Module User's Guide	EK–KA650–UG
KDA50–Q CPU Module User's Guide	EK–KDA5Q–UG
KDJ11–D/S CPU Module User's Guide	EK–KDJ1D–UG
KDJ11–B CPU Module User's Guide	EK–KDJ1B–UG
KDF11–BA CPU Module User's Guide	EK–KDFEB–UG
KMV11 Programmable Communications Controller User's Guide	EK–KMV11–UG
KMV11 Programmable Communications Controller Technical Manual	EK–KMV11–TM

Document Title	Order Number
Modules	
LSI–11 Analog System User's Guide	EK–AXV11–UG
Q-Bus DMA Analog System User's Guide	EK–AV11D–UG
RQDX2 Controller Module User's Guide	EK–RQDX2–UG
RQDX3 Controller Module User's Guide	EK–RQDX3–UG
Disk and Tape Drives	
RA60 Disk Drive Service Manual	EK–ORA60–SV
RA60 Disk Drive User's Guide	EK–ORA60–UG
RA81 Disk Drive Service Manual	EK–ORA81–SV
RA81 Disk Drive User's Guide	EK–ORA81–UG
SA482 Storage Array User's Guide (for RA82)	EK–SA482–UG
SA482 Storage Array Service Manual (for RA82)	EK–SA482–SV
RC25 Disk Subsystem User's Guide	EK–ORC25–UG
RC25 Disk Subsystem Pocket Service Guide	EK–ORC25–PS
RRD50 Subsystem Pocket Service Guide	EK–RRD50–PS
RRD50 Digital Disk Drive User's Guide	EK–RRD50–UG
RX33 Technical Description Manual	EK–RX33T–TM
RX50–D, –R Dual Flexible Disk Drive Subsystem Owner's Manual	EK–LEP01–OM
TK50 Tape Drive Subsystem User's Guide	EK–LEP05–UG
TS05 Tape Transport Pocket Service Guide	EK–TSV05–PS
TS05 Tape Transport Subsystem Technical Manual	EK–TSV05–TM
TS05 Tape Transport System User's Guide	EK–TSV05–UG

Document Title	Order Number
Systems	
MicroVAX Special Systems Maintenance	EK–181AA–MG
630QB Maintenance Print Set	MP–02071–01
630QE Maintenance Print Set	MP–02219–01
630QY Maintenance Print Set	MP–02065–01
630QZ Maintenance Print Set	MP–02068–01
BA23 Enclosure Maintenance	EK–186AA–MG
BA123 Enclosure Maintenance	EK–188AA–MG
BA213 Enclosure Maintenance	EK–189AA–MG
BA214 Enclosure Maintenance	EK–190AA–MG
BA215 Enclosure Maintenance	EK–191AA–MG
H9642–J Cabinet Maintenance	EK–187AA–MG
H9644 Cabinet Maintenance	EK–221AA–MG
KA630 CPU System Maintenance	EK–178AA–MG
KA640 CPU System Maintenance	EK–179AA–MG
KA650 CPU System Maintenance	EK–180AA–MG
KDF11–B CPU System Maintenance	EK–245AA–MG
KDJ11–B CPU System Maintenance	EK–247AA–MG
KDJ11–D/S CPU System Maintenance	EK–246AA–MG
MicroPDP–11 Hardware Information Kit (for BA23)	00–ZYAAA–GZ
MicroPDP–11 Hardware Information Kit (for BA123)	00–ZYAAB–GZ
MicroPDP–11 Hardware Information Kit (for H9642–J)	00–ZYAAE–GZ
MicroPDP–11 Hardware Information Kit (for BA213)	00–ZYAAS–GZ
Microsystems Options	EK–192AA–MG
Microsystems Site Preparation Guide	EK–O67AB–PG
MicroVAX II Hardware Information Kit (for BA23)	00–ZNAAA–GZ
MicroVAX II Hardware Information Kit (for BA123)	00–ZNAAB–GZ
MicroVAX II Hardware Information Kit (for H9642–J)	00–ZNAAE–GZ
MicroVAX 3500 Customer Hardware Information Kit	00–ZNAES–GZ
MicroVAX 3600 Customer Hardware Information Kit (for H9644)	00–ZNAEF–GZ
VAXstation 3200 Owner's Manual (BA23)	EK–154AA–OW
VAXstation 3500 Owner's Manual (BA213)	EK–171AA–OW
VAXstation II/GPX Owner's Manual (BA23)	EK–106AA–OW
VAXstation II/GPX Owner's Manual (BA123)	EK–105AA–OW

Document Title	Order Number
Diagnostics	
DEC/X11 Reference Card	AV–F145A–MC
DEC/X11 User's Manual	AC–FO53D–MC
XXDP User's Manual	AZ–GNJAA–MC
XXDP DEC/X11 Programming Card	EK–OXXDP–MC
MicroVAX Diagnostic Monitor Ethernet Server User's Guide	AA–FNTAC–DN
MicroVAX Diagnostic Monitor Reference Card	AV–FMXAA–DN
MicroVAX Diagnostic Monitor User's Guide	AA–FM7AB–DN
Networks	
Ethernet Transceiver Tester User's Manual	EK–ETHTT–UG
VAX/VMS Networking Manual	AA–Y512C–TE
VAX NI Exerciser User's Guide	AA–HI06A–TE

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NOTES

HOW TO ORDER ADDITIONAL DOCUMENTATION

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Alaska, Hawaii, or New Hampshire	603–884–6660	Digital Equipment Corporation P.O. Box CS2008 Nashua, NH 03061
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* Prepaid orders from Puerto Rico, call DIGITAL's local subsidiary (809–754–7575)		
Canada	800–267–6219 (for software documentation) 613–592–5111 (for hardware documentation)	Digital Equipment of Canada Ltd. 100 Herzberg Road Kanata, Ontario, Canada K2K 2A6 Attn: Direct Order desk
Internal orders (for software documentation)	—	Software Distribution Center (SDC) Digital Equipment Corporation Westminster, MA 01473
Internal orders (for hardware documentation)	DTN: 234–4323 508–351–4323	Publishing & Circulation Serv. (P&CS) NRO3–1/W3 Digital Equipment Corporation Northboro, MA 01532

Reader's Comments

KDJ11–D/S CPU System Maintenance
EK–246AA–MG–001

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Completeness (enough information)	☐	☐	☐	☐
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☐ Other (please specify) _____

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